Surety Bonding in Alberta

Economic and Social Benefits

Research Report | May 2025

CANCEA

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About This Report

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- Aviva Insurance Company of Canada
- Intact Insurance Company
- Liberty Mutual Insurance Company
- Travelers Insurance Company of Canada
- Trisura Guarantee Insurance Company
- Western Surety Company
- Zurich Insurance Company Ltd.

Collectively, these companies underwrite over 85% surety bonds for the construction market in Canada.

EXECUTIVE SUMMARY

BACKGROUND AND OBJECTIVES

Surety bonds protect against non-performance and non-payment risks associated with the operation and financial standing of construction enterprises and their relationships. In a highly integrated economy, understanding the economic value of surety bonds is no simple task and requires:

- The ability to model the contractual and commercial connections (network structure) that permeate through industries – particularly in the construction sector – to understand the "domino" impacts of financial and operational distress on the broader economy.
- A significant amount of data on the interaction of the surety industry with stakeholders in the construction sector and the broader economy, how stakeholders purchase surety products, construction projects on which surety bonds are used, and the performance of projects with and without surety bonds; and
- Analytical tools designed to quantify the economic impacts that extend beyond aggregate economic activity and include impact on jobs and taxes and quantify where risks and rewards (intended or otherwise) arise for different stakeholders.

Alberta's construction industry plays a significant role in the province economy, currently contributing 7.4% of Alberta's GDP – a share that has decreased over the last 15 years. Nationally, insolvency rates in the construction industry are close to historical lows (excluding the pandemic period) averaging around 2.5 insolvencies per 1,000 firms over the last 10 years. This is almost 6 times lower than in the early 1990s when insolvency rates were averaging 17.7 per 1,000 firms.

The objective of this research project was to conduct a network-based quantitative analysis of the economic and social value of surety bonds (e.g., performance bonds, payment bonds) for different construction activity (with varying capital types), and industries (i.e., public and private capital projects). The aim is to illuminate surety's value proposition for policymakers, the public, and other key stakeholders.

Our research follows the same approach as conducted by CANCEA (2017) and is updated for economic and surety industry statistics, as well as a Canadian dataset of more than 150,000 surety project records from the past decade to explore the value proposition for the use of performance bonds and payment bonds in the construction of public capital projects. Surety bonds can cover a wide range of projects, including large-scale infrastructure endeavors and smaller regional contracts. Using CANCEA's agent-based model of the Canadian economy, which considers the interconnected market network structure of various industries, we can understand the relative value of surety bonds by applying two different types of forward-looking credit risk scenarios over the next 30 years, being a low-risk scenario and a high-risk scenario.

FINDINGS AT A GLANCE

Our analysis shows how the use of surety bonding provides considerable protection and support to Alberta's economy and the well-being of its residents. In total value terms, the lower end value of the use of performance and payment bonds for public infrastructure projects averages more than a **four-fold payback on the premiums paid for protection**, with 80% representing the avoided economic activity loss and 20% representing protecting the well-being of people who could be affected by construction financial distress and insolvency.

Reduced risk of insolvency	A non-bonded construction enterprise is 10 times more likely to become insolvent than bonded companies.
Protection of economic activity (GDP)	**Low-risk scenario:** Under a forward-looking scenario of historically low construction insolvencies (status quo risk scenario), performance and payment bonds protect on average **$4.13 million of GDP for every $1 million** of premium paid on public infrastructure projects. **High-risk scenario:** Under the scenario of increased future risk, the relative value of surety bonds is magnified. A return to persistently higher risk when the rate of construction insolvencies were 5 times their current levels, performance and payment bonds protected **$29.10 million of GDP for every $1 million** in premium paid on public infrastructure projects.
Protection of people's well-being	**Low-risk scenario:** Protecting jobs and financial security for employees in the economy helps maintain their well-being resulting in a social value benefit of **$1.02 per $1 of premiums** paid on public infrastructure projects. 24.4 jobs per $1M of premiums are protected annually. **High-risk scenario:** Under the scenario of increased future risk, performance and payment bonds protected well-being resulting in a social value benefit of **$7.20 per $1 of premiums** paid on public infrastructure projects. 172.3 jobs per $1M of premiums are protected annually.
Fiscally responsible	In the **High-risk scenario,** governments show a net gain, protecting $2.52 of broader economic tax revenue for every $1 premium spent, while in the status quo case, $0.36 is protected for every $1 premium spent.
Extent of industry coverage is important	The size and significance of the surety bond benefits vary depending upon the level of risk in the economy (e.g., increasing interest rates, debt levels, recession, and global shocks). The highest economic and fiscal benefits versus the premium costs required comes from a policy that requires a combination of **performance and payment bonds – with public infrastructure projects bonded.**

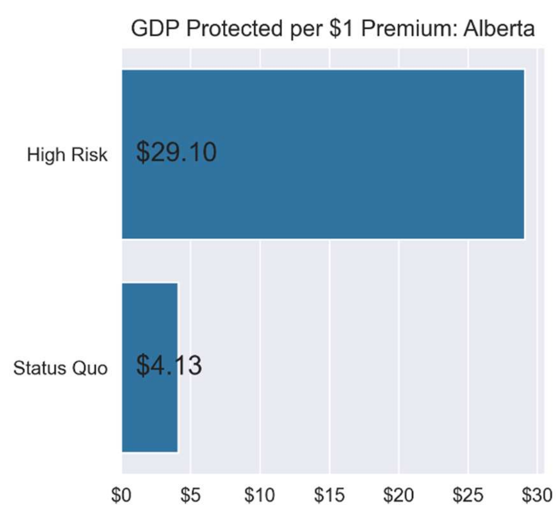
Approach

This study utilizes CANCEA's socio-economic agent-based simulation platform to investigate how insolvency rates, project delays, and the economy respond to the presence of surety bonding policies:

- **Best-of-class approach:** Using official economic account and well-being data to create a digital twin[1] of the Canadian regional economies using agent-based modelling that features a statistical representation of the construction industry network of projects and supply lines.
- **Digital twin:** A virtual model designed to reflect the key structures and business activity of the economy. Agent-based modelling makes digital twinning for surety products possible.
- **Agent-based modelling:** Computer simulations used to study the interactions between people, things, places, and time. They are probabilistic statistical models built from the bottom up meaning individual agents (people, firms, governments) are modelled to gain an understanding of their collective response to a policy under stylized conditions.
- **Stylized conditions:** Follow standard impact analysis practice. Assume constant interest rates, market participant types, productivity levels, immigration, and workforce training.

Discussion

A performance bond is a special class of contract signed by a contractor (the 'principal') and a surety in which the contractor and surety guarantee to a third party (an 'obligee', often a project owner) that the contractor will perform a specific construction contract. If the contractor fails to perform, then the project owner may look to the surety under the bond for the costs of completing the contract and additional related costs.



Labour and material payment bonds (or simply, payment bonds), a related class of bonds, are signed by a contractor and its surety and guarantee that the contractor will pay its subcontractors, suppliers and labourers on a specific contract. If the contractor fails to honour its payment obligations, then subcontractors, suppliers and labourers may look to the surety for payment under the bond.

[1] In an economic modeling context, a digital twin is a continuously updated, virtual representation of the Canadian economic system (such as a market, supply chain, or policy environment) that mirrors the real system's structure, inputs, and behaviors. It is built using real-world data and advanced analytics, integrating machine learning and simulation techniques, to provide decision-makers with a dynamic, "living" model. The model is used for forecasting, stress testing, scenario analysis, and strategic planning, enabling users to assess how changes in one part of the economic system (e.g., consumer demand, production costs, regulatory shifts) might ripple throughout the entire system in real time or under hypothetical conditions.

Low-Risk Scenario: Status Quo

If the levels of insolvency risks remains similar to the last several years (excluding the pandemic), the combination of performance and payment bonds result in significant economic and social benefits. If 100% of public infrastructure projects have performance and payment bonds, $4.13M of GDP is protected per million dollars of surety bond premiums paid. 24.4 jobs per $1M of premiums are protected annually providing stability for employees and employers. The well-being impacts resulting from reduced insolvencies and protected economic activity results in a social value equivalent of $1.02M per million dollars of premiums paid.

High-Risk Scenario

The high-risk scenario reflects the level of insolvency risk seen in 1990s. If 100% of public infrastructure projects have performance and payment bonds, $29.10M of GDP is protected per million dollars of surety bond premiums. This is attributed to the both the reduction in insolvencies of companies and the systemic benefits which arise from having the infrastructure built on time. Since the likelihood of delay without bonding is greater in the high-risk scenario, a larger aggregate portfolio of projects is at risk of being delayed resulting in the greater impact for surety. By protecting 172.3 jobs per $1M in premiums, the well-being impacts of reduced insolvency rates and protected economic activity results in social value equivalent of $7.20M per million dollars of premiums paid.

Performance and Payment Synergies

The combination of performance and payment bonds results in greater economic and social benefits than performance bonds alone. By ensuring that subcontractors get paid, it not only helps the subcontractor stay in business, but it also reduces the likelihood of them being unable to complete other projects. This enhances systemic robustness of the industry networks.

All Capital Projects

Expanding bonding to include all capital projects (including those that are not infrastructure) results in positive economic returns of $2.77M and $17.94M of GDP per million dollars of premiums paid in the low-risk and high-risk scenarios respectively when both payment and performance bonds are present. However, the economic and social case per premium paid, while still positive, is less than focussing strictly on public infrastructure. This is due to the fact that many non-infrastructure projects have less of a systemic productivity impact if projects were to be delayed. For example, while there is a positive case for surety bonding on the construction a commercial building, the long-term systemic costs of delay in that projects are less than for delays of a critical infrastructure project, such as water or wastewater projects.

Conclusions

Credit and operational risks within the construction industry are significantly influenced by interest rate fluctuations, economic downturns, supply chain disruptions, debt burdens, and periods of constrained credit availability. By thoroughly understanding, quantifying, and simulating the interconnectedness of construction suppliers, subcontractors, and the broader economy, this report has assessed the socio-economic value of employing surety bonds in Alberta's public capital construction sector.

Our analysis demonstrates that the use of surety guarantees, alongside the rigorous due diligence they entail, consistently yields positive impacts across various scenarios. Notably, the combination of performance and payment bonds on public infrastructure projects was found to provide the greatest protection and value relative to the cost of premiums. Specifically, under the current status-quo scenario, each $1 million in premiums paid protects approximately $4.13 million in GDP, protects $0.36 million in tax revenues, and secures $1.02 million in additional social value.

The benefits become even more pronounced under high-risk scenarios. In such circumstances, performance and payment bonds protect $29.10 million in GDP, $2.52 million in tax revenue, and adds $7.20 million in social value for each $1 million in premiums paid. These figures underscore the critical role bonding plays in safeguarding economic stability and social well-being during periods of heightened uncertainty and risk.

Moreover, the combined use of performance and payment bonds mitigates the risk of insolvency spreading across subcontractors and suppliers, thereby ensuring continued economic productivity. Conversely, broad-based bonding across all projects diminishes returns by including lower-impact projects, thus diluting the overall economic benefits of bonding.

In conclusion, strategically applied performance and payment bonds, particularly focused on infrastructure investments, offer significant socio-economic advantages by protecting GDP growth, securing tax revenues, and preserving social value, far outweighing the premiums invested.

