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A Letter from the Ford School of Public Policy's
Dean Celeste Watkins-Hayes

As dean of the Ford School, I'm incredibly proud of the Michigan Journal of Public Affairs, a wholly student-run and peer-reviewed journal that offers rigorous policy analysis from some of the brightest graduate students, policy practitioners, and academics across the U.S. and internationally.

This volume marks 20 years of showcasing scholarship that sheds light on a wide range of topics and contributes to important policy debate. Although much has changed in the policy landscape since volume one was released in 2004, the MJPA continues to exemplify excellence in communicating substantive solutions to complex and pressing challenges.

Congratulations to the editorial board and thank you for your hard work and leadership in producing another terrific edition and carrying on this strong Ford School tradition.

Sincerely,

Celeste Watkins-Hayes
Joan and Sanford Weill Dean
Founding Director, Center for Racial Justice
Gerald R. Ford School of Public Policy

A Letter from the Editors-in-Chief

Dear Readers,

We are thrilled to present Volume 20 of the Michigan Journal of Public Affairs. After a nearly two-year hiatus due to COVID and other complicating factors, the MJPA executive team coalesced around a shared vision of Journal revival. Our amazing staff of editors joined the effort, and their resilience and dedication have resulted in the publication that follows.

MJPA's editorial process is extensive and arduous. Our staff, consisting of Gerald R. Ford School graduate students (MPP and PhD), initiates the operation during the fall semester, when we solicit over 300 institutions and individuals for articles. Over the following months, MJPA receives dozens of quality submissions from researchers and professionals around the world. Each of our editors critiques every submission through a blind review process, culminating in a team-wide selection conference. The most original, articulate, and impactful pieces receive offers of conditional acceptance and are then subjected to a semester-long editing process. Through this collaborative enterprise, teams of editors work together with authors to ensure each article is in top form for publication. All members of MJPA volunteer their time and talents outside of their curricular commitments, and nearly every member of Volume 20 did so without previous MJPA experience. Our editors are the backbone of this publication, and their commitment to the work of the Journal enables these deserving perspectives to reach the public.

Volume 20 of MJPA includes novel pieces on post-Brexit agricultural policy, the impact of student debt on Black mothers, the newly proposed Second Look Sentencing Act, groundwater management in Michigan, funding options for public education, the significance of HBCUs on the future success of Black students, and food inflation rates in Indonesia. We're delighted to include research from a diverse collection of graduate students, professors, and policy practitioners who offer fresh thinking and rigorous analysis for the public good. As with all things in the policy realm, it is not expected that every reader will agree with all points made in this volume. However, we feel strongly that the topics discussed here are vital to the public discourse, and we are proud to offer the opportunity for dialogue in the interest of advancing equitable and just policy efforts.

We are so proud of, and grateful for, each individual's contributions of time and thought to this volume. From our accomplished authors to our tenacious staff, it has been a true privilege to work with such a great group; the future is now brighter for your efforts.

In closing, we hope you enjoy the latest volume of the Michigan Journal of Public Affairs.

Sincerely,
Hank Peters-Wood and Tyler Baird, Editors-in-Chief

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Countering Diffuse Water Pollution: Can Post-Brexit Agriculture Policy Go Against the Flow?

Timothy Arvan[†]

Abstract

Three years after Brexit, long-term economic, social, and environmental implications for the UK remain uncertain and subject to political debate. In this paper, I draw on a set of contemporaneous discussions during the Brexit negotiations with academic experts in British environmental policy and law to argue, narrowly, that withdrawal from the EU presents a transformative opportunity for the UK to redesign its agriculture policy to better manage diffuse water pollution. First, I introduce long-standing monitoring and enforcement challenges under the EU's Common Agricultural Policy, and their impacts on UK water quality. I then propose a roadmap for regulating the British agriculture sector given its unique characteristics including farm size and stewardship values. I argue that favorable lobbying dynamics after Brexit create an opportune moment for policy reform. Finally, I offer recommendations toward a set of policy tools that center the polluter-pays principle, offer local adaptability, enable farmer participation in stewardship, and align with long-term ecological goals.

Introduction

The United Kingdom's exit from the European Union, finalized on 31 December 2020, was the culmination of a four-year withdrawal process with vast implications for national security, global trade and investment, immigration, and labor. Already, a substantial political economy literature has emerged seeking both to explain the underlying causes of Brexit and consider its implications for the liberal international order.[1] Environmental issues were not a significant factor in the referendum campaign and less attention has been afforded to understanding the impacts of Brexit on the British environment, though speculation runs in both directions. On one hand, Brexit returns "environmental sovereignty" to the UK, giving the government, Parliament, and civil service flexibility to test new policy tools while remaining aligned with the body of European environmental law.[2] On the other, some experts fear environmental priorities could be overlooked altogether as the Conservative government pursues deregulation and new trade deals with Europe and global

[†] PhD Candidate in Political Science and Public Policy, University of Michigan.

[1] Martill, B., & Staiger, U. (Eds.). "Brexit and Beyond: Rethinking the Futures of Europe," *UCL Press*. (2018)

[2] Hilson, C. "The Impact of Brexit on the Environment: Exploring the Dynamics of a Complex Relationship," *Transnational Environmental Law 7* (1): 89–113. (2018)

partners.[3] The full environmental implications of Brexit are complex and nuanced, so that a full accounting of costs and benefits—and lessons for global environmental governance—may only be revealed over the long-term.

In the most comprehensive study of the "dynamic relationship" between UK and EU environmental policy, Hilson (2018) describes several domains including air quality and fracking in which the UK has been an environmental laggard and the beneficiary of policy integration with the EU. Yet in other domains, such as agriculture and fisheries, EU membership has weakened the UK regulatory process, and in others, such as climate change and biodiversity protection, the effects are varied and multi-directional.[4] Brexit transformed the UK-EU relationship across all domains (including those only now emerging, like governance for solar geoengineering), making it difficult to predict Brexit's net effect on environmental quality. Here I argue only that Brexit provides particular reason for optimism in terms of greening the UK's agriculture sector, specifically by opening a window of opportunity to address long-standing challenges in the regulation of diffuse water pollution from agriculture (DWPA).

This paper is motivated by my own immersion in the policy context as an M.Phil. student in the University of Cambridge Department of Land Economy during the peak of the Brexit negotiations in 2019 and 2020. My analysis is informed in particular by conversations with Ian Hodge, Emeritus Professor of Rural Economy and member of the Economic Advisory Panel for the UK's Department for Environment Food and Rural Affairs (Defra). To develop this project, I also consulted Dr. Ksenia Gerasimova of the Cambridge Centre for Environment, Energy and Natural Resource Governance (my dissertation supervisor at the time, who has published widely on food systems), and I participated in seminars and workshops on related topics with experts from the Department of Land Economy and Faculty of Law, including Professors Shaun Larcom, Jorge Viñuales, Marie-Claire Cordonier Segger, and Markus Gehring. Here I do not undertake original data collection, nor do I perform a systematic literature review. Rather, I rely on first-hand knowledge and discussions with experts to inform a short argumentative review that seeks to explain key dynamics and propose a roadmap for timely policy action.

The paper is organized as follows. Section I defines DWPA, then reviews its causes, the challenges it presents for regulators, and its effects that make it a primary driver of ecological damage in the UK and Europe. Section II contends that by transitioning away from the EU's poorly designed Common Agricultural Policy (CAP), the UK can eliminate perverse incentives for farmers to intensify their practices and address technical and behavioral drivers of DWPA from Britain's relatively large-scale farms. Section III assesses lobbying dynamics in the UK to explain why the restructuring of British agriculture policy after Brexit is likely to succeed in delivering environmental benefits at this juncture. Section IV introduces several potential policy innovations informed by the polluter-pays principle which could

[3] Burns, C., & Carter, N. "Brexit and UK Environmental Policy and Politics," *Revue Française de Civilisation Britannique* XXIII–3. (2018)

[4] Martill & Staiger. "Brexit and Beyond."

soon be developed to address DWPA.

I. Regulating Diffuse Pollution

Diffuse pollution, or nonpoint source pollution, describes the human-caused release of pollutants into the environment from widespread land use activities.[5] Agriculture is a major driver of diffuse pollution, particularly from the application of nitrogen-based and other chemical fertilizers and compounds during farming, which creates harmful runoff into the water system.[6] In addition to the threat DWPA poses for aquatic and terrestrial species and the provision of ecosystem services, it is also linked to significant economic losses from diminished commercial and recreational value of water resources, and it represents a substantial risk to public health if drinking water supplies become contaminated.[7] Despite the large and tangible benefits of mitigating DWPA, the problem is made intractable by environmental, behavioral, and temporal dynamics that raise the cost and complexity of monitoring and control programs relative to those for point-source pollution (i.e., from factories, power plants, or sewage treatment facilities).[8] I discuss each set of dynamics in turn.