1.0 INTRODUCTION

1.1 BACKGROUND

Understanding the true economic value of surety is no simple task. It requires the ability to model the full network structure of industry – particularly in the construction sector – to understand the broad impacts of an adverse event. It also requires a significant amount of data on surety, such as who purchases it, what projects they work on, and what happens with those projects. Finally, it requires appreciating that economic impacts go beyond GDP; that they also include the likes of jobs and taxes, to understand where risks and rewards (intended or otherwise) may land. As the economy and industries evolve over time, the effect of surety bonding may change as well. As such, as part of its industry advocacy work, the Surety Association of Canada (SAC) approached CANCEA to refresh its prior analysis of the industry with major members confidentially providing updated data to support the analysis.

1.2 OBJECTIVES

The objective of this report is to provide a quantitative analysis of the economic and social value of surety (e.g., performance bonds, payments bonds) for different:

- Construction activity (with varying capital types); and
- Industries (i.e., public and private capital projects).

Using the framework established in previous and related work, CANCEA's unique modeling platform is utilized to demonstrate the value proposition for policymakers, the general public, and other key stakeholders. This includes understanding how both economic metrics, such as GDP, jobs, and tax revenue, as well as social metrics driven by the well-being of the population, are affected by the presence and absence of surety bonds.

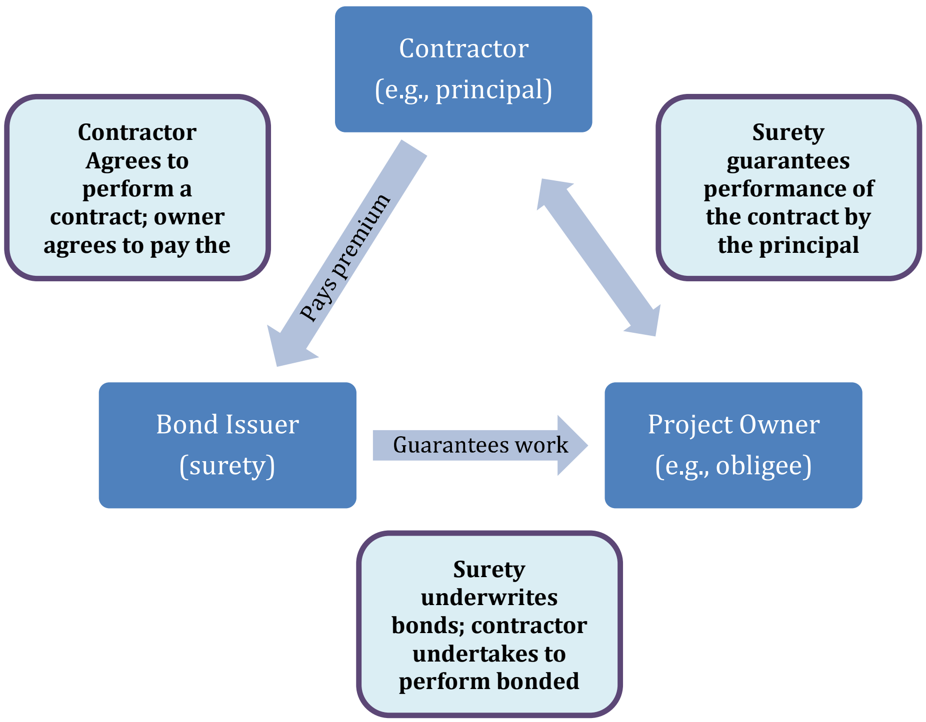
1.3 WHAT IS SURETY?

The enterprise of suretyship, where one person guarantees and answers for the performance of another person's obligations to a third party, is a form of performance security that has been effective and has persisted through time. Religious and civic laws have regulated the use of surety instruments in commerce and society since ancient times. By 1840, the first successful corporate Surety – Guaranty Society of London – was founded, and in 1935, the US federal *Miller Act* was established to require use of performance bonds for public works contracts in excess of $100,000 and payment bonds for contracts in excess of $25,000 (Surety Bonds Timeline, 2017). In 1992, The Surety Association of Canada (SAC) was formed by companies seeking advocacy independent of the insurance industry. SAC currently has close to 80 members.[2]

[2] See Surety Association of Canada Membership for details

The diagram below illustrates the 3-party relationship that is at the heart of a surety bond. While the surety issuer engages in a process of due diligence in evaluating the credit and performance capacity of a construction enterprise and often forms a business relationship with a contractor, the surety's primary obligation under a bond is to the obligee (often a project owner).

Figure 1 Basic surety diagram



Among the various types of surety bonds underwritten by the surety industry in Canada, this study focuses on performance bonds and payment bonds used in the construction industry. In the Canadian market, performance bonds typically have a value of 50% of the value of the bonded contract and are normally issued in tandem with a payment bond also having a value of 50% of the bonded contract.

The proceeds of a payment bond are restricted and can be used only to pay qualifying subcontractors, suppliers and labourers on the bonded contract. Payment of these subcontractors and suppliers can preserve warranty on products, equipment and work, and ensure continuity of a project team to avoid delay in completion of a defaulted project. A payment bond can also ensure payment of subcontractors and others who would otherwise seek recovery of unpaid accounts by registering a lien on the project or taking other legal action that could disrupt the completion of a project.

The proceeds of a performance bond are available to offset additional costs of completing a bonded contract in the event of the default of the principal contractor and financial protection is provided to a project owner against the risk of contractor default.

1.3.1 ASSURANCE RATHER THAN INSURANCE

While surety has commonalities with insurance and banking, it should not be confused with either. An insurance company typically gathers premiums from a large group of customers at risk of some adverse event occurring (e.g., a car accident). This creates a substantial pool of money that can be used to pay out the costs of adverse events to the small subset of customers to whom they occur, spreading the costs of such risk across all customers. Details gathered on potential customers are generally only used to determine the premiums paid, without much regard for the individual characteristics that could determine actual “riskiness” (e.g., while people of a certain subgroup, like teenagers, may be more at risk in *general* of car accidents, *individuals* in that group may be excellent drivers).

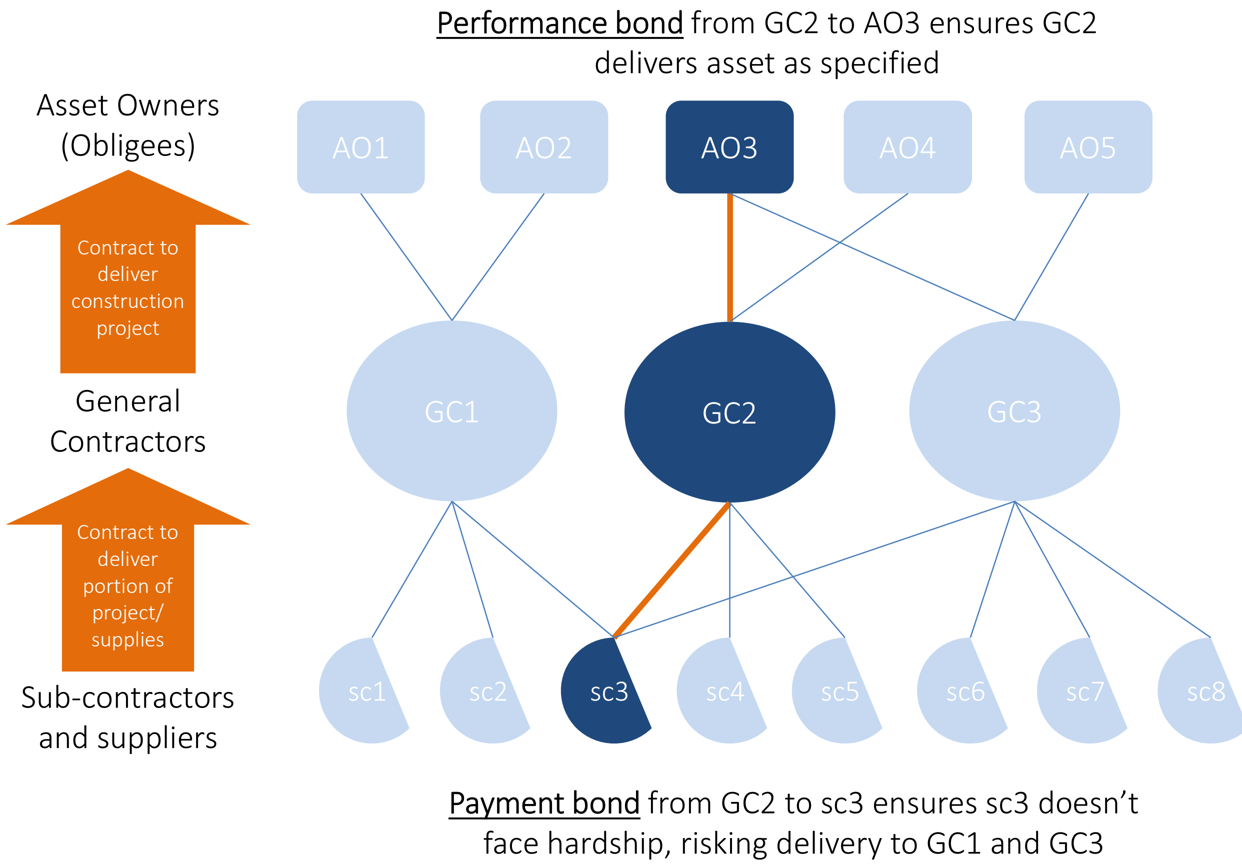
But the fundamental idea of surety bonds is to *avoid* adverse events, because a surety company is putting up its own resources to ensure projects get completed. This makes surety bonds more like an extension of credit with the assumption that there will be no losses, such as co-signing a loan. This means that surety is more about *assurance* than *insurance*. A surety company assesses a contractor’s experience and track record (e.g., in financial and project management), capacity (both financial and performance), character, and other factors before deciding whether or not to issue a bond. If a particular contractor is deemed too risky, the surety will simply decline to issue bond. Premiums are collected to cover the costs of underwriting expenses, not to pay losses. Taking on an overly risky contractor can be a costly decision.

The construction sector is part of an incredibly complex economic system with a vast array of networked interactions between many diverse “agents”. If analysis only relies on averages to estimate causes and effects, then it only looks at the economy from the top down. But we are not averages. We behave differently. We offer different things to different people. And we all face different constraints.

In other words, how things are connected within a system impacts how actions reverberate through it. Without properly understanding the linkages between economic agents (e.g., firms), a full understanding of what happens when an adverse event hits is impossible. Metaphorically, a car accident on the highway may only do severe damage to the few cars directly involved, but many more cars get affected.

As an example, Figure 2 illustrates the ease with which networked companies can indirectly impact other organizations within a network. Trying to model such a network top down would entirely lose these linkages, and hide knock-on effects from an interruption (e.g., from a financial hardship).

Figure 2 Performance and payment surety bonds



1.4 Methods

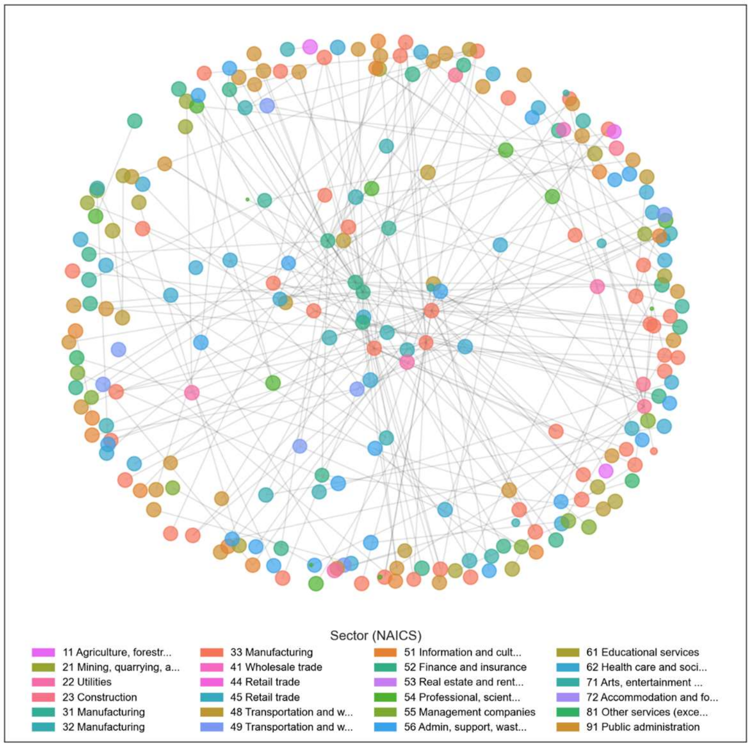
1.4.1 ECONOMIC CONTRIBUTION ESTIMATION

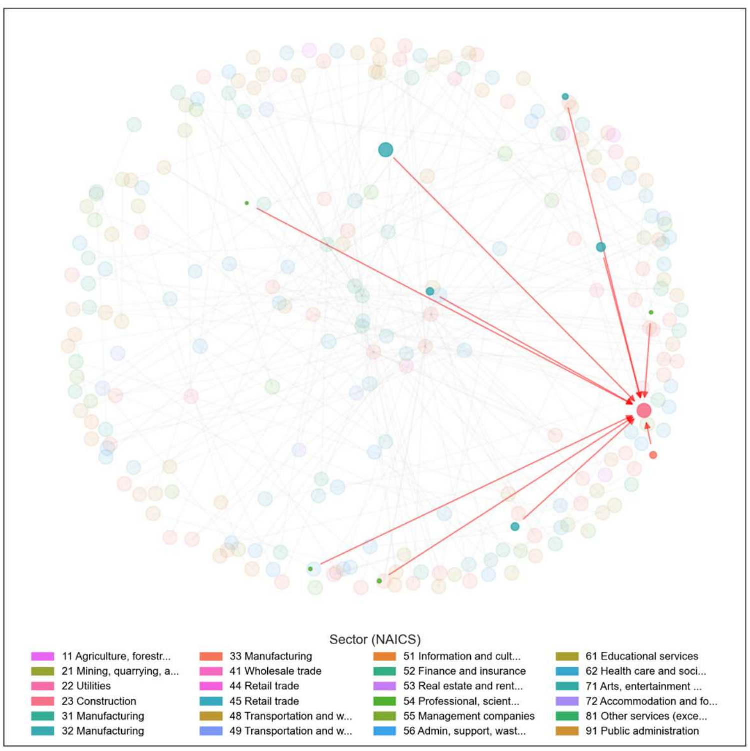
This study utilizes CANCEA's agent-based modelling platform to analyze the economic and labour impacts of surety bonding in Alberta. CANCEA's agent-based platform is a detailed socioeconomic simulation platform designed to analyze policy and infrastructure investment scenarios across over 5,000 societal sustainability and prosperity topics. It performs calculations on the level of individual people, firms, and governments, which are modelled using extensive data inputs. For example, data inputs for individual households include, in addition to demographics, factors such as household structure, labour force participation, and finances. The economy is modelled using a structural approach, and individual businesses are modelled using a combination of Statistics Canada data and input/output tables at the local level. Importantly, the platform is geospatial and covers more than 58,000 dissemination areas across Canada.

Taking this to the fullest, in order to capture the effect of interruptions in the network, it must be modelled for over the 2 million companies in 20 industry sectors across Canada. While difficult to represent graphically, Figure 3, presents a subsection of a set of networked companies by showing the linkages (inputs and outputs) between the largest companies by industry (the size of marker here represents the number of employees). The Figure then shows an individual construction company, which has many linkages (e.g., suppliers or subcontractors), each of which has many of its own, and so on.

Therefore, if such a company were to become insolvent, suppliers would have an increased chance of insolvency, based on both their own underlying industry rates and a fraction of revenue from the insolvent customer. Payment bonds remove the impact of the fraction of revenue from insolvent customers but do not affect the underlying industry rates. On the flip side, if a supplier or subcontractor became insolvent, it could introduce delays in other projects depending on the fraction of inputs it supplies.

Figure 3 Inter-business connections





1.4.2 SOCIAL VALUE EVALUATION

Social value is a measure of the impact a policy has on the well-being of the population. CANCEA conducts social value evaluation by combining statistical well-being estimation with agent-based modelling. In particular, the use of well-being estimation in economic impact research is supported by research in the social sciences, the OECD, and various G20 governments, all of which recognize the validity and reliability of life satisfaction measures in policy-supporting studies. Importantly, scholars emphasize the ability of well-being measurement to incorporate respondents' values and preferences, reflecting the outcomes of their choices, thus making it a valuable tool in social value evaluation (Diener, Inglehart, & Tay, 2013; Layard, 2010; Frey & Stutzer, 1999; Stutzer & Frey, 2010; Yang, 2018).

The methodology quantifies the monetary equivalent of well-being changes resulting from proposed interventions, such as a new infrastructure project (OMERS Social Value Report, 2021; Alberta PPP Social Value Report, 2022; Housing Crisis Social Value, 2024). The first step is to map the well-being of affected individuals to their traits, socioeconomic characteristics, environment, and connections, allowing for the estimation of well-being changes that result from the effects of the intervention. These changes can be either positive or negative, depending on the individual variables described. Links between a person’s well-being across time and their characteristics, and the community and environmental circumstances they face have been identified in numerous studies (Lu, Schellenberg, Hou, & Helliwell, 2015; Helliwell & Wang, 2011; Chen & Hou, 2010; Kytta, Broberg, Haybatollahi, & Schmidt-Thome, 2016; Layard, Mayraz, & Nickell, The marginal utility of income, 2008).

The second step is to then draw, for each person, the change in individual income, all else being equal, that would result in the same change in well-being. The computed income change is defined as the *monetary equivalent* of the estimated well-being change (OMERS Social Value Report, 2021; Alberta PPP Social Value Report, 2022; Housing Crisis Social Value, 2024). Finally, monetary equivalents are aggregated across all individuals affected, yielding a total monetary equivalent, defined as the *social value* of the intervention. The translation of well-being changes into income adjustments and the subsequent aggregation of these adjustments into a social value estimate is a key feature of Murtin, Boarini, & Ripoll (2017) and Llena-Nozal, Martin, & Murtin (2019).

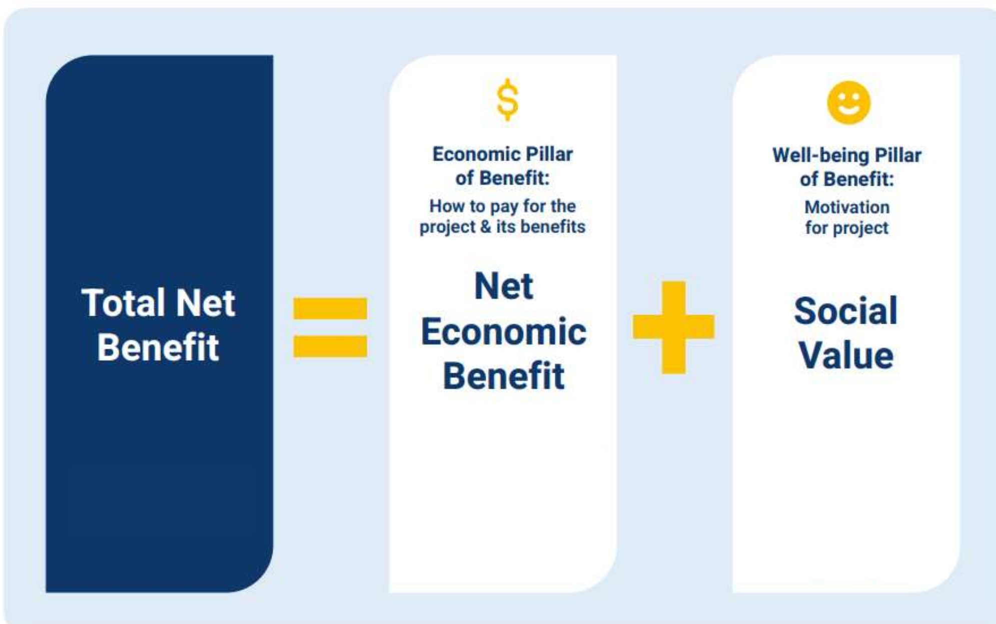
By combining well-being estimation with agent-based modelling, this approach considers the myriad factors influencing individual well-being, including demographic, socioeconomic, financial, and environmental aspects. These factors influence well-being through different channels, such as financial stability and community cohesion. The adopted methodology thus considers people’s overall well-being changes in proportion to the improvement in their different well-being domains, such as health and community satisfaction, and measures it according to individuals’ preferences over money. It offers a holistic view of the social value generated by proposed interventions.

1.5 Total Value

Any policy or project has a combination of both economic and social consequences. The social value identifies if the policy has a positive effect on the overall well-being of society. A project that results in a negative social value would, on average, degrade the quality of life of people affected. In contrast, a positive social value indicates that, on average, it would improve people's quality of life. The economic value of a project or policy, on the other hand, only indicates if it is financially viable. By itself, the economic value cannot discern and indicate how it affects people's well-being.

With these concepts in mind, failing to compute social value estimates alongside economic contributions leads to an incomplete picture of the total value of a project. Given that the motivation for a project or policy should be its impact on people, the social value is an intrinsic aspect of its total value. In other words, while the **net economic value** indicates the financial viability of a project, the **social value** provides the reasons why a project should be undertaken in the first place.

Figure 4 Total value of a project or policy



1.6 Surety Association of Canada Member Data

Data provided by SAC members is used to:

- Better parameterize the Canadian and provincial construction sectors;
- Understand the values and durations of construction projects; and
- Tune the relationships between surety bonding, project delays, and business insolvencies.

Data is used in conjunction with Statistics Canada datasets including:

- Demographics and employment
- Economic accounts
- Business structure
- Insolvencies
- Capital investment
- Taxes

Aggregate summary statistics presented are an amalgamation of all data provided by SAC members covering over 85% of the Canadian surety market.