First, natural variability of rural environments complicates efforts to link diffuse pollution to environmental damage, and vice versa.[9] For instance, in a case study of nitrate runoff from agricultural sources in the UK's Yorkshire Derwent catchment (or watershed, an area of land over which water collects into a single body), Hutchins (2009) finds the effectiveness of mitigation techniques to be variable across space and difficult to estimate precisely. Specifically, impacts of reduced fertilizer application and conversion of arable land to grassland could not be easily predicted or measured due to underlying differences in environmental factors such as soil quality, location of farms relative to water bodies, and the topography of the land.[10] In an inter-regional comparison of catchments in Cumbria, Norfolk, and Hampshire Avon, Owen (2012) reports variability in climate conditions including rainfall and temperature that affect the concentration of pollutants in runoff. These studies demonstrate major challenges for the administration of mitigation efforts in the absence of "efficient spatial targeting of measures."[11]

Second, farmers in different climates have developed specialized farming techniques as well as land and water conservation practices that affect their baseline perceptions of DWPA and

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[5] Kampas, A., Edwards, A. C., & Ferrier, R. C. "Joint Pollution Control at a Catchment Scale: Compliance Costs and Policy Implications," *Journal of Environmental Management 66* (3): 281–91. (2002)

[6] Cleasby et al. "An Exploration of Individual, Social and Material Factors Influencing Water Pollution Mitigation Behaviours within the Farming Community," *Land Use Policy 70*: 16–26. (2018)

[7] Owa, F. D. "Water Pollution: Sources, Effects, Control and Management," Mediterranean Journal of Social Sciences 4 (8): 65–68. (2013)

[8] Hodge, I. "The Governance of the Countryside," *Cambridge University Press*. (2016)

[9] Blandford et al. "Reforming Agricultural Nonpoint Pollution Policy in an Increasingly Budget-Constrained Environment," *Environmental Science & Technology 46* (3): 1316–25. (2012)

[10] Bateman et al. "Cost-Effective Mitigation of Diffuse Pollution: Setting Criteria for River Basin Management at Multiple Locations," *Environmental Management 44* (2): 256–67. (2009)

[11] Bateman et al. "Cost-Effective Mitigation of Diffuse Pollution."

willingness to take up mitigation efforts.[12] For this reason, there are large information asymmetries between farmers, who draw on local expertise and lived experience to take or avoid certain actions that affect DWPA, and regulators, who lack first-hand knowledge of conditions on the ground.[13] Such asymmetries, although not harmful in all cases, generate vulnerabilities to issues of adverse selection and moral hazard. For example, adverse selection would result if regulators lacked information needed to target interventions to DWPA-prone catchments, and instead new programs disproportionately enrolled farmers already embracing sustainable practices. Here, regulators might falsely believe their interventions to be working. Moral hazard would result if new programs, regardless of their location, could not be credibly enforced, allowing noncompliance to become normalized among farmers. For these reasons, tackling DWPA at scale means contending with the high costs of program implementation due to inaccurate or unavailable information at the local level.[14]

Third, the iterative process of detecting and addressing diffuse pollution may only unfold over long time horizons. Braden (1993) notes the interaction of DWPA with point-source (i.e., direct) pollution from urban and industrial activities, making local ambient pollution levels an unreliable indicator of the origins and relative concentrations of contributing sources.[15] Consequently, isolating the effect of DWPA in available water quality data is analytically intensive, and it may take many months for the true extent of DWPA to become known to regulators. Furthermore, Hodge (2016) describes disparate residence times for DWPA in the water system, as well as protracted time lags between "the actions causing pollution and subsequent environmental damage."[16] It follows that time lags are also likely before the effects of DWPA mitigation programs can be observed on the local environment. These factors, taken together, undermine efforts to assess the scope and severity of DWPA in the first instance, evaluate compliance with mitigation programs, and establish social and political acceptance of such programs.

Given these layered challenges, it comes as little surprise that existing policy efforts have largely failed to rein in DWPA across Europe. Shortcomings under the EU Water Framework Directive are especially profound. Following decades of "piecemeal" EU legislation on nitrates in agriculture, urban wastewater, industrial pollution and other threats to water quality, the Directive, which entered force in late 2000, was a major consolidation of water policy "within a common approach and with common objectives, principles

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[12] Benskin et al. "Monitoring Agricultural Diffuse Pollution through a Dense Monitoring Network in the River Eden Demonstration Test Catchment, Cumbria," *Area* 44 (4): 443–53. (2012)

[13] Horan, R. D., Ribaudo, M. O. "Policy Objectives and Economic Incentives for Controlling Agricultural Sources of Nonpoint Pollution," *Journal of the American Water Resources Association* 35 (5): 1023–35. (1999)

[14] Braden, J. B., Segerson, K. "Information Problems in the Design of Nonpoint Source Pollution Policy," In: "Theory Modeling, and Experience in the Management of Nonpoint-Source Pollution", C. S. Russell and J. F. Shogren (Eds). *Kluwer Academic Publishers*. (1993)

[15] Braden & Segerson. "Information Problems."

[16] Hodge. "The Governance of the Countryside."

and basic measures."[17] [18] Tasking EU member states with the implementation of national laws to ensure "good status" of all water bodies by 2015, the Water Framework Directive set objective and scientifically informed minimum standards for the biological, hydrological, and chemical qualities of compliant surface, estuarine, and ground waters.[19] In addition to preventing regression of existing "good status" waters, states must propose detailed river basin management plans providing a comprehensive assessment of human impacts on water quality in the basin, along with case-specific management techniques required to "fill the gap" necessary for "good status" attainment.[20] While derogations from "good status" may be granted for substantially artificial waters or extenuating circumstances such as cost prohibitive management, the Directive is generally thought to be innovative in its coordination of approaches.[21] In England and Wales, however, just 27% of water bodies were found in "good ecological status" by 2012, with a third of known failures attributable to DWPA.[22] With recent changes to water quality testing methods able to take better account of certain long-lasting pollutants, data released by Defra in 2020 found this figure to have declined to 16%, with 0% of rivers achieving desired chemical levels.[23] Performance lags significantly behind both Water Framework Directive objectives and those of the UK Government's 25 Year Environment Plan, and full attainment is not expected for years to come.[24]

Deficient enforcement of existing mitigation policies is a key cause of lagging performance under the Water Framework Directive. For example, Nitrate Vulnerable Zones under the EU Nitrates Directive have been implemented at scale to limit the quantity and timing of fertilizer applications, with the goal of minimizing runoff. However, designation of such zones has largely failed to prevent eutrophic conditions, where excess nutrients from fertilizers induce algal blooms, which in turn lead to depleted dissolved oxygen levels that threaten aquatic life. Indeed, despite detailed guidance developed for farmers, 69% of English Nitrate Vulnerable Zones exhibited "no significant improvement in surface water nitrate concentrations after fifteen years."[25] This suggests a general disregard for the guidance, made possible

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[17] "Introduction to the EU Water Framework Directive," *European Commission*. (2019). https://environment.ec.europa.eu/topics/water/water-framework-directive_en

[18] Yang, Y. S., Wang, L. "A Review of Modelling Tools for Implementation of the EU Water Framework Directive in Handling Diffuse Water Pollution," *Water Resources Management* 24 (9): 1819–43. (2010)

[19] Bateman et al. "Integrated Assessment of Water Framework Directive Nitrate Reduction Measures," *Agricultural Economics* 41 (2): 123–34. (2010)

[20] Bailey et al. "Towards a More Strategic Approach to Research to Support Catchment-Based Policy Approaches to Mitigate Agricultural Water Pollution: A UK Case-Study," *Environmental Science & Policy* 4–14. (2012)

[21] Blandford et al. "Reforming Agricultural Nonpoint Pollution Policy."

[22] Bailey et al. "Towards a More Strategic Approach to Research."

[23] "Catchment Data," *Department for Environment Food & Rural Affairs*. (2021). https://environment.data.gov.uk/catchment-planning/

[24] Hodge. "The Governance of the Countryside."

[25] Worrall, F., Spencer, E., Burt, T. P. "The Effectiveness of Nitrate Vulnerable Zones for Limiting Surface Water Nitrate Concentrations," *Journal of Hydrology* 370 (1–4): 21–28. (2009)

by systemic failures in enforcement.[26]

II. Britain Un-CAP-ped

The UK has not set its own agriculture policy since 1972; instead, for the last 50 years, it has been subject to the EU's Common Agricultural Policy. The evolution of modern farming in Europe largely parallels the history of the CAP and its various reforms seeking to preserve the competitiveness of the sector over time. For better and worse, EU technocrats have navigated UK farmers through major economic and technological transitions, including mechan-ization and the use of biotechnology. Accordingly, the design of the CAP is instructive for under-standing British agriculture's long and fraught relationship with the natural environment. Now, for the first time in agriculture's modern era, Brexit compels the UK to leave the CAP and consider this relationship afresh.

The CAP was originally implemented to promote European self-sufficiency for food by increasing production. To achieve this, policymakers designed the policy to maintain domestic commodity prices above world market levels using import taxes. In the UK, the CAP accelerated the diversification of the British manufacturing-based economy while developing stable incomes for farmers. Across Europe, rapid scale-up of farms helped transition the EU to become a net exporter of agricultural products by the early 1980s.[27] Suddenly confronted with excess production, the UK government sought to maintain high domestic prices by buying intervention stock (i.e., acquiring products, storing them, and selling them at a loss on the world market), and using other interventions to avoid a politically damaging reduction of domestic prices.[28] As direct production support for farmers persisted, fraud (i.e., falsely reporting output levels), environmental degradation from intensification (i.e., increasing fertilizer, pesticide, and machinery use per unit land), and overproduction became commonplace.[29] The MacSharry Reforms of the early 2000s reduced the level of production support, but substituted it with direct payments based on arable area and headage payments for each unit of livestock kept by a farm (collectively known as pillar 1 of the CAP), while also introducing rural development programs (known as pillar 2).[30] In recent years, "cross-compliance" measures have been introduced in effort to make pillar 1 payments conditional upon various pro-environmental actions, including protection of watercourses from DWPA. Nevertheless, weak monitoring and poor incentives to undertake substantial, costly mitigation actions have plagued the initiative.[31] Today, the CAP continues to command 36% of EU spending, and significant inefficiencies remain.

While poor design features of the CAP have long

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[26] Hodge. "The Governance of the Countryside."

[27] Hodge. "The Governance of the Countryside."

[28] Hodge. "The Governance of the Countryside."

[29] Roederer-Rynning, C., & Matthews, A. "What Common Agricultural Policy After Brexit?" *Politics and Governance* 7 (3): 40–50. (2019)

[30] Roederer & Matthews. "What Common Agricultural Policy After Brexit?"

[31] Hodge. "The Governance of the Countryside."

been acknowledged by European leaders, efforts to overhaul the policy have been repeatedly mired in complex negotiations due to division among EU member states.[32] Many elements of the CAP are deeply entrenched, even if they are problematic for the environment, and the complexity of the policy has created fears that reform could throw markets into chaos or harm Europe's global competitiveness. Proposed reforms must also overcome stark differences in trade preferences among EU members, a political barrier that has proven insurmountable to date.[33]

Accordingly, Brexit offers a unique opportunity for the UK to dramatically reframe its approach to agriculture without interference. Most promisingly, the landmark UK Agriculture Act of 2020 outlines plans to reform farming subsidies and implement a "public money for public goods" regime designed to enhance environmental quality, with the goal to limit unsustainable production and induce major improvements in local water quality under river basin management plans.[34] Though the new regime remains opaque and subject to the fickle nature of British politics—including pressures from changing leadership under Prime Ministers Boris Johnson, Liz Truss, and Rishi Sunak, and a looming general election before January 2025—there are reasons for optimism. If newly designed instruments are fit for purpose, Brexit may come to be regarded as a turning point in the global effort to combat water pollution from agriculture.

One of the primary reasons for optimism is that Brexit sets the stage for an agriculture policy capable of addressing pollution challenges specific to large-scale farms. Perverse incentives to scale-up production under the CAP have contributed to a Europe-wide trend of "fewer, bigger, more intensive" farms. Between 2005 and 2016, the total number of farms in the EU dropped from 14.5 million to 10.3 million, while total output grew steadily.[35] Consolidation has been especially rapid in the UK, which has long embraced larger farms than other major food producing countries in Europe, such as Italy and Poland.[36] In fact, in 2016, the UK ranked first in the EU in terms of average family farm size, at just under 70 hectares; by contrast, in Romania, known for its tradition of small-scale family farming, over 90% of farms were smaller than 5 hectares.[37] Most EU agriculture sectors look more like Romania's than the UK's, as evidenced by the roughly two-thirds of EU farms that were smaller than 5 hectares in

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[32] Daugbjerg, C., & Swinbank, A. "The Politics of CAP Reform: Trade Negotiations, Institutional Settings and Blame Avoidance," *JCMS: Journal of Common Market Studies* 45 (1): 1-22. (2007)

[33] Daugbjerg & Swinbank. "The Politics of CAP Reform."

[34] De Vito, L., Fairbrother, M., & Russel, D. "Implementing the Water Framework Directive and Tackling Diffuse Pollution from Agriculture: Lessons from England and Scotland," *Water* 12 (1): 244–269. (2020)

[35] Harvey, F. "Fewer, Bigger, more Intensive: EU Vows to Stem Drastic Loss of Small Farms," *The Guardian*. (2021). https://www.theguardian.com/environment/2021/may/24/fewer-bigger-more-intensive-eu-vows-to-stem-drastic-loss-of-small-farms

[36] Neslen, A. "England Flaunts Green Reforms while EU Stays in Hock to Farmers," *Politico*. (2020). https://www.politico.eu/article/england-flaunts-green-reforms-while-eu-stays-in-hock-to-farmers/

[37] "Agriculture Statistics – Family Farming in the EU". Eurostat. (2016). https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agriculture_statistics_-_family_farming_in_the_EU#Structural_profile_of_farms_-_analysis_for_the_EU

2016.[38] Because of the structure of pillar 1 payments under the CAP, which compensate farmers *per hectare* of arable land, large UK farming operations are disproportionately favored by the policy. And because cross-compliance efforts have largely failed to deter large farms from reinvesting these payments into increasingly environmentally damaging production methods, the UK environment is disproportionately harmed.

As a result, the dominant form of agriculture in the UK has come to look more like "US-style megafarms" than the iconic small-scale family farms for which Europe is known.[39] For instance, the number of requests for "intensive need permits" for large livestock facilities with over 1,000 animals (meeting the US Department of Agriculture's definition of a "concentrated animal feeding operation") has grown exponentially in the UK in recent years.[40] [41]

With operations of this scale, the nature of water quality monitoring problems shifts. For instance, because industrial agriculture relies heavily on mechanization, human oversight is minimal, making episodes of pollution difficult to detect in a timely manner.[42] Further, the concentration of animal activity at large farms compounds the severity of typical threats to water quality, such as eutrophication, while introducing new ones such as novel pathogens and multi-drug resistant bacteria from the regular application of antibiotics to livestock.[43] Because monitoring and enforcement of environmental standards relies largely on "self-reporting and physical, resource-intensive, infrequent inspections," rule-breaking operations can easily exploit regulators' lack of capacity.[44] Indeed, just a few non-compliant megafarms could inflict lasting damage to aquatic ecosystems at the catchment level if regulators fail to detect elevated water pollution levels in a timely manner.

The UK's model of large-scale agriculture also has implications for how farmers perceive regulatory efforts. In surveys of UK farmers, Inman (2018) finds widespread skepticism among farmers of the causal link between their fertilizer use and DWPA, indicating both deficient scientific understanding, and a general lack of internalization of social responsibility for water quality.[45] For example, despite a long-running "system of catchment-sensitive farming" in the UK aimed at

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[38] "Agriculture Statistics – Family Farming in the EU," *Eurostat*. (2016). https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agriculture_statistics_-_family_farming_in_the_EU#Structural_profile_of_farms_-_analysis_for_the_EU

[39] Child et al. "UK has Nearly 800 Livestock Mega Farms, Investigation Reveals," *The Guardian*. (2017). https://www.theguardian.com/environment/2017/jul/17/uk-has-nearly-800-livestock-mega-farms-investigation-reveals

[40] Clemans et al. "Antibiotic Resistance, Gene Transfer, and Water Quality Patterns Observed in Waterways Near CAFO Farms and Wastewater Treatment Facilities," *Water, Air, & Soil Pollution* 217 (1): 473–489. (2011)

[41] Child et al. "UK has Nearly 800 Livestock Mega Farms."

[42] Hodge. "The Governance of the Countryside."

[43] Clemans et al. "Antibiotic Resistance, Gene Transfer, and Water Quality Patterns."

[44] Anderson et al. "Enhancing Environmental Enforcement with Near Real-Time Monitoring: Likelihood-Based Detection of Structural Expansion of Intensive Livestock Farms," *International Journal of Applied Earth Observation and Geoinformation* 103: 102463. (2021)

[45] Cleasby et al. "An Exploration of Individual, Social and Material Factors."

facilitating training and awareness of DWPA, promoting nutrient management, and providing funding for mitigation actions, a vast majority of farmers have failed to embrace voluntary mitigation measures.[46] This evidence complements previous research from the US demonstrating that small-scale farmers have stronger environmental stewardship values, and are more receptive to conservation programs than farmers who practice industrial agriculture.[47] Among UK farmers, Inman (2018) highlights a pervasive belief that environmental damage is an unavoidable consequence of production,[48] while Hodge (2016) documents UK farmers' willingness to over-apply fertilizers and pesticides to bolster productivity.[49]

Ultimately, this literature lends weight to the argument that Brexit enables the UK to divorce itself from CAP payments that are especially damaging given the unique characteristics of the British agriculture sector. Notably, in 2021, 80% of CAP direct payments flowed to just 20% of (large-scale) farms, where the UK is overrepresented.[50] Thus, restructuring of British agriculture policy ought to enable decision-makers to account for the relatively localized issue of megafarms. For this reason, post-Brexit approaches may inform policy discourses in other countries coping with environmental externalities from large-scale farming, such as the US, Australia, or Canada.

III. Overcoming the Farm Lobby

Even before Britain joined the European Economic Community in the early 1970s, the EU's farm lobby staunchly opposed pro-environmental CAP reforms. It has taken this position ever since. The lobby is led by two powerful interest groups, which merged in the 1960s: the Comité des Organisations Professionnelles Agricole (COPA) and the Comité Général de la Coopération Agricole de l'Union Européenne (COGECA). Over time, COPA-COGECA's influence in Brussels has profoundly shaped EU policy on trade, food safety, animal welfare, and the environment. By releasing UK policymakers from the powerful grip of COPA-COGECA, Brexit enables environmental advocates to "attack" at an opportune moment when Britain's *domestic* farm lobby is divided and acquiescent, a classic strategy of timing.[51] In the decades prior to Brexit, COPA-COGECA came to enjoy unrivaled access to the official decision-making channels of the European Commission. For instance, the European Commission's Civil Dialogue Groups, designed to facilitate transparent information exchange and with business and civil society stakeholders on policy-relevant matters including agriculture, have functioned in practice to advance the farm lobby's agenda. As of February 2021, COPA and COGECA representatives occupied about half of the seats within the dialogue group most relevant to

[46] Cleasby et al. "An Exploration of Individual, Social and Material Factors."

[47] Buttel, F. H., & Gillespie, G. W. Jr. "Preferences for Crop Production Practices Among Conventional and Alternative Farmers," *American Journal of Alternative Agriculture* 3: 11–17. (1988)

[48] Cleasby et al. "An Exploration of Individual, Social and Material Factors."

[49] Hodge. "The Governance of the Countryside."

[50] Harvey. "Fewer, Bigger, more Intensive."

[51] Ling Yean Yng et al. "Military Principles of Chinese Origin to Improve Competitiveness," *Organization, Technology & Management in Construction: An International Journal* 1 (1): 3–9. (2009)

agriculture, and the group's meeting times were decided according to COPA's schedule.[52] Across thirteen total dialogue groups, eight were chaired by a COPA or COGECA affiliate.