2.0 THE CONSTRUCTION INDUSTRY AND SURETY

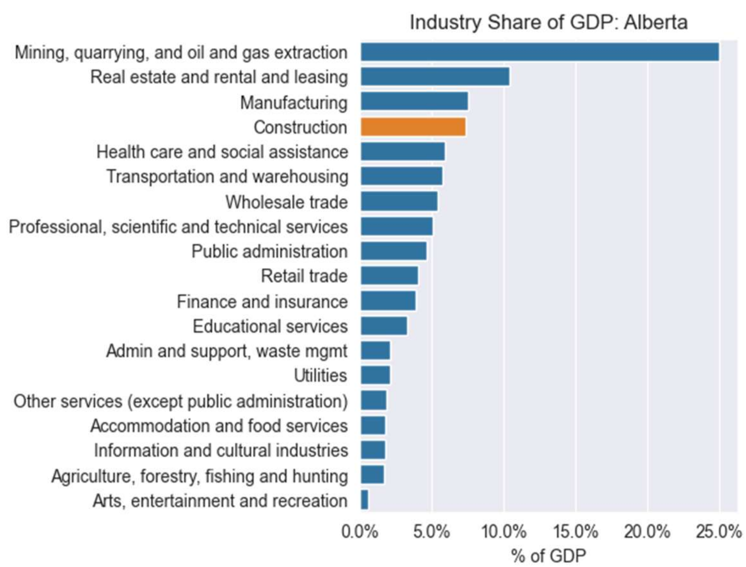
The impact of surety bonding will depend on the size and extent of the region's construction industry[3].

2.1 Overview

The Construction sector is the 3rd largest sector in Canada and 4th largest in Alberta. It provides 7.7% of Canada's GDP, and 7.4% to Alberta's economy (as shown in Figure 5). The output of the construction sectors includes:

- Public capital projects (including public infrastructure and social projects)
- Private infrastructure
- Private housing
- Industrial, Commercial and Institutional construction

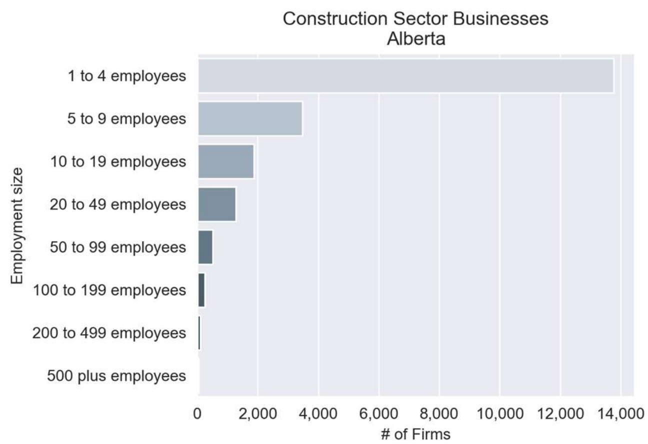
Figure 5 Industry share of GDP in Alberta



Across Alberta, as shown in Figure 6, the construction sector is dominated by small businesses with fewer than 20 employees. These small businesses are typically at greater risk of insolvency than larger firms. As a result, surety bonding, particularly payment bonds, can have a significant impact on their stability.

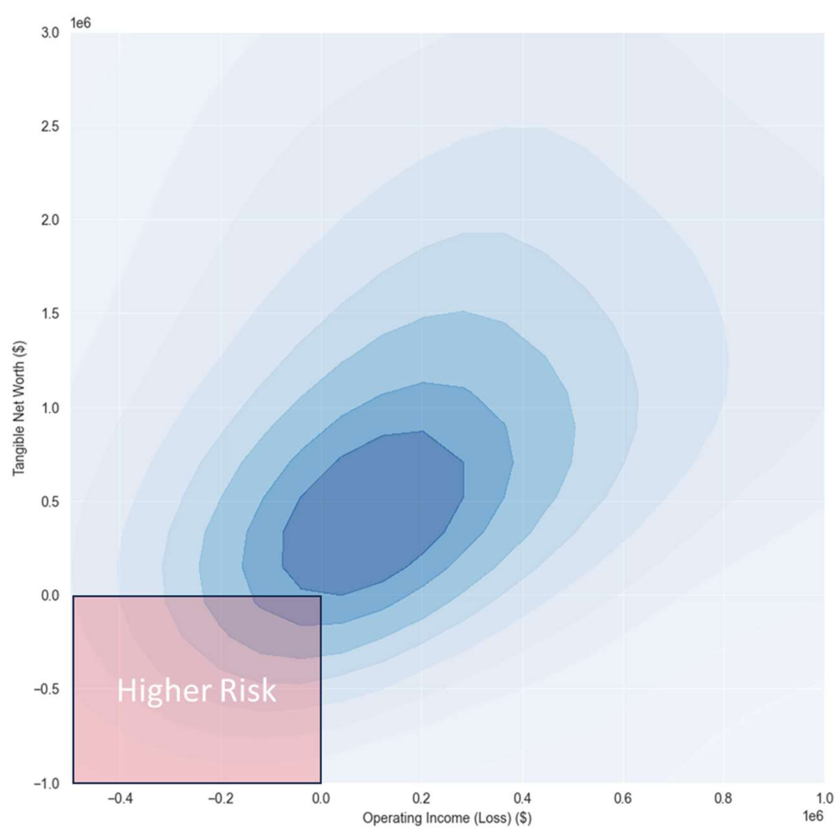
[3] For the purposes of this analysis construction includes building construction (non-residential – industrial, commercial, and institutional, plus residential); and engineering construction (e.g., transportation, water & wastewater, communications, and other engineering construction). Each has a public and private component.

Figure 6 Alberta Construction Sector Profile



Across the industry, the total employment in the sector is over 186,000 with a large number of 35 to 55 year olds, as shown in Figure 6. As will be discussed in Section 2.4, these age groups are at particular risk to negative well-being impact in the event of unemployment. As a result, any policy that provides greater financial security can result in well-being improvements. Since both business size and demographics play an important role in the potential impacts of surety bonding, both factors are incorporated in the analysis.

Figure 7 Companies at higher risk of insolvency or financial distress

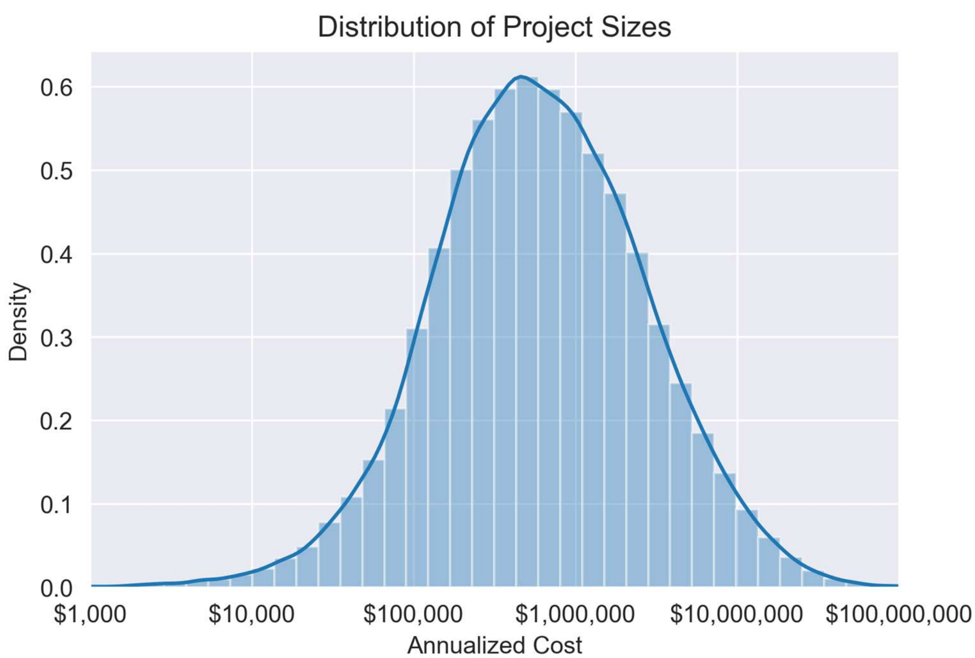


In addition to the size of businesses (by number of employees), the financial profile of companies is critical to the impact of surety bonds. Companies with regular losses and low net worth are at higher risk of financial distress. In companies with surety bonded projects, there are relatively few companies in the high-risk region, as shown in Figure 7. This suggests that the due diligence that surety enforces, along with the surety itself (in cases requiring it), help to reduce strain in the economic network, although this does not apply to all companies evenly.

2.2 Distribution of Project Sizes and Premiums

Project values range from tens of thousands to multi-million dollars with the majority in the $200,000 to $2,000,000 range, as shown in Figure 8. Note that project values are "annualized" by dividing total value by expected duration of construction (in years), as this is more reflective of the rate that money enters the economy.

Figure 8 Distribution of project sizes



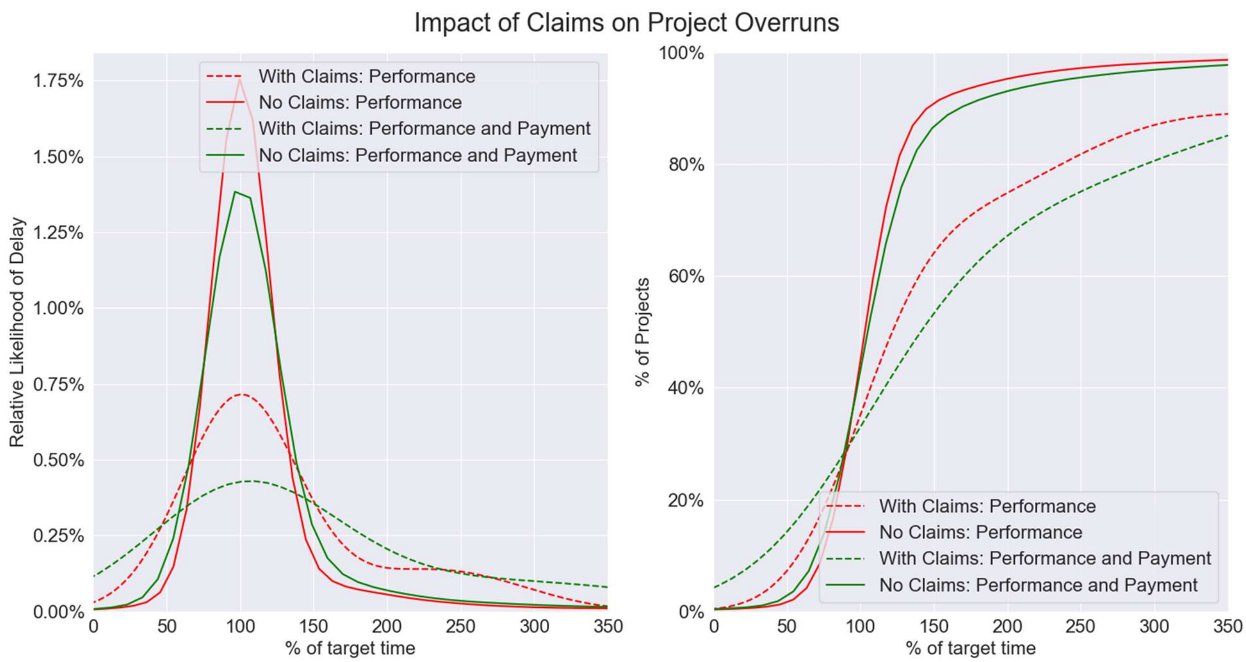
Given the project size, the model picks bond properties based on the distributions from the SAC dataset, and premiums and percentage of project value bonded may vary depending on bond type (performance vs performance and payment). This gives us a way of randomly selecting realistic bond characteristics in the simulations.