In 2019, a *New York Times* investigation found that the EU farm lobby wields exceptional power in Brussels, despite that farming is no longer a dominant component of European GDP, explaining:

> *"Agricultural lobbyists, among the most influential in Europe, have exclusive, closed-door access to government leaders. […] As long as there has been farm money, COPA-COGECA, Europe's largest organization for farmers, has swayed where it goes. European leaders have historically treated the group not as mere recipients of government money, but as partners in policymaking."*[53]

Among other potential conflicts of interests, reporting revealed that prior to meetings of European farm ministers, the President of the European Council, "as a matter of tradition," grants a private meeting to COPA-COGECA. Similar access has been denied to environmental groups.[54]

Historically, COPA-COGECA have pushed to maintain unconditional pillar 1 payments, primarily advocating for policies that benefit large farms.[55] The lobby's agricultural "research projects" inform position papers which advocate for "simplification" of regulations, oppose efforts to reduce pesticide and fertilizer use, and refute the health risks of farming intensification.[56] For instance, on DWPA in particular, the lobby warns against "overambitious targets" which are "not properly reflecting reality or community perceptions about the quality of water," and condemns efforts to "valorise water" as an ecosystem service.[57]

Because COPA-COGECA has virtually monopolized the farming industry's political clout in Brussels, there has been little reason for the UK's own farm lobby to engage deeply on matters of the CAP. Though some British pro-agribusiness NGOs have emerged in the wake of Brexit, they form a relatively unorganized network without a substantial track record. Beyond their inexperience, British farming interest groups face reduced capacity to oppose post-Brexit environmental policy for three additional reasons:

1. Brexit negotiations were unexpectedly long and complicated, creating significant economic uncertainty. It is now a matter of urgency for British

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[52] Herman, E. "Behind the CAP Reform –The Rooted Lobbying of COPA-COGECA," *Eyes on Europe*. (2021). https://www.eyes-on-europe.eu/behind-the-cap-reform-the-rooted-lobbying-of-copa-cogeca/

[53] Apuzzo, M., & Gebrekidan, S. "Who Keeps Europe's Farm Billions Flowing? Often, Those Who Benefit," *The New York Times*. (2019). https://www.nytimes.com/2019/12/11/world/europe/eu-farm-subsidy-lobbying.html

[54] Apuzzo & Gebrekidan. "Who Keeps Europe's Farm Billions Flowing?"

[55] Zdanovskis, K., & Pilvere, I. "Engagement of Agricultural Nongovernmental Organisations in Making the Common Agricultural Policy," *Economic Science for Rural Development* 38: 239–249. (2015)

[56] "European Farming," *COPA-COGECA*. (2022). https://www.google.com/url?q=https://copa-cogeca.eu/europeanfarming%23b193&sa=D&source=docs&ust=1715184453563630&usg=AOvVaw09xW18zEvznWg6-nmC1Bms

[57] "Position Paper: Fitness-Check of the Water Framework Directive," *COPA-COGECA* EN (17) 3758: 5. (2018)

farmers to ensure new favorable trade deals are negotiated to open foreign markets to British agricultural products.[58] The turbulent political climate has prevented even well-established farmers' advocacy groups, such as the National Farmers' Union of England and Wales from mobilizing forcefully against (relatively less imminent) environmental issues, allowing the pro-environmental vision of the 2020 Agriculture Bill to pass without much contestation.[59]

2. Heightened social consciousness around the environment, driven especially by the COP26 UN climate talks, which were hosted in Glasgow in 2021, has meant that British politics is now unprecedentedly united on topics such as climate change and sustainability.[60] Having enacted a landmark 25 Year Environment Plan in 2018, both Conservative and Labour leaders are keen to take credit for its implementation. As climate change continues to gain in salience, it is likely that this shift in political attitudes will be enduring.

3. Somewhat paradoxically, a significant majority of British farmers voted for Brexit, despite receiving a disproportionate share of CAP payments. May et al. (2021) attribute this to a combination of forces, including negative perceptions toward the EU and the belief that leaving the EU would "make agricultural policy less restrictive" and increase the profitability of the sector, though it is unclear whether such beliefs are well founded.[61] Regardless of farmers' motivations, the vote may constrain the ability of the UK farm lobby to oppose alternatives to the CAP that directly emerge from Brexit, including various environmental reforms.

In combination, these factors point to Brexit as opening a significant window of opportunity for policy entrepreneurship to address DWPA at a time of weak and fragmented resistance. By disentangling itself from the influence of COPA-COGECA, the UK is positioned to set a promising example to other governments facing policy gridlock due to powerful interests. Of course, reform will take time, especially as the UK economy emerges from the uncertainty of the Covid-19 pandemic and confronts pressures from inflation and the war in Ukraine. Environmental issues must also compete for space on the agenda in Westminster at a time when immigration, housing affordability, and a struggling national healthcare system are front-of-mind for many Britons. Still, in time, the story of British agriculture policy may prove especially relevant for the future of global climate action, which has long been diluted in ambition by industrial interests.[62]

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[58] Harvey, F. "'Completely contradictory': NFU Leader Attacks UK Farming Policy". *The Guardian*. (2022). https://www.theguardian.com/environment/2022/feb/22/completely-contradictory-nfu-leader-attacks-uks-farming-policy

[59] "Written Evidence Submitted by the National Farmers Union to the Agriculture Bill Public Bill Committee," *National Farmers Union*. (2020).

[60] Burns & Carter. "Brexit and UK Environmental Policy and Politics."

[61] May, D., Arancibia, S., & Manning, L. "Understanding UK Farmers' Brexit Voting Decision: A Behavioural Approach," *Journal of Rural Studies* 81: 281–293. (2021)

[62] Kolk, A., & Pinkse, J. "Multinationals' Political Activities on Climate Change," *Business & Society* 46 (2): 201–228. (2007)

IV. Going Against the Flow

Looking ahead, a range of new interventions are needed to accelerate water quality improvements in the UK in line with Water Framework Directive standards, and possible reforms are now receiving attention from local and national decision-makers. (Although Brexit formally released the UK from the Directive, it has been transposed into English law. Defra may ultimately diverge from specific aspects of the Directive, but attaining good ecological status of water bodies remains a key component of the government's Environment Plan.)

Among the most promising policies to consider at this juncture are those capturing the polluter-pays principle, which has featured only superficially in the EU agricultural sector to date, in part because of strong resistance from the farm lobby.[63] Polluter-pays instruments, such as water quality trading, fertilizer (and other input) taxes, and land use permitting, are an attractive way to correct market failures from DWPA because, by requiring polluters to bear the costs of externalities, they reinforce the concept of social entitlement to clean water.[64] At the same time, these instruments have the potential to treat farmers as valuable coalition members in environmental stewardship, rather than adversaries, and may enjoy greater political feasibility over command-and-control alternatives.

Water quality trading, like emissions trading, reallocates the right to pollute among farmers, achieving socially efficient levels of DWPA reduction, as mitigation is conducted by farms able to change practices at lowest cost. Such schemes are not without their own administrative burdens; like DWPA monitoring, water quality trading requires prior knowledge of baseline environmental conditions, and there are trans-action costs incurred in the trading process. Still, water quality trading affords farmers flexibility to combat DWPA in innovative ways and has achieved results outside the UK. Evidence from New Zealand documents a five-year 20% reduction in nitrate emissions from regulated farms under the Lake Taupo watershed's binding trading program.[65] And in the United States, a "partially capped" trading system has been effective in securing profitable DWPA mitigation as regulated point-source facilities buy pollution reductions from farmers, who might then convert arable land to riparian buffers.[66]

Pesticide and fertilizer taxes, meanwhile, can simultaneously encourage farmers to reduce their reliance on harmful compounds and generate significant tax revenues. The reinvestment of revenues in capacity-building and education programs for farmers could, in theory, drive a virtuous cycle of pollution reduction over time. Norway has implemented a pesticide tax since the 1990s, which has successfully changed public attitudes about the impact of pesticides on

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[63] Hodge. "The Governance of the Countryside."

[64] Choi, I. "Global Climate Change and the Use of Economic Approaches: The Ideal Design Features of Domestic Greenhouse Gas Emissions Trading with an Analysis of the European Union's CO2 Emissions Trading Directive and the Climate Stewardship Act," *Natural Resources Journal* 45: 865–952. (2005)

[65] Bissonnette et al. "Water Quality Trading Schemes as a Form of State Intervention: Two Case Studies of State-Market Hybridization from Canada and New Zealand," *Ecosystem Services* 36 (April): 100890. (2019)

[66] Bissonnette et al. "Water Quality Trading Schemes."

environment and human health, while France aims to halve pesticide use between 2015 and 2025 under its fertilizer tax.[67] While ex-post evaluation of program effectiveness remains limited, successful deployment of such policies in Europe could guide UK decision-makers in overcoming common challenges of tax design, such as long-run inelastic demand for farm inputs, concern about harmful substitutions, and difficulty adjusting the tax level across space.[68]

The difficulty of spatially tailoring interventions like taxes can be overcome with more granular interventions like a pollution trading system using land use permits, which could be deployed at the catchment level. Under such a system, an ecological assessment would be undertaken to determine allowable nitrogen levels in each catchment. Findings would inform the total number of individual leaching permits available to farmers, with initial permit allocations within catchments determined according to farm size. Each season, a farmer would need to hold an appropriate number of permits, accounting for the fact that certain types of crops leach more nitrogen than others and would thus require more permits. Over time, permits will be acquired by inefficient farmers, while efficient farms will abate their fertilizer use. However, transaction costs will result from the need to monitor land uses and permit holding, and there is little incentive for farmers to use fertilizer efficiently once permits are held (other than price paid for fertilizer).

The fraught track record of agriculture policy reform in the UK and ingrained resistance over decades underline the barriers to achieving lasting behavior change from farmers deeply skeptical of government. Moreover, international experience suggests that when it comes to market-based incentives, there are no one-size-fits-all solutions. Rather, a mix of mechanisms, working in coordination, is likely to bring the greatest benefit to post-Brexit Britain. Decision-makers ought to seize upon the current window of opportunity to test a range of polluter-pays interventions, keeping in mind the following guiding principles:

- Local flexibility in choice of mitigation methods is crucial for achieving buy-in. Farmers are local experts and must be given leeway to control pollution creatively and on their own terms. UK farmers have lost trust in heavy-handed EU control of the agriculture sector, and new interventions ought to fulfill the spirit of Brexit by granting farmers agency to shape the programs that affect them.

- Farmers require access to reliable information to participate faithfully in pollution reduction programs. Expectations of participating farms must be communicated in clear and measurable terms and adapted to the local farming context. It is unreasonable to expect farmers to accept significant administrative burdens as a condition of their participation, or to adopt pollution control measures beyond those necessary to capture incentives.

- Interventions should be prioritized

[67] Böcker et al. "Revisiting Pesticide Taxation Schemes," *Ecological Economics* 134 (April): 263–66. (2017)

[68] Hodge. "The Governance of the Countryside."

according to their scalability. In addition to maximizing short-term pollution reductions and accelerating attainment of Water Framework Directive goals, scalable interventions also capture the benefits that arise from collective learning among large groups of farmers. As a result, the agriculture industry may be pushed in innovative and entrepreneurial directions with respect to environmental protection.

- The UK government should not be tempted by offering short term, limited incentives to realize superficial progress (i.e., ahead of local elections). Instead, farmers must be deterred from reverting to intensive practices after cessation of pro-environmental programs. By following through on investments that demonstrate long-term commitment to tackling DWPA, the government can facilitate the creation of durable coalitions of farmers willing to pursue deintensification as an economically viable strategy over the long-term.

While Brexit provides the key impetus for policy entrepreneurship on DWPA, significant educational investments are also needed to create a "water-literate society" in which farmers feel encouraged and supported within stewardship networks.[69] Respect for local institutions will be essential to empower farmers to regard DWPA mitigation as worthwhile and non-adversarial. Overall, policy instruments must be sensitive to the characteristics of DWPA, integrating best-available scientific data with transparent planning to minimize and overcome transaction costs inherent in the regulation of diffuse pollution.[70] Efforts to this end ought to be guided broadly by Sustainable Development Goal 6, with particular attention to target 6.B which calls for strengthening "the participation of local communities in improving water and sanitation management" through stakeholder engagement.

Further research spanning disciplines of environmental science, economics, politics, and law is urgently needed to ensure that opportunities to green the UK agriculture sector outlined here are not forfeited due to inaction or fear of the unknown. For instance, studies must now be undertaken to confirm forecasted impacts of new instruments on farm incomes, market competitiveness, and national food security. Policy analysis is needed to investigate the likely distributional effects of new interventions on farms of different size and location, with an eye toward equity and justice. Comparative case studies, meanwhile, ought to identify early successes and shortcomings from policy roll-out at the local (i.e., catchment) level to overcome technical barriers, build institutional capacity, and inform decisions about upscaling. Finally, longitudinal studies must be initiated to assess long-term changes in key water quality, biodiversity, and public health metrics. With research and policy agendas aligned to counter DWPA, Britain *can* "go against the flow," redefining its relationship with both agriculture and the environment for a new era.

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[69] Boardman et al. "Making Water Policy Work in the United Kingdom: A Case Study of Practical Approaches to Strengthening Complex, Multi-Tiered Systems of Water Governance," *Environmental Science & Policy* 71 (May): 41–55. (2017)

[70] Boardman et al. "Making Water Policy Work in the United Kingdom."

A Call for Research and Social Policy Equity: The Burden of Student Loan Debt on Black Mothers' Financial Wellbeing

Lyneisha Dukes[†]

Abstract

Researchers have reached a consensus that Black households face a disproportionate financial risk when acquiring student loans. The financial risks associated with college degree attainment are greater, and the rewards of a degree are often delayed and priced higher, for Black women. The inclusion of various household composition types and acknowledgment of the heterogeneity of Black households will enrich the research concerning the impacts of student debt on Black families and their ability to garner and maintain wealth. I assert that our nation's history of post-secondary education attainment exclusion and present-day predatory inclusion practices position Black mothers with student loan debt to experience disparate levels of financial strain and stress relative to the promised benefit of upward economic mobility.

The Higher Education and Financial Aid Ecosystem: Black women pay a higher cost and receive fewer benefits.

Historically, education has been hailed by Black Americans as a tool for freedom. Black Americans' adoption of the "education gospel" has reinforced post-secondary education attainment as a widely accepted tool to advance socially and economically, despite the economic cost.[1] While post-secondary degree attainment is expected to yield a *college wage premium*–an increase in economic capital as a result of post-secondary degree attainment, it can sometimes create financial instability for Black women and become an obstacle to wealth acquisition.

Black degree holders not only start their education with less income/wealth and attain more student loans to attend and complete their education programs, but they also face wage inequity within the labor market. Black borrowers with bachelor's degrees are more likely to experience

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[1] Cottom, T. M. "Lower Ed: The Troubling Rise of For-Profit Colleges in the New Economy," *The New Press* (2017).; Houle, J. N., & Addo, F. R. "A Dream Defaulted: The Student Loan Crisis Among Black Borrowers," *Harvard Education Press*. (2022).; Hout, M. "Social and Economic Returns to College Education in the United States," *Annual Review of Sociology* 38: 379–400. (2012). https://doi.org/10.1146/annurev.soc.012809.102503

unemployment and earn 15 % less than other degree holders of the same age range.[2] Attempts to address the structural frailties of our financial aid/ education ecosystem must incorporate a racialized lens, considering the historical and current impact institutional racism has on Black borrowers. Black women, on average, accrue more student loan debt to complete degree programs than any other race and gender group in America, and at a higher rate.[3] Black women hold 47% more student loan debt than White men and 27% more than White women.[4] Predatory Inclusion is a process where members of a marginalized group are provided with access to a good, service, or opportunity from which they have historically been excluded but the conditions within which the good is offered jeopardize any potential benefits of access.[5] Access to education promises economic mobility but results in increased debt and limited wealth for Black women, a clear illustration of predatory inclusion.

As a college education has become more accessible, the costs associated with education have increased, partially due to decreases in direct subsidies to university systems from state governments. This has created an ecosystem in which students rely primarily on loans to finance their education.[6] As a result of our current education and financial aid ecosystem and the ever-present racial wealth gap, the Federal Direct Loan Program is utilized most by Black student borrowers, who account for 49.8% of all borrowers.[7]

Economic Mobility

Recognizing that structural barriers exacerbate student debt accumulation, researchers are intentionally exploring the nuance of race, student loan debt, and how the Black student loan debt crisis impacts adverse outcomes such as the lack of Black wealth attainment.[8] Herring and Henderson (2016) argue that the "cumulative effects of discrimination" restrain the opportunities for Black individuals and families to earn, save, and/or inherit wealth.[9] They also reveal that Black individuals average $156,115 less wealth than their White counterparts when controlling

[2] Davis et al. "Legislation, Policy, and the Black Student Debt Crisis," *NAACP* 41. (2020). https://naacp.org/resources/legislation-policy-and-black-student-debt-crisis

[3] Bostick, D. N., Henry, C. M., & Brown, L. C. "Exploring Black Graduate Women's Perceptions of Student Loan Debt," *Journal of Diversity in Higher Education*. (2021). https://doi.org/10.1037/dhe0000341; Jackson, V., & Williams, B. "How Black Women Experience Student Debt," *Education Trust*. (2022). https://edtrust.org/resource/how-black-women-experience-student-debt/; Miller, B. "The Continued Student Loan Crisis for Black Borrowers," *Center for American Progress*. (2019). https://www.americanprogress.org/article/continued-student-loan-crisis-black-borrowers/

[4] Davis et al. "Legislation, Policy, and the Black Student Debt Crisis."

[5] Seamster, L., & Charron-Chénier, R. "Predatory Inclusion and Education Debt: Rethinking the Racial Wealth Gap," *Social Currents* 4, no. 3: 199–207. (2017). https://doi.org/10.1177/2329496516686620

[6] Goldrick-Rab, S, Kelchen, R, & Houle, J.N. "The Color of Student Debt: Implications of Federal Loan Program Reforms for Black Students and Historically Black Colleges and Universities," Wisconsin HOPE Lab. (2014).

[7] Davis et al. "Legislation, Policy, and the Black Student Debt Crisis."

[8] Davis et al. "Legislation, Policy, and the Black Student Debt Crisis."; Houle & Addo. "A Dream Defaulted."; Jackson & Williams. "How Black Women Experience Student Debt."

[9] Herring, C., & Henderson, L. "Wealth Inequality in Black and White: Cultural and Structural Sources of the Racial Wealth Gap," *Race and Social Problems, 8*(1), 4–17. (2016). https://doi.org/10.1007/s12552-016-9159-8

for other factors such as age, education, income, etc. Current research supports this claim noting that White high school graduates are likelier to own a home than Black college degree holders.[10] Despite the individual efforts of Black students to attain economic mobility using education, the predatory U.S. government labor market and education ecosystem creates an environment that predetermines their access to wealth.