2.3 Insolvencies and Delays

Examining the data, as shown in Figure 9, we see there is a distribution of delays given financial stress (where claims were used as a proxy for financial stress) with different bond types. Non-bonded companies experiencing financial stress would, conservatively, have projects facing the largest delay distribution. Similarly, the percentage of projects with claims have more delays than those without. This provides:

- A lower estimate of the delays that might be experienced without bonds; and
- The delays that might be avoided for projects that become bonded.

Figure 9 Impact of claims and financial stress on project timelines



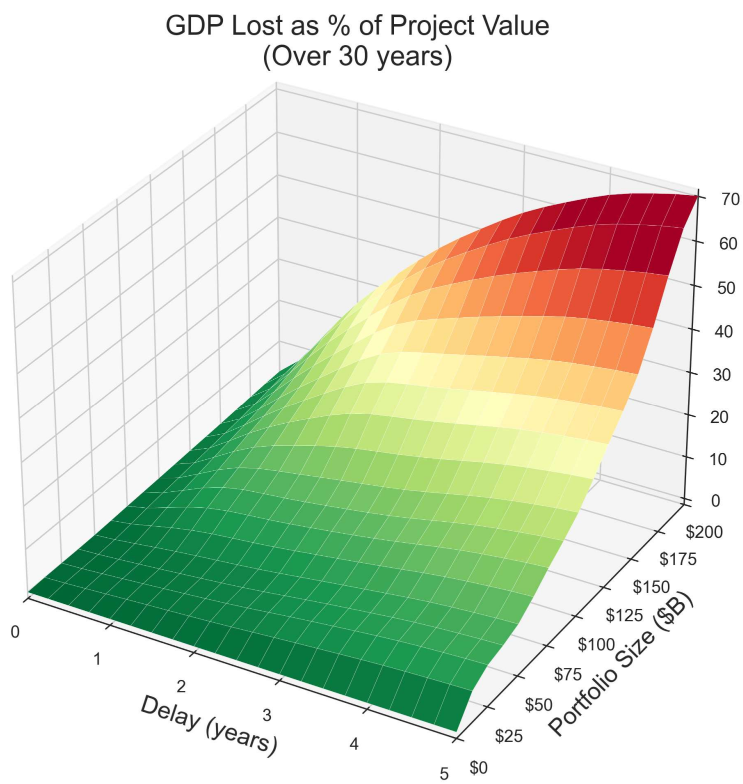
What this shows is that:

- Most projects are completed around the expected timeframe, though less so for those being undertaken by companies under financial stress (i.e., with claims); and
- While roughly 90% of projects not under financial stress (i.e., without claims) are completed within a 40% delay, a similar proportion of those under financial stress (i.e., with claims) are only completed within a 200% delay.

Note that we are not assigning any specific reason for the change in total time from expectation. Projects may extend beyond their initial target date for a variety of reasons, including both non-financial factors such as scope changes and unforeseen issues, as well as financial issues such as insolvency. As a result, there are overruns for projects without claims as well.

Further, as highlighted in previous work by CANCEA (2016), there are significant economic consequences to infrastructure project delays. Infrastructure delivery is about "right size, right place, and *right time*". If something stands in the way of delivering or enabling a vital public service at that time, then the economy suffers. Since infrastructure plays a critical role in the efficient operation of the economy, the effect of delays today compounds over decades. As a result, the effective present-day value of an infrastructure project is reduced significantly for larger projects and greater delay in implementation. That is, for smaller projects, the impact of delays, even up to a few years, has a relatively small effect. However, as shown in Figure 10, as the portfolio of projects grows in size, the cost of delays to the Canadian economy quickly becomes more significant (Canadian Centre for Economic Analysis, 2016).

Figure 10 Effect of delays on infrastructure projects



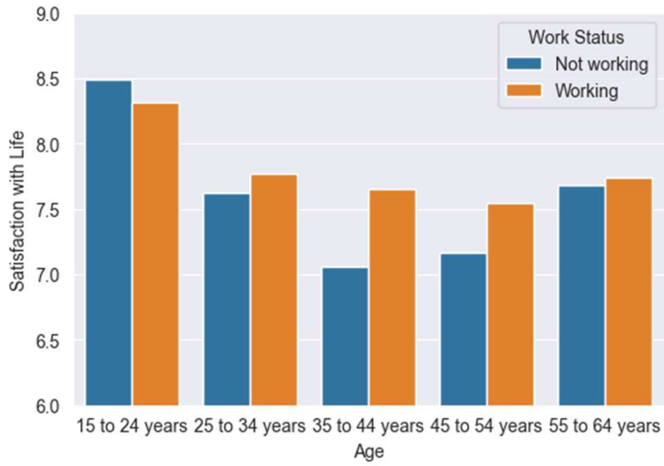
2.4 Well-Being Effects

Social value of a policy is its measure of the impact of people's well-being[4]. Many factors contribute to a person's overall well-being including their health, relationship status, housing situation, financial security, and their employment status. People who are working and financially secure, typically will have a higher satisfaction with life than those who are not. This is particularly true for people in middle age groups (35 to 55) who frequently have more financial obligations than other age groups. When a business faces financial stress or insolvency, its employees may experience

[4] Well-being is frequently used interchangeably with satisfaction with life, or more casually 'happiness'

temporary unemployment or uncertainty about their financial security. As shown in Figure 11, this can have a considerable impact on their well-being.

Figure 11 Impact of short-term unemployment on people's well-being



As a result, any policy, such as surety bonding, that helps prevent episodes of unemployment or financial uncertainty can have considerable social value by maintaining the well-being of employees.

3.0 ECONOMIC AND SOCIAL VALUE OF SURETY

3.1 SCENARIOS

One benefit of using CANCEA's platform is that multiple scenarios can be run and compared against a baseline. This shows, across thousands of randomized trials, the likely outcomes (plus the not-so-likely ones), and their broad impact across the entire economy. It also allows for in-depth sensitivity analysis (employed here) to help decision-makers determine "optimal" policies. For this project, there are some key steps:

- *Define a 'baseline' capital investment profile*: construction (public and private) under the status quo over the next 30 years.
- *Assign companies to build projects*: Under the status quo, companies are randomly assigned to build the projects (accounting for insolvencies) with project sizes corresponding to company capabilities.
- *Quantify impacts of Surety bonds*: Vary the number of bonded projects to study the impact through changes in insolvency and project delays.

In total, four economic and policy combinations are considered in this analysis:

1. **Status quo** insolvency rates with **performance** bonds only
2. **Status quo** insolvency rates with **performance and payment** bonds
3. **High risk** insolvency rates with **performance** bonds only
4. **High risk** insolvency rates with **performance and payment** bonds

In addition, each scenario considers bonding:

1. **Public infrastructure** project only
2. **All construction** projects

This results in 8 scenarios to be considered in total.

The status quo and high-risk scenarios are based on historical datasets. As shown in Figure 12:

- The dashed green line shows a typical modelled rate of insolvency in the status-quo scenario with no surety bonds; and
- The dashed red line shows a typical modelled rate of insolvency in the high-risk scenario with no surety bonds.

These scenarios are chosen to present the lower and upper extremes on the benefit of surety bonding. For intermediate levels of insolvency, the impact would lie between the extremes.

Figure 12 Status quo and high-risk insolvency scenarios in the construction sector

3.2 Economic Value

The combination of performance and payment bonds on public infrastructure protects the greatest economic value relative to the premiums paid. Per million dollars of premium on public sector infrastructure projects, the combination of performance and payment bonds results in the protection of $4.13 million of GDP in the status quo case. In the high-risk scenario, it increases to $29.10 million per million in premiums paid. The reduction in both general contractor and subcontractor insolvencies, and the increase of projects completed on time are the driving factors of the larger benefits.

Table 1 Economic value of surety per $1 of premiums – Public Infrastructure

	Performance and Payment Bonds Public Infrastructure		Performance Bonds Public Infrastructure	
	Status Quo Scenario	High Risk Scenario	Status Quo Scenario	High Risk Scenario
GDP protected per $1 premium	$4.13	$29.10	$3.27	$16.62
Jobs year protected per $1M premium	24.4	172.3	19.3	98.4
Taxation revenues protected per $ premium	$0.36	$2.52	$0.28	$1.44

As shown in Table 1, depending on the scenario some or all of the premiums paid by the government for bonds on public work can be recovered through tax revenue. In the status quo scenario, governments will protect $0.36 of broader economic tax revenue for every $1 premium spent. As the risk increases, it starts to get back more than what it pays. In the high-risk scenario, governments show a net gain, protecting $2.52 of broader economic tax revenue for every $1 premium spent.

If bonding is extended to all construction projects beyond public infrastructure (Table 2), the economic benefits remain positive but are smaller relative to public infrastructure projects only. As more premiums are being spent on projects which have less of a systemic impact on the productivity and employment in the economy, the total economic benefits per premium paid is reduced.

Table 2 Economic value of surety per $1 of premiums – All Construction

	Performance and Payment Bonds All Construction		Performance Bonds All Construction	
	Status Quo Scenario	High Risk Scenario	Status Quo Scenario	High Risk Scenario
GDP protected per $1 premium	$2.77	$17.94	$2.06	$10.95
Jobs year protected per $1M premium	16.4	106.2	12.2	64.8
Taxation revenues protected per $ premium	$0.24	$1.55	$0.18	$0.95

A full sensitivity analysis of differing project thresholds and fraction of the industry bonded is provided in Appendix A.

3.3 Social Value

The social value, arising from the well-being impacts of surety bonds on the economic and labour market, are shown in Table 3 (public infrastructure projects only) and Table 4 (all construction projects). In the case of limiting bonding to public infrastructure projects, the social value is greater than the premiums paid, with the most significant social value arising in the high-risk scenario with performance and payments bonds. This is due to the employment and financial security protected in the high-risk case. Bonding significantly reduced the risks of both general and subcontractors facing financial distress and the resulting unemployment for their employees.

Table 3 Social value of surety per $1 of premiums

	Performance and Payment Bonds Public Infrastructure		Performance Bonds Public Infrastructure	
	Status Quo Scenario	High Risk Scenario	Status Quo Scenario	High Risk Scenario
Social Value protected per $1 Premium	$1.02	$7.20	$0.81	$4.11

When bonding is extended to all projects, there is still a positive social value per premium paid, but it is less than focussing on public infrastructure. The reasons are the same as for the economic value with more premiums being spent on projects which have less of a systemic impact on the productivity and employment in the economy.

Table 4 Social value of surety per $1 of premiums

	Performance and Payment Bonds All Construction		Performance Bonds All Construction	
	Status Quo Scenario	High Risk Scenario	Status Quo Scenario	High Risk Scenario
Social Value protected per $1 Premium	$0.68	$4.44	$0.51	$2.71

3.4 Total Value

The total value, which is the sum of the economic and social values of surety bonds, is shown in Table 5 for the case of bonding on public infrastructure projects. The total rate of return over the next 30 years is significant, particularly in the case where risks of insolvency were to increase. While the high-risk case included a sustained period of elevated risks, the return for any more moderate scenario, such as a few years of high risk, would fall between status quo case and the high-risk scenario.