Black women are uniquely impacted by economic, racial, and gender-based oppression, positioning them at the margins despite efforts to advance. Black women remain among the lowest earners in the labor market, despite their strides toward economic mobility utilizing education.[11] The median wealth of Black women with no bachelor's degree is $500 and $5,000 for Black women with a Bachelor's degree, while White women with no degree have $8,000 and with a bachelor's degree have $36,000, while Black college-educated women average $37,558 in student loan debt.[12] The racial wealth gap is most significant among college degree holders.[13] Current research incorporates race and gender to examine disproportionate economic risks for Black student borrowers with growing discussion around Black women borrowers.[14] This intersectional research serves as a foundation to further explore the variation among Black student borrowers. Adding the dimension of parental status strengthens student debt literature and highlights the distinction of Black mother borrowers. From this vantage point, the efforts to attain economic mobility through educational attainment can be viewed as detrimental to Black borrowers, specifically Black mothers', who are even more vulnerable than Black women without children due to the added dimension of parenthood. Black collegegoers face a hard reality: they cannot afford to pay for college, but they also cannot afford not to go.

Some might argue that the decision to incur debt in pursuit of education is a distinct consequence of financial illiteracy. However, mainstream financial literacy products, programs, and tools

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[10] Houle & Addo. "A Dream Defaulted."

[11] Ewing-Nelson, C. "All of the Jobs Lost in December Were Women's Jobs," *National Women's Law Center*. (2021).

[12] Zaw et al. "Women, Race and Wealth". *Research Brief Series* 1, no. 1: 1–4. (2017). https://socialequity.duke.edu/portfolio-item/women-race-and-wealth/; Davis et al. "Legislation, Policy, and the Black Student Debt Crisis."

[13] Emmons, W. R., & Noeth, B. J. "Why Didn't Higher Education Protect Hispanic and Black Wealth?" *Federal Reserve Bank of St. Louis*. (2015). https://www.stlouisfed.org/publications/in-the-balance/2015/why-didnt-higher-education-protect-hispanic-and-black-wealth; Houle & Addo. "A Dream Defaulted."

[14] Houle & Addo. "A Dream Defaulted."; Jackson, B. A., & Reynolds, J. R. "The Price of Opportunity: Race, Student Loan Debt, and College Achievement," *Sociological Inquiry* 83, no. 3: 335–368. (2013). https://doi.org/10.1111/soin.12012; Martin, E. C., & Dwyer, R. E. "Financial Stress, Race, and Student Debt During the Great Recession," *Social Currents* 8, no. 5: 424–445. (2021). https://doi.org/10.1177/23294965211026692; Scott-Clayton, J., & Li, J. "Black-white Disparity in Student Loan Debt More than Triples after Graduation," *Brookings*. (2016). https://www.brookings.edu/articles/black-white-disparity-in-student-loan-debt-more-than-triples-after-graduation/; Seamster & Charron-Chénier. "Predatory Inclusion and Education Debt."; Davis et al. "Legislation, Policy, and the Black Student Debt Crisis."; Jackson & Williams. "How Black Women Experience Student Debt."; Bumpers, T. "The Impact of Implicit Education Debt on the Lives of African American Mothers in PhD Programs: A Phenomenological Research Study," *Illinois State University*. (2022). https://www.proquest.com/openview/863974181b8635a4c4b316d8e9e60bf6/1?pq-origsite=gscholar&cbl=18750&diss=y

utilized are not centered on the needs and circumstances of the Black community, with consideration to their unique historical and present standing within our economic system. As it stands, financial literacy education fails to account for the structural oppression embedded in our society's structure.[15] While college graduates typically earn higher incomes and face lower levels of poverty, the financial risks associated with college degree attainment are greater, and the rewards of a degree are often delayed and priced higher, for Black women.[16]

Addo and Houle (2022) note that the lack of wealth (stemming from systemic racism) necessitates that Black collegegoers acquire more student debt and then penalizes them for their student debt due to a racist double standard.[17] Among Black families with dependent students graduating college in 2015-2016, almost 50% of households earned less than $35,000 annually. The limited earnings lead to the acquisition of more loans to pay for college, immediately impacting the financial well-being of the family and/or student through the increased debt-to-income ratio. In addition, Black student borrowers can expect labor market racism to create a distinctly precarious reality for Black families and Black students with debt. Despite efforts for economic mobility through education, they are struggling to repay more debt with less. Scholars note the combination of these factors contributes to the fragile Black middle class and intensifies the racial wealth gap.[18] A close examination of the higher education and financial aid ecosystem exposes a financial precarity unique to Black students pursuing post-secondary education, following centuries of exclusion.

Black mothers are student parents

Today, many students are nontraditional in the sense that they fall outside the mold of a college student which exists in the public imagination: 18-24 years of age, unmarried, and without dependents. Non-traditional students include parents of both dependent children and those financially independent of them, military veterans, students who work full time, and students enrolled part-time.[19] A joint research effort led by the Institute for Women's Policy Research (IWPR) and the Aspen Institute notes that 22% of undergraduate students are student parents; 53% of student parents do not complete their program

[15] McKenzie, C. "Fact Sheet: Black Women's Financial Trauma." *Georgetown Law Center*. (n.d.). https://genderjusticeandopportunity.georgetown.edu/wp-content/uploads/2021/04/Black-Womens-Financial-Trauma.pdf

[16] McKenzie. "Fact Sheet: Black Women's Financial Trauma."; Addo, F. "Parents' Wealth Helps Explain Racial Disparities in Student Loan Debt," *Federal Reserve Bank of St. Louis*. (2018). https://www.stlouisfed.org/publications/in-the-balance/2018/parents-wealth-helps-explain-racial-disparities-in-student-loan-debt.; Jackson & Reynolds. "The Price of Opportunity."; Davis et al. "Legislation, Policy, and the Black Student Debt Crisis."

[17] Houle & Addo. "A Dream Defaulted."

[18] Addo, F. R., Houle, J. N., & Simon, D. "Young, Black, and (Still) in the Red: Parental Wealth, Race, and Student Loan Debt," *Race and Social Problems*. (2016). https://doi.org/10.1007/s12552-016-9162-0

[19] AAUW. "Deeper in Debit: Women and Student Loans," *American Association of University Women*. (2017).

or earn a degree.[20] Research is emerging which highlights the vulnerability of Black mothers navigating higher education, their persistence, and the impact of implicit and explicit debt on Black mothers pursuing education.[21] Additional research has explored perceptions of single mothers in higher education, Black women repaying student loans, and student loan default among Black students.[22]

An analysis of the National Postsecondary Student Aid Study (NPSAS) data and Beginning Postsecondary Student Longitudinal Study (BPS) conducted by IWPR, notes that almost 42% of Black female students are mothers, and of this group, 78 percent identify as single. Childcare costs and time constraints are noted as contributing factors for student parents who do not complete their programs.[23] Black student parents have more student debt than student parents of any other racial background and struggle more to repay their student loans. Student parents are more likely to borrow student loans, and to use those loans to cover everyday expenses in addition to tuition payments.[24]

Scholars have explored the impacts of financial outcomes on mental health, noting the correlation between financial concerns with elevated stress levels, mental health issues, and increased

[20] Bumpers. "The Impact of Implicit Education Debt."; Cruse et al. "Parents in College: By the Numbers," *Institute for Women's Policy Research*. (2019). https://iwpr.org/parents-in-college-by-the-numbers/; Kruvelis, M., Cruse, L. R., & Gault, B. "Single Mothers in College: Growing Enrollment, Financial Challenges, and the Benefits of Attainment". *Institute for Women's Policy Research*. (2017). https://iwpr.org/single-mothers-in-college-growing-enrollment-financial-challenges-and-the-benefits-of-attainment/

[21] White, C., & Bruder, F. H. "Not Built with Them in Mind: It's Time to Center Black Single Mothers in Higher Ed," *Institute for Women's Policy Research*. (2022). https://iwpr.org/not-built-with-them-in-mind-its-time-to-center-black-single-mothers-in-higher-ed/; Lemon, K. "Student Loans, Persistence, and Well-being: The Need to Support Single Mothers in College: A Qualitative Study," *West Chester University*. (2023). https://digitalcommons.wcupa.edu/all_doctoral/199/; Chambers, T. T., & Huggins, K. S. "The Influence of School Factors on Racial Opportunity Cost for High-Achieving Students of Color," *Journal of School Leadership* 24: 189–225. (2014). https://doi.org/10.1177/1052684614024001; Bumpers. "The Impact of Implicit Education Debt."

[22] DelMar, J. "A Phenomenological Inquiry into the Perceptions of Single Mother College Students," *Minnesota State University Moorhead*. (2021). https://red.mnstate.edu/thesis/549/; Bostick, D. N. "The Individual and Shared Narratives of Black Women Repaying Student Loan Debt," *University of Georgia*. (2021). https://esploro.libs.uga.edu/esploro/outputs/9949391257302959; Bostick et al. "Exploring Black Graduate Women's Perceptions of Student Loan Debt.; Elliott, D., & Walker, F. "Centering Black Women in Income and Wealth Policymaking," *Urban Institute*. (2022). https://www.urban.org/research/publication/centering-black-women-income-and-wealth-policymaking; Jackson & Williams. "How Black Women Experience Student Debt."; Sanchez, O. "Black Women are Uniquely Burdened by Student Debt, Report Finds," *The Hechinger Report*. (2022). https://hechingerreport.org/black-women-are-uniquely-burdened-by-student-debt-report-finds/; Houle & Addo. "A Dream Defaulted."; Robie, A. "Debt Sentence: A Critical Race Theory Analysis of Student Loan Default," *Northern Arizona University*. (2021). https://openknowledge.nau.edu/id/eprint/5809/

[23] Bumpers. "The Impact of Implicit Education Debt."; Kruvelis et al. "Single Mothers in College."; Turner, & White, C. "Black Women Have Made Major Gains in Higher Education, but Black Single Mothers Still Struggle to Attain Degrees," *Institute for Women's Policy Research*. (2023). https://iwpr.org/black-women-have-made-major-gains-in-higher-education-but-black-single-mothers-still-struggle-to-attain-degrees/

[24] Dundar, A., Tighe, L. A., & Turner, J. "Underwater: Student Mothers and Fathers Struggle to Support Their Families and Pay off College Loans," *Institute for Women's Policy Research*. (2023b). https://eric.ed.gov/?id=ED630826

financial stress specifically for mothers.[25] Black women reported the highest levels of stress related to student loan repayment of any other racial or gender group.[26] Black mothers attempting to advance economically through higher education face a range of financial challenges compounded by the marginalization of their intersecting identities.