Table 5 Total value for surety on public infrastructure projects

	Performance and Payment Bonds Public Infrastructure		Performance Bonds Public Infrastructure	
	Status Quo Scenario	High Risk Scenario	Status Quo Scenario	High Risk Scenario
Net GDP[5] protected per $1 premium	$3.13	$28.10	$2.27	$15.62
Social Value protected per $1 Premium	$1.02	$7.20	$0.81	$4.11
Net Benefit per $1 Premium	**$4.15**	**$35.30**	**$3.08**	**$19.73**
Net Rate of Return	4.9%	12.6%	3.8%	10.5%

Finally, Table 6 shows the net value if all capital projects are bonded. While the returns are positive in all scenarios, they are less than those seen with bonding is limited to public infrastructure projects.

Table 6 Total value of surety on all capital projects

	Performance and Payment Bonds All Construction		Performance Bonds All Construction	
	Status Quo Scenario	High Risk Scenario	Status Quo Scenario	High Risk Scenario
Net GDP protected per $1 premium	$1.77	$16.94	$1.06	$9.95
Social Value protected per $1 Premium	$0.68	$4.44	$0.51	$2.71
Net Benefit per $1 Premium	**$2.45**	**$21.38**	**$1.57**	**$12.66**
Net Rate of Return	3.0%	10.7%	1.5%	8.8%

[5] Net GDP is the GDP benefit minus the premiums paid.

4.0 CONCLUSIONS

Credit and operational risk in the construction industry can vary significantly due to the movement of interest rates, recession, supply shocks, debt levels, credit squeezes and so on. By understanding, quantifying and simulating the way in which the construction industry is connected between suppliers and subcontractors of materials and services and to the broader economy, the value of providing surety guarantees for projects to the socio-economic network of Alberta could be measured. We found that the impact of surety – and the additional due diligence its use ensures – is generally positive, regardless of which scenario run. However, a combination of performance and payment bonds – with a focus on public infrastructure projects – yields the highest benefits (measured in terms of GDP growth) relative to the costs required.

The combination of performance and payment bonds on public infrastructure protects the greatest economic and social value relative to the premiums paid.

In the status-quo scenario, the combination of performance and payment bonds on public infrastructure projects protects

- $4.13M of GDP for every $1M of premiums paid
- $0.36M of tax revenue for every $1M of premiums paid
- $1.02M of social value for every $1M of premiums paid

In the high-risk case, the combination of performance and payment bonds on public infrastructure projects protects

- $29.10M of GDP for every $1M of premiums paid
- $2.52M of tax revenue for every $1M of premiums paid
- $7.20M of social value for every $1M of premiums paid

The pairing of performance and payment bonds helps to reduce the risk of insolvency cascading through businesses by ensuring that sub-contractors are able to complete other projects resulting in more GDP protected per premium paid than performance bonds alone. Bonding on all projects reduces the return as many projects are bonded that have less impact on the long-term productivity on the economy, lessening the impact of delays on completion.

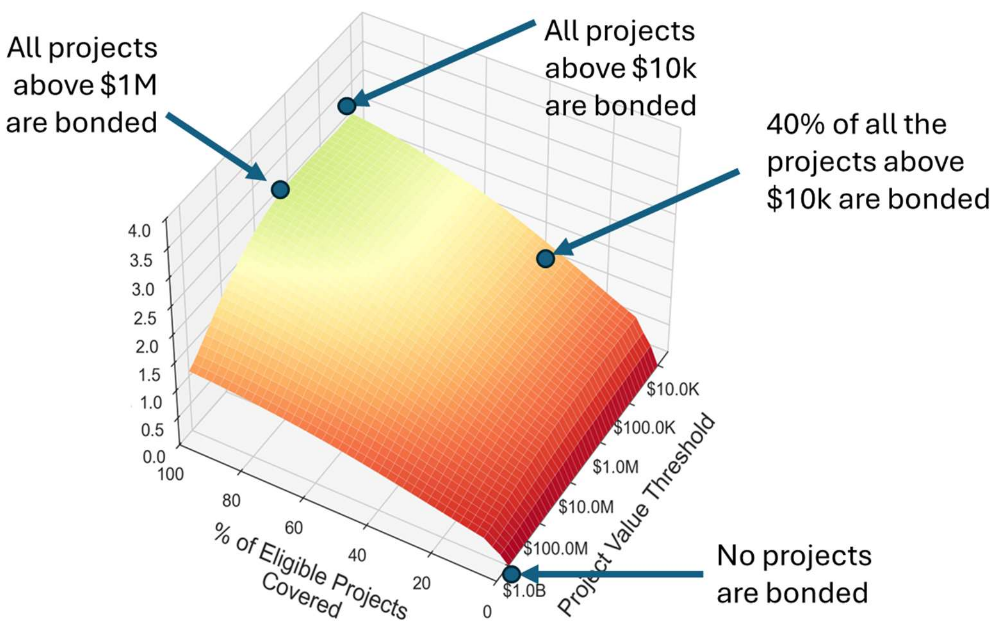
A. SENSITIVITY ANALYSIS

The results presented in the report assume that all projects above $10k are bonded. However, it is important to understand the sensitivity of the outcomes to characteristics of the projects bonded. Two parameters are varied:

- The minimum project size bonded (lower right-hand axis in the figures below), and
- The percentage of all projects of that size that are bonded (lower left-hand axis).

In all figures, the “back corner” of $10k project threshold and 100% of projects bonded corresponds to the values in the report. Figure 13 show how to read the sensitivity graphs by highlighting some example points on the surfaces.

Figure 13 Illustrative point on the sensitivity graphs



In general terms, if more than 60% of all projects above $250k are bonded, as seen in the following sections, the results are fairly stable.

A.1. STATUS QUO SCENARIO

In the status quo scenario, the underlying insolvency risks to the construction sectors are assumed to reflect the recent trends (pre-pandemic).

Figure 14 GDP sensitivity to minimum project size and fraction of those projects which are bonded under a status quo risk scenario

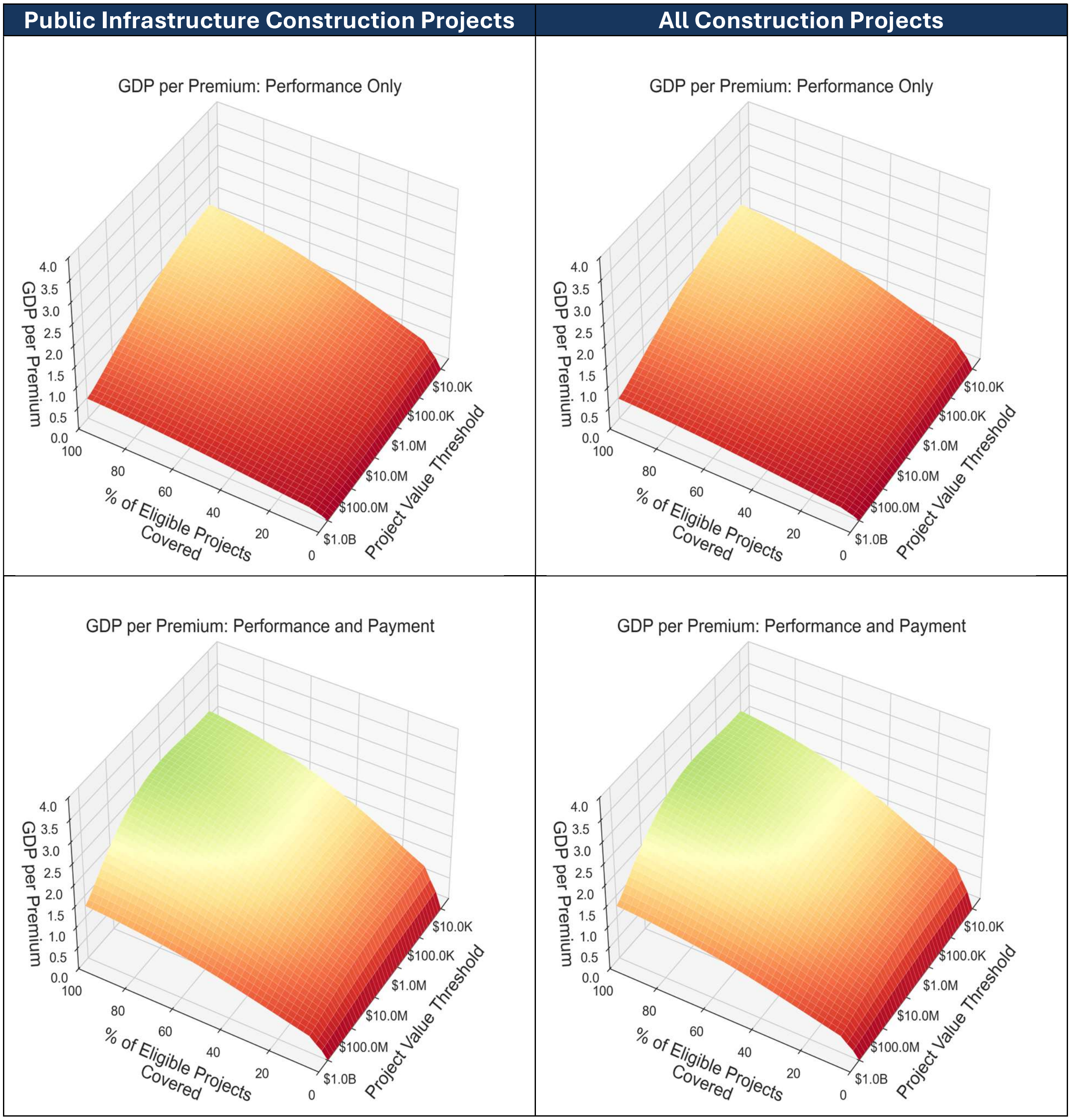


Figure 15 Job sensitivity to minimum project size and fraction of those projects which are bonded under a status quo risk scenario

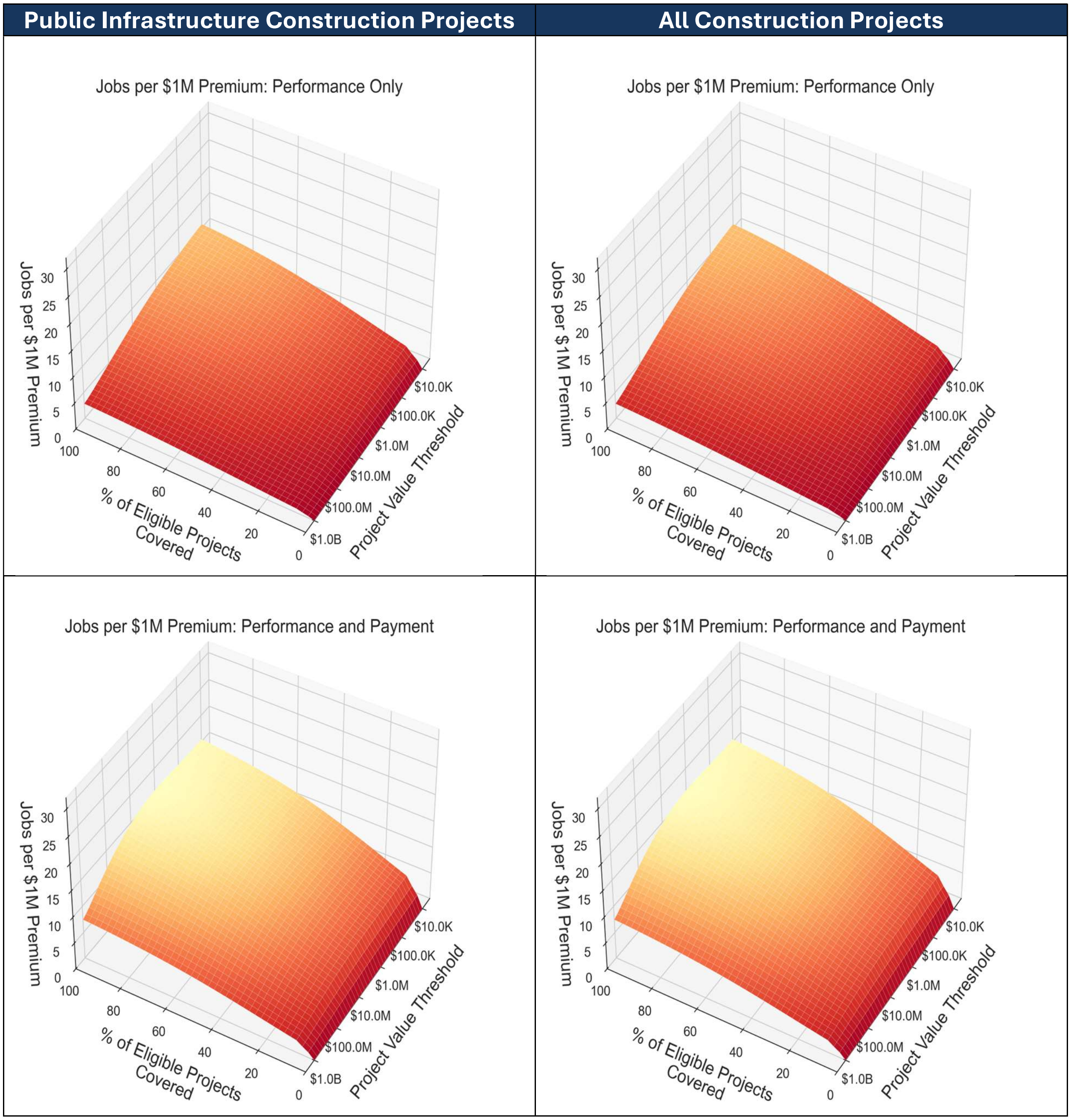
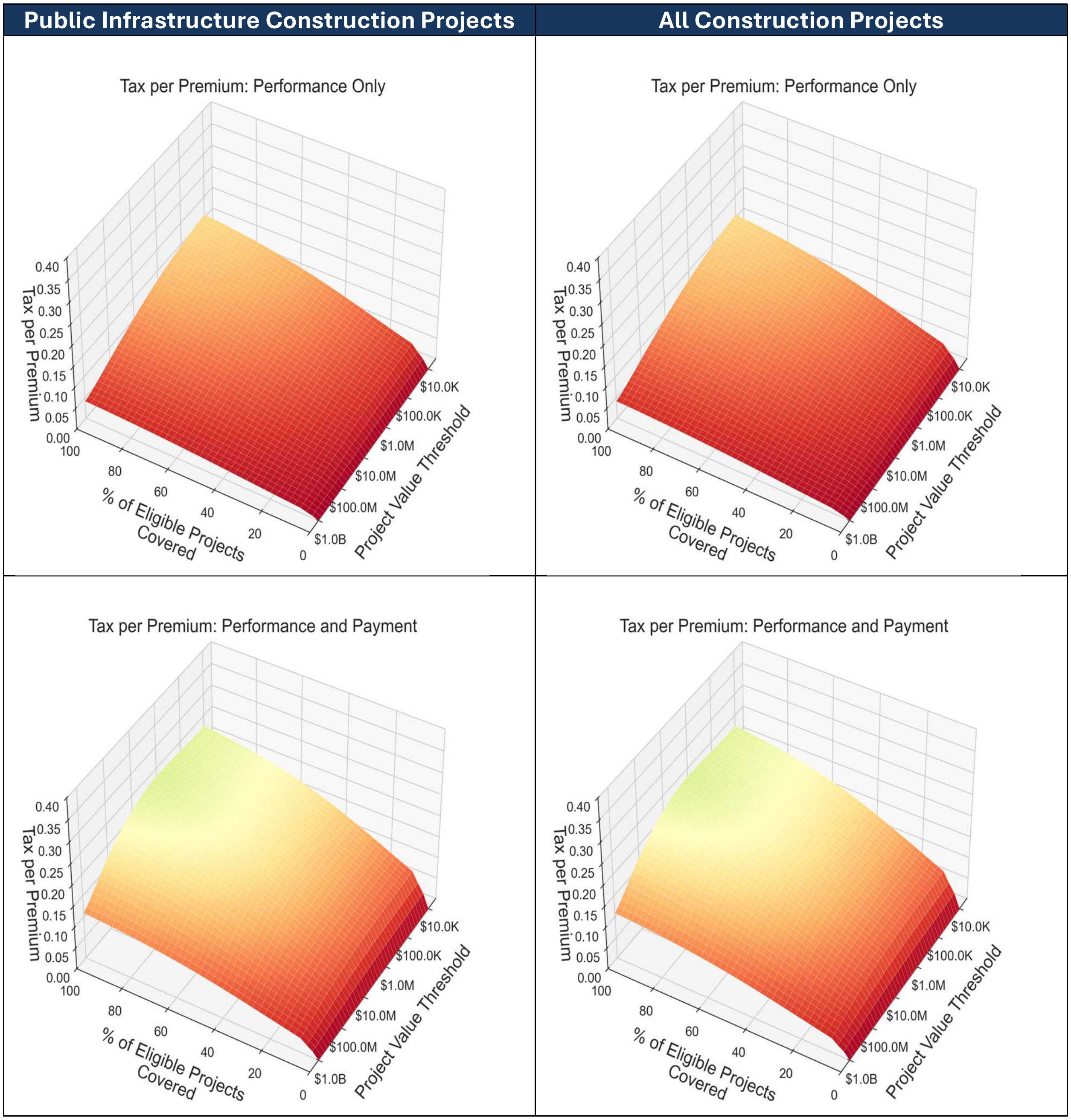


Figure 16 Tax return sensitivity to minimum project size and fraction of those projects which are bonded under a status quo risk scenario



A.2. High Risk Scenario

In the high-risk scenario, the economic and social outcomes are much greater than in the status quo scenario. Note that the vertical axis scales are different in the high-risk scenario than in the status quo case.

Figure 17 GDP sensitivity to minimum project size and fraction of those projects which are bonded under a high-risk scenario

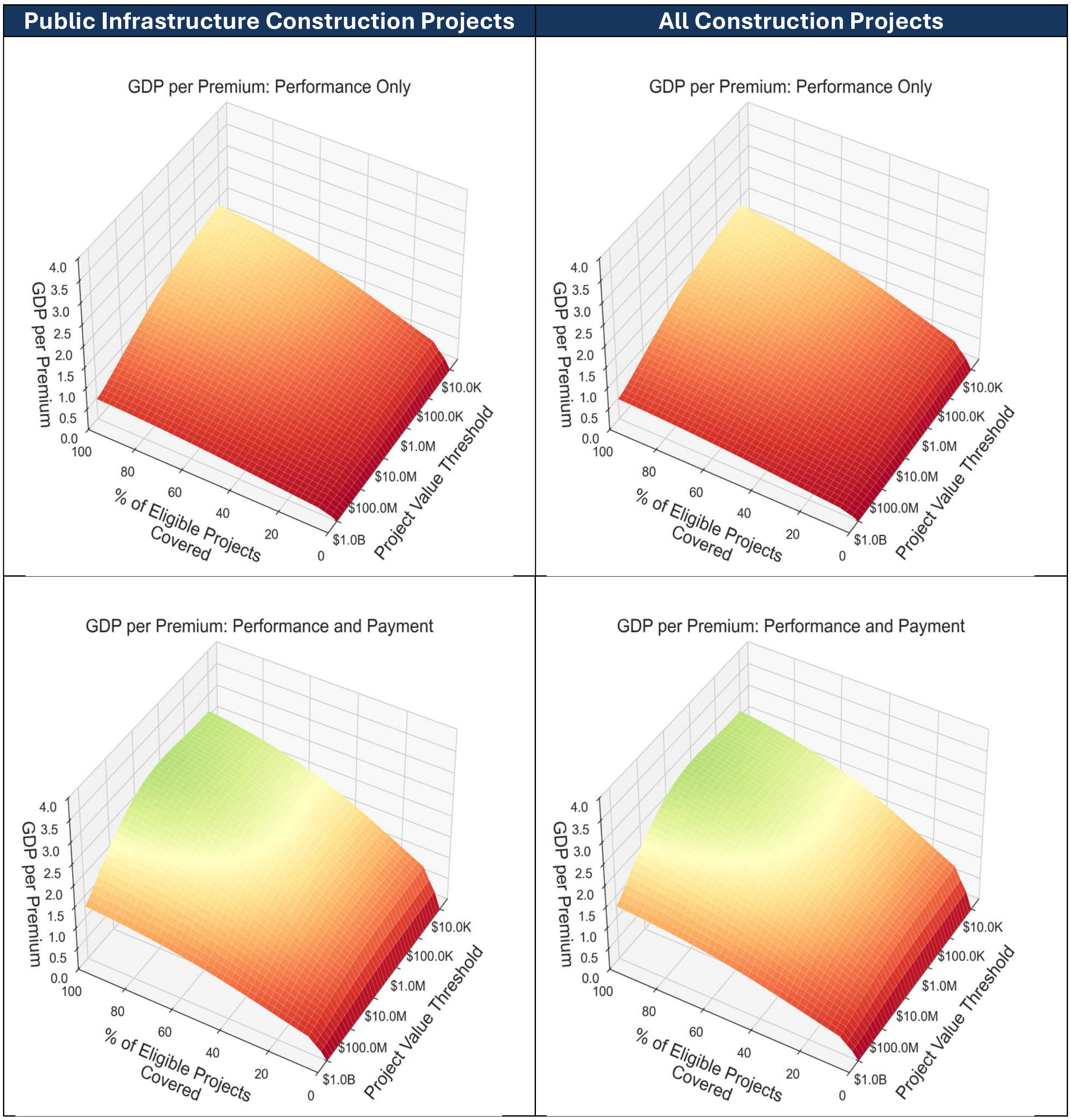


Figure 18 Job sensitivity to minimum project size and fraction of those projects which are bonded under a high-risk scenario