Despite this, there has yet to be an intersectional analysis (inclusive of race) examining the impact of parenthood student debt accumulation and repayment. Since currently literature reveals the economic frailty of student parents; one can suppose that the added layer of race exacerbates the financial burden disproportionately felt by Black mothers rather than White mothers and Black nonmothers. More representative studies of parents in higher education require improved methods for data collection and reporting. The Integrated Post-Secondary Education Data System (IPEDS) is a rich federal data source, including information on student race, age, and ethnicity, however, no data are collected regarding parental status.[27]

Black borrowers face a lifetime "debt sentence"

The report, "Jim Crow Debt" from Mustaffa & Davis (2021) is the first and only nationwide study focused on Black student borrowers, capturing 1300 participant surveys and 100 interviews.[28] This study exposed the specific challenges that Black borrowers encounter with student loan repayment. Of the participants captured in the study, 72% were enrolled in Income-Driven Repayment (IDR) plans. Participants described their growing student loan balances under the IDR plans as "shackles on their ankles" preventing full freedom and access to economic mobility that higher education was promised to provide. Black borrowers enrolled in IDR plans reported difficulties affording necessities such as food (22%), rent (25%), health care (24%), and childcare, while almost 75% of participants reported having a hard time affording a savings account.

In addition to hurdles with everyday expenses, Black borrowers expressed how student loans impacted their mental health and wellness; 69% of participants surveyed reported that student loans hurt their quality of life, 76% identified loans as the primary source of financial stress, and 64%

[25] Anderson et al. "Stress in America," *American Psychological Association*. (2014). https://www.apa.org/news/press/releases/stress/2013/stress-report.pdf; Roll et al. "Assessing the Short-term Stability of Financial Well-being in Low-and Moderate-income Households," *Journal of Family and Economic Issues*: 1–28. (2021). https://doi.org/10.1007/s10834-021-09760-w; Bialowolski et al. "The Role of Financial Conditions for Physical and Mental Health: Evidence from a Longitudinal Survey and Insurance Claims Data," *Social Science & Medicine*, 281, 114041. (2021). https://doi.org/10.1016/j.socscimed.2021.114041; Reynolds, T. "Black Mothering, Paid Work and Identity," *Ethnic and Racial Studies* 24, no. 6: 1046–1064. (2001). https://doi.org/10.1080/01419870120077968

[26] Miller. "The Continued Student Loan Crisis for Black Borrowers."

[27] Gault, B., Holtzman, T., & Reichlin Cruse, L. "Understanding the Student Parent Experience: The Need for Improved Data Collection on Parent Status in Higher Education," *Institute for Women's Policy Research*. (2020). https://iwpr.org/understanding-student-parent-experience-need-improved-data-collection/

[28] Mustaffa, J. B., & Davis, J. C. "Jim Crow Debt: How Black Borrowers Experience Student Loans," *Education Trust*. (2021). https://edtrust.org/resource/jim-crow-debt/

noted that loans had a negative impact on their mental health. As noted previously, nationwide data display the disproportionate rate at which Black borrowers are enrolled in IDR plans and are granted $0 monthly payments due to the limited income they have available to cover their loan payments.[29] While the IDR plans aim to divert students from defaulting on their loans and prevent education institutions from facing financial penalties, Black borrowers face loan balance growth and extended loan terms.[30] These efforts to support borrowers with repayment are not working for Black borrowers, hindering their economic mobility and perpetuating economic insecurity.

Student Loan Debt Repayment and Default

The racial wealth gap not only predicts Black Americans' reliance on federal student aid, comprised mostly of loans. These federal student loans contribute to Black Americans' disparity in student debt accrual and default, both which contribute to the racial wealth gap.[31] Student borrowers face a harsh reality, they are struggling to repay student loans as their loan balances continue to rise. Black borrowers experience the student debt crisis distinctively when compared to other borrowers. The National Center for Education Statistics' Beginning Postsecondary Student Longitudinal Study (BPS) exposes a shocking reality regarding student loan repayment. Twelve years after graduation, Black women on average, owe 13% more than their original loan balance, while White male borrowers have decreased their loan debt by 44%.[32]

There are several repayment plan types instituted by the Department of Education, and Income-Driven Repayment (IDR) plans are of great significance when examining Black borrowers' repayment patterns. IDR plans are designed to significantly reduce federal loan repayment by limiting the standard portion of income designated for repayment and requiring as little as $0 a month for borrowers with low incomes in exchange for extended loan terms. IDR plans shield students from defaulting on their loans by lowering their payment amounts which results in not paying down the interest on their loans and simultaneously lowering the repayment of their loans.[33]

The racial wage gap is a contributing factor to the increased use of IDR plans by Black borrowers. When controlling for education and experience, Black men are paid 22.2 % less than their White male counterparts while Black women are paid 33.7% less, confirming that the intersection of

[29] Miller. "The Continued Student Loan Crisis for Black Borrowers."

[30] Kelchen, R., & Li, A. Y. "Institutional Accountability: A Comparison of the Predictors of Student Loan Repayment and Default Rates," *The ANNALS of the American Academy of Political and Social Science* 671, no. 1: 202–223. (2017). https://doi.org/10.1177/0002716217701681

[31] Houle & Addo. "A Dream Defaulted."; Ma, J., & Pender, M. "Trends in College Pricing and Student Aid 2021," *CollegeBoard*. (2021)

[32] Jackson & Williams. "How Black Women Experience Student Debt."

[33] Kelchen & Li. "Institutional Accountability."

race and gender imposes larger wage penalties.[34] Black borrowers' discrimination within the labor market results in lower wages that create a reliance on IDR plans. Interest accrued while in IDR plans lead to higher amounts owed and higher debt/to income ratios persisting. This is problematic, as Black students borrow more and are challenged with societal discrimination which has contributed to the disparity in their earnings and wealth which impact their ability to pay off debt.

Difficulties in repayment can lead to delinquency; a borrower becomes delinquent one day after their student loan due date. Black borrowers represent only 17% of the college population but account for 30% of all student loan defaults. Black women face disproportionate rates of default, 45% who began college in 2003-04 defaulted on their student loans within 12 years.[35] However, this data does not distinguish between Black mothers and non-mothers. Loan default can significantly impact one's purchasing power – the ability to secure housing, transportation, and employment. Lastly, default can result in garnishment of wages, income taxes, and Social Security benefits.[36]

Consequences of Debt: The Widening Racial Wealth Gap

The disparity in student debt accumulation is not only impacted by Black families' limited intergenerational wealth. Student loan debt contributes to Black borrowers' present-day financial well-being and access to wealth, in addition to their daily functioning and mental well-being.[37] The elimination of codified discrimination in higher education admissions assumes that the starting point for Black mothers is the same as for Black women, Black men, and White counterparts but all available research suggests that this is not the case.[38] Black mothers who attempt to enter the education system, which has historically excluded them, are vulnerable to exploitation, as the education system's benefits are not afforded to them. Their inclusion in the education system not only counters the promised economic benefit, the burden of high student debt amounts, and difficulty repaying student debt due to racial and gender discrimination in the labor market, jeopardizes the economic benefits of access.

Student loan debt acquired to access higher education – and consequently a better quality of life

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[34] Wilson, V., & Darity, W. A. "Understanding Black-White Disparities in Labor Market Outcomes Requires Models that Account for Persistent Discrimination and Unequal Bargaining Power," *Economic Policy Institute*. (2022). https://www.epi.org/unequalpower/publications/understanding-black-white-disparities-in-labor-market-outcomes/

[35] Jackson & Williams. "How Black Women Experience Student Debt."

[36] Jackson & Williams. "How Black Women Experience Student Debt."

[37] Addo. "Parents' Wealth Helps Explain Racial Disparities."; Addo et al. "Young, Black, and (Still) in the Red."; Houle, J. N. "A Generation Indebted: Young Adult Debt Across Three Cohorts," *Social Problems* 61, no. 3: 448–465. (2014a). https://www.jstor.org/stable/10.1525/sp.2014.12110 ; Houle, J. N. "Disparities in Debt: Parents' Socioeconomic Resources and Young Adult Student Loan Debt," *Sociology of Education* 87, no. 1: 53–69. (2014b). https://doi.org/10.1177/0038040713512213; Houle, J. N., & Addo, F. R. "Racial Disparities in Student Debt and the Reproduction of the Fragile Black Middle Class," *Sociology of Race and Ethnicity* 5, no. 4: 562–577. (2019). https://doi.org/10.1177/2332649218790989; Mustaffa & Davis. "Jim Crow Debt."

[38] Collins, P. H. "Black Feminist Thought: Knowledge, Consciousness, and the Politics of Empowerment," *Routledge*. (2002).