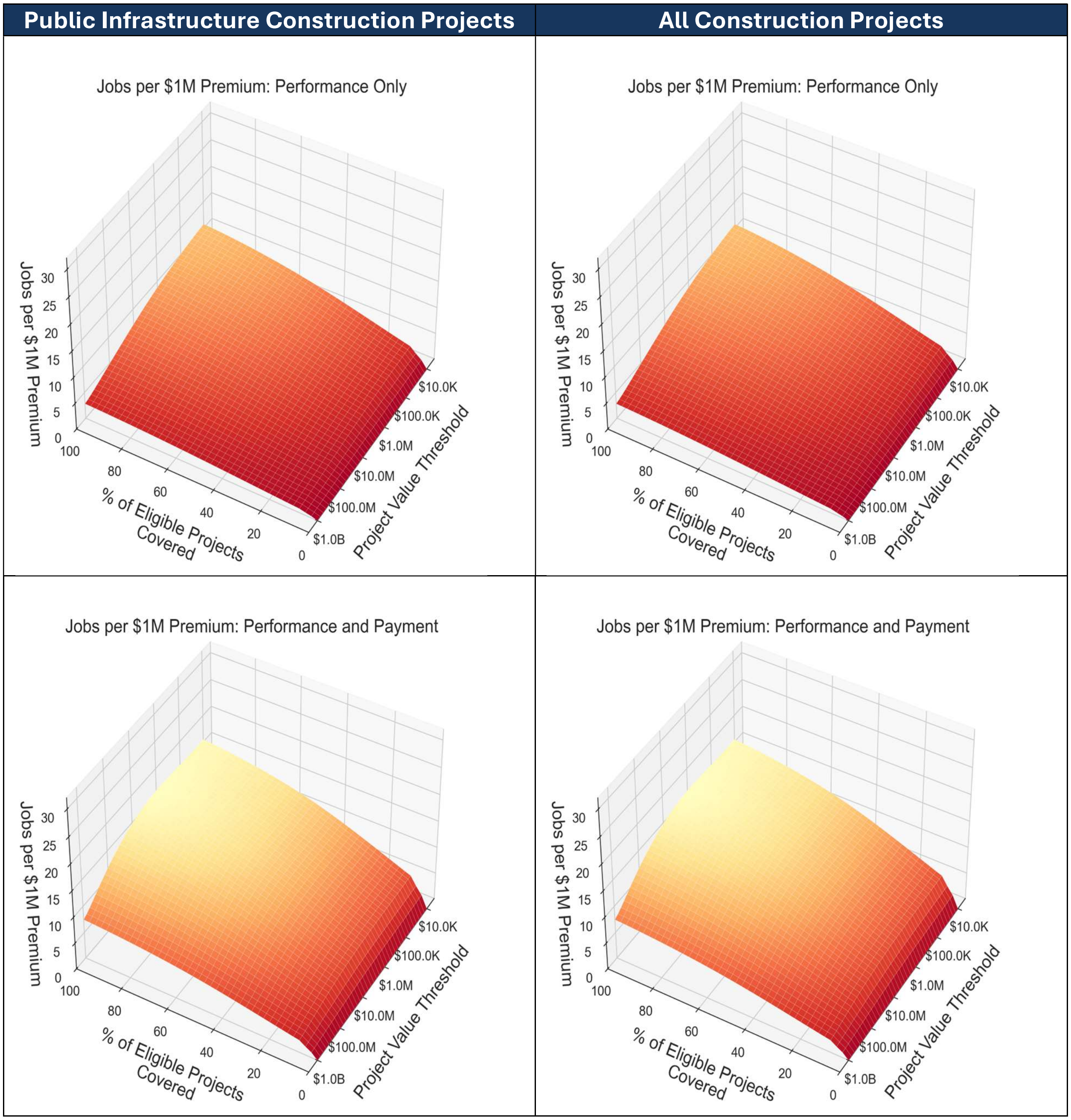
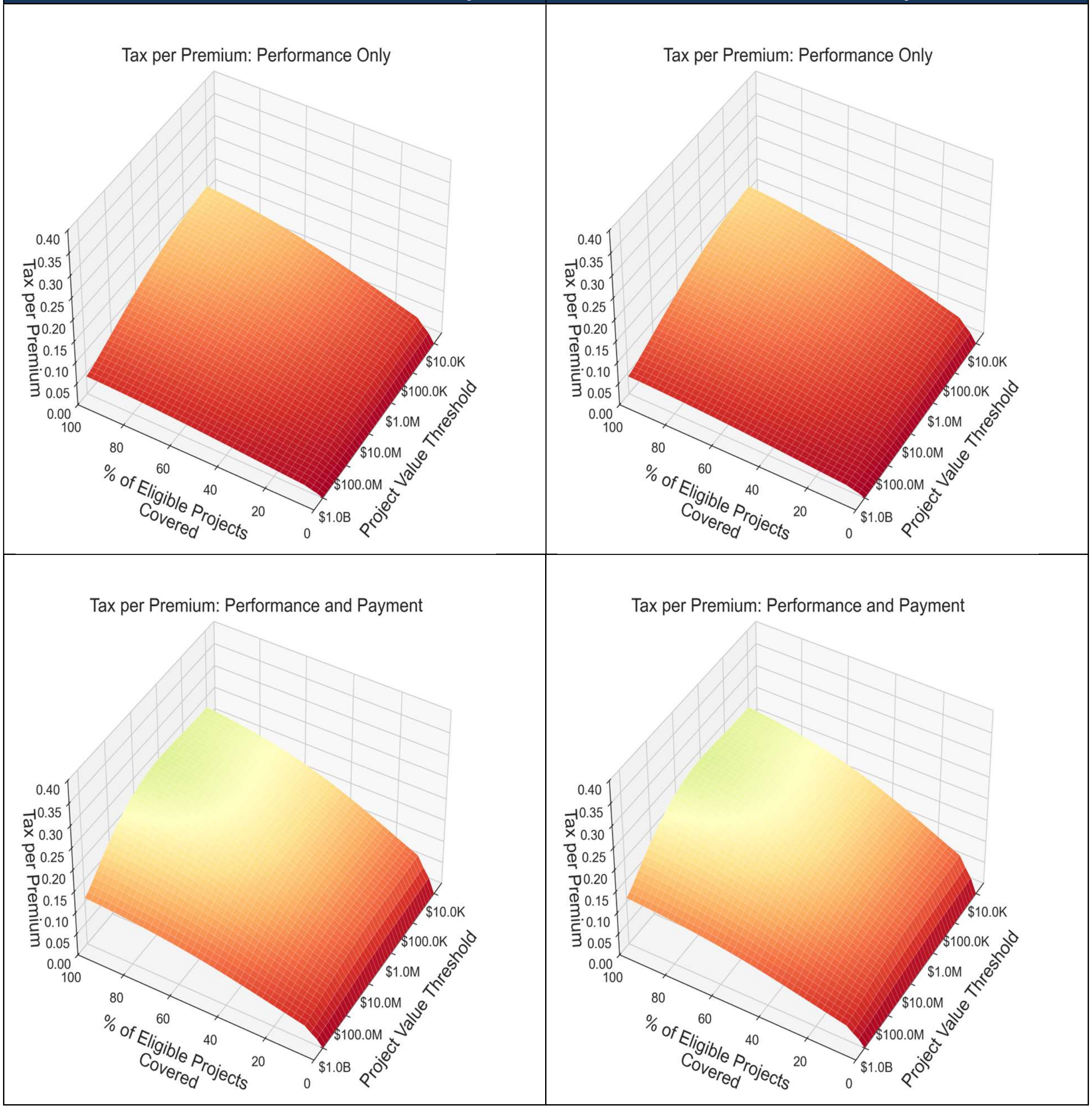


Figure 19 Tax return sensitivity to minimum project size and fraction of those projects which are bonded under a high-risk scenario

Public Infrastructure Construction Projects	All Construction Projects



B. SOCIAL VALUE CALCULATIONS

CANCEA's social value evaluation (SVE) approach couples agent-based modelling with statistical well-being estimation. Agent-based modelling is adopted to probabilistically track the socio-economic states and well-being of individuals longitudinally over time. The platform follows the individual evolution of each agent, such as a person, household, or business across time. Given starting states, individuals interact and face changing circumstances according to empirically derived probability distributions. In this way, the dynamics of the model emerge stochastically. While each of the individual decision processes may be straightforward, the combined dynamics of millions of heterogeneous people and businesses, subject to limited resources, can yield complex non-linear results. The utilization of agent-based models (ABM) in economic studies has been prescribed and supported by extensive research (Baptista, et al., 2016; Turrell, 2016; Haldane & Turrell, 2017; Farmer & Foley, 2009; Mazzucato, et al., 2020; UK HM Treasury, 2020; UK HM Treasury, 2020).

CANCEA's approach to SVE is rooted in the idea that subjective well-being valuation (Tesileanu, 2008; Dolan, Peasgood, & White, 2008; Carlsson, 2011) is an intrinsic part of SVE. Indeed, scholars emphasize the ability of well-being measurement to incorporate respondents' values and preferences, reflecting the outcomes of their choices, thus making it an indispensable tool in SVE (Diener, Inglehart, & Tay, 2013; Layard, 2010; Frey & Stutzer, 1999; Stutzer & Frey, 2010; Yang, 2018; OECD, 2013). Moreover, when future well-being expectation changes are involved, the aggregation process requires discounting for future well-being expectations at the individual level before aggregation. Handling time and well-being preferences is important for long-term assets, addressing issues like inflation, risk and well-being expectations, as outlined in the UK Green Book (2018)

In light of this, CANCEA conducts SVE by combining modelled agent dynamics with a well-being function for each agent. These functions are supported by statistics derived from detailed well-being surveys. In our analyses of subjective well-being with data from Statistics Canada's General Social Survey (GSS) and Canadian Community Housing Survey (CCHS), for instance, we can uncover strong correlations between individual characteristics and their well-being levels. Primarily, these analyses entail the computation of linear regressions corrected for interactions between independent variables and for non-linear relationships between well-being and some individual characteristics. This is motivated by extensive research identifying links between a person's well-being across time and their characteristics and the community and environmental circumstances they face (Lu, Schellenberg, Hou, & Helliwell, 2015; Helliwell & Wang, 2011; Chen & Hou, 2010; Kytta, Broberg, Haybatollahi, & Schmidt-Thome, 2016; Layard, Mayraz, & Nickell, 2008).

Following this approach, SVE requires the separate specification of a baseline scenario, in which the status quo is maintained in the long run and no structural changes are introduced, and an alternative scenario, in which a proposed structural change is introduced. Each of these scenarios yields, for every individual analyzed, a probability distribution of outcomes regarding their well-being and socio-economic states. The expected value of these outcomes is then adopted as the representative measure of that scenario.

In the baseline, given status quo relationships that are derived from historical data, the number of possible journeys followed by an individual over the period analyzed is equal to the number of possible (reasonable and realistic) combinations of all demographic and socio-economic characteristics of the individual. Each of these combinations is a possible state of the individual at a given time. The probability of each such state occurring is equal to the probability that all variables of the individual have a given realized value, given the individual's preceding state. This yields a probability distribution of individual states.

Based on this distribution, the expected value of the well-being in the baseline scenario for this individual is equal to the expected value of that individual's well-being function. That is, given the individual's initial state, the expected value of their well-being at the end of the period is equal to the sum of all possible well-being values (defined over all possible states), weighted appropriately by the probability of each state occurring.

The expected well-being of the individual in the alternative scenario is computed similarly, with individual states and state changes being affected by the introduction of some change in circumstances, such as a policy or infrastructure project.

The difference between these expected well-being values for the baseline and alternative scenarios yields the well-being impact of the change in circumstances for the individual in question. Then, analysis is conducted to identify the income change over the analyzed period that would result in the same change in well-being for this individual, holding the remaining state variables constant. This income change, referred to as monetary equivalent, is then present valued using the yield curve for a zero coupon bond to obtain discount factors. These present-valued monetary equivalents are aggregated over all individuals affected by their change in circumstances in response to what is being evaluated, yielding the total social value. The translation of well-being changes into monetary equivalents and the subsequent aggregation of these adjustments into a social value estimate is a key feature of Murtin, Boarini, & Ripoll (2017) and Llena-Nozal, Martin, & Murtin (2019), for example.

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