– is a tool used to monitor and control Black women post-graduation.[39] Debt is a pervasive surveillance tool that controls access to essential goods and public resources that require a credit check. Additionally, debt is a determinant of one's financial standing and access to formal credit markets; excessive amounts of debt inhibit one's ability to acquire assets.[40] Student loan debt has a direct impact on Black borrower's ability to generate wealth. Whether it is the growing loan balances of those who are enrolled in IDR plans that contribute to their unsatisfactory debt-to-income ratio or high monthly payments that can prevent personal savings, both methods of repayment negatively impact one's ability to build wealth.[41] With this information, we can infer that the financial burden of student debt could potentially harm Black mothers in pursuit of homeownership, as it does Black women. Houle and Addo (2022) highlight the experience of a Black college graduate who fears her student debt may deter her from acquiring wealth in the form of home ownership.

> *"One of my main goals is to buy a house at some point before I'm forty. But I'm really worried that my student loan debt could prevent me from getting a good deal on a house. I know student debt is the biggest thing on my credit report right now, so I know that's impacting my credit score."*[42]

The impact of student loan debt on Black Americans, "The Black Student Debt Crisis" is not homogenous. Its impact on women is an example of how one's social location can further position one at the margins of oppression.

Policy Implications

Research has demonstrated the capacity of many potential methods to address this crisis and shape national public policy. For instance, elected officials have recently become interested in Universal Student Debt Forgiveness efforts amongst elected officials. President Biden's plan to forgive debt (up to $10,000 for non-Pell Grant recipients and $20,000 for Pell recipients with individual income of 125,000 or less or 250,000 for households) would have potentially eliminated or reduced debt for as many as 43 million borrowers, however, the Supreme Court (*Biden v. Nebraska*, 2023) ruled against this monumental, proposed policy.

Nonetheless, the Biden-Harris administration has successfully relieved 45.6 billion in debt for 930,500 borrowers enrolled in IDR payments. The U.S. Department of Education has applied eligible forgiveness based upon the Higher Education Act and the Department's regulations,

[39] Houle & Addo. "A Dream Defaulted."

[40] Houle & Addo. "A Dream Defaulted."

[41] Geiman, J. "Disproportionately Impacted: Closing the Racial Wealth Gap through Student Loan Cancellation, Payment Reforms, and Investment in College Affordability," 107 *Center for Law and Social Policy, Inc. (CLASP)*. (2022). https://www.clasp.org/publications/report/brief/disproportionately-impacted-closing-the-racial-wealth-gap-through-student-loan-cancellation-payment-reforms-and-investment-in-college-affordability/

[42] Houle & Addo. "A Dream Defaulted."

forgiving borrowers who have made 240 or 300 monthly payments—the equivalent of 20 or 25 years on qualifying IDR plans. Additionally, the policy enabled borrowers to reach Public Service Loan Forgiveness (PLSF) based upon the criteria change for qualifying payments. This decision has likely had a considerable impact on Black borrowers, as they account for 1/3 of all IDR plans.

To counter the disproportionate negative impact the student debt crisis has had on Black borrowers, additional research grounded in racial equity is needed. Until further research is grounded in racial equity, particularly among Black mothers is advanced, there remain other policy options which likely advance educational equity. While not a race-specific policy, scholars note that a policy which combines the cancelation of high debt levels with low-income eligibility, would maximize policy reach, best serve the most vulnerable, and increase wealth gains for borrowers. Debt relief policies ranging from $50,000 to $75,000 in debt relief for households whose income is at or less than $100,000 would cancel debt for up to 51% of all reported student debt and 61% for Black households.[43] It is also important to note for these eligibility criteria that income alone is not an adequate indicator of wealth or available discretionary funds, and if an income cap is necessary, it should account for household composition; a $100,000 income for a family of four (two adults and two children) is accounted for differently than $100,000 annual income for a single person or a couple with no children.

Lastly, policy should distinguish how debt will be forgiven for parents who have acquired Parent PLUS loans for their children, expanding the debt limit or specifying how debt will be relieved in these cases. Parent PLUS loans have become a widely used tool for Black families (who have less wealth) to access the education system. In their current form, Parent PLUS loans offer higher interest rates with limited options for repayment or forgiveness.[44] In addition to creating equitable policy, accessing said policy offers a new set of challenges. Navigating the loan service system has presented challenges and had unintended consequences for various borrowers. Instituting the autoenrollment of borrowers deemed eligible via IRS and/or other government data sources could potentially address administrative hurdles in securing student debt relief.

Alternatively, the Public Service Loan Forgiveness (PSLF) program could be reimagined to incentivize public service in a similar manner to how the G.I. Bill incentivized military service. In its current state, PSLF requires 10 years of service and/or 120 qualifying payments. Until 2023 the criteria defining qualifying payments left only very few to reap the benefits of said program (7,000 borrowers). Administrative changes to the PSLF program from President Biden's administration addressed some of the criteria and resulted in $56.7 billion in forgiveness for 793,000

[43] Charron-Chénier et al. "A Pathway to Racial Equity: Student Debt Cancellation Policy Designs," *Social Currents* 9, no. 1: 4–24. (2022). https://doi.org/10.1177/23294965211024671

[44] Knott, K. "Parent PLUS Loans a 'Double-Edged Sword' for Black Families," *Inside Higher Ed*. (2023). https://www.insidehighered.com/news/government/student-aid-policy/2023/06/14/how-parent-plus-loans-impact-black-families

borrowers.[45] Instead in a PSLF program that operated similarly to our Armed Forces, students commit to serving the public for 5 years and receive full student debt relief after their service. This public service could be a useful pipeline to address staff shortages in areas such as education, child welfare, and social services. Similar programs exist at the local level such as the New York State Social Worker, Teacher, and Child Welfare Loan Forgiveness programs.[46] These programs provide a limited amount of loan forgiveness to borrowers for their service in said professions. However, an even more equitable revamping could honorably discharge the debt of PSLF program participants, immediately removing their debt upon a commitment to public service and removing a substantial barrier to wealth accumulation.

If we aim to provide an equitable response to the widening racial wealth gap, we must use research that centers on race and incorporates the added dimensions of gender and parental status to produce a race-conscious policy. Use of the abovementioned race-neutral policy options, in the interim, can positively impact Black borrowers. This said, race-neutral policy alone will not address the unintended impacts of our nation's historical and present-day predatory inclusion practices. By adopting and effectively implementing evidence-based race-conscious policy, we can relieve financial constraints that are contributing to the widening racial wealth gap while reestablishing education's promise of economic mobility to Black Americans.

[45] "Biden-Harris Administration Announces Additional $4.9 Billion in Approved Student Debt Relief," *U.S. Department of Education*. (2024). https://www.ed.gov/news/press-releases/biden-harris-administration-announces-additional-49-billion-approved-student-debt-relief

[46] Higher Service Education Corporation. "New York State Loan Forgiveness", *New York State*. (2024). https://www.hesc.ny.gov/repay-your-loans/repayment-options-assistance/loan-forgiveness-cancellation-and-discharge.html

Second Look Legislation in Michigan: A Cost Savings Analysis

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Abstract

Michigan's average sentence length is almost three times longer than the national average, and this is mainly due to strict sentencing practices.[1] The newly proposed Second Look Sentencing Act offers a solution by permitting individuals to petition for sentence review after completing a minimum of 10 years, regardless of their initial sentence duration. Our research outlines the demographic impacts of this legislation and analyzes the financial implications of this policy change by creating a cost-savings model for its impact on the Michigan Department of Corrections (MDOC) budget. Our analysis sug-gests that Second Look could reduce the state's prison population by up to 10,600 individuals, resulting in a corresponding reduction of approximately $560,300,00 in marginal spending for the Michigan Department of Corrections over 10 years. Accounting for both marginal costs and potential reductions in material and labor expenses, our model predicts substantial savings of $1,962,000,000 after 10 years and at least $2,767,000,000 within the initial 50 years of its enactment. These projected cost savings present an opportunity for more efficient resource allocation, enhancing the effectiveness of services to facilitate successful reentry into society and reduce overall crime rates.

Long-Term Sentencing in Michigan

Individuals in Michigan tend to stay in prison longer than anywhere else in the country.[2] One policy driving this trend is Michigan's Truth in Sentencing Laws that were introduced at the end of the 20th century and later expanded in the early 21st century. These policies stipulate that all convicted felony offenders must serve their full minimum sentence before becoming eligible for parole review.[3] With these policies, and by imposing the highest proportion of long-term sentences in the country, Michigan has increased the percentage of individuals serving sentences of 20 years or more significantly over the past two and

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1 Gaes, G. G., & Laskorunsky, J. "The Relationship Between Sentence Length, Time Served, and State Prison Population Levels," Federal Sentencing Reporter, 36(1-2), 54-62. (2023). doi:10.1080/10510962.2023.198138

2 Gaes & Laskorunsky. "The Relationship Between Sentence Length."

3 "Truth in Sentencing Information," Michigan Department of Corrections. (2024). https://www.michigan.gov/corrections/services/family-information/truth-in-sentencing-information

a half decades.[4] In 1998, when Michigan introduced its Truth In Sentencing Laws, 18.3% of the Michigan prison population was serving sentences of over 20 years.[5] In 2017, 32.8% of the population was serving 20 years or more. Excluding life sentences, 18.6% of the population was serving 20+ years in 2017, and 19.1% were in 2023.

Michigan's long-term sentences are problematic for several reasons. Estimates by Safe and Just Michigan suggest that long-term sentences will sustain or drive prison population growth, hindering goals by Michigan policymakers to reduce the prison population, even if continued reforms reduce the population of short-term prison sentences. As of August 2023, MDOC was responsible for overseeing the incarceration of 32,785 individuals, representing a 36.4% decline in the state's prison population since its peak in 2006.[6] However, this reduction in population size has been counterbalanced by a consistent increase in the length of incarceration.[7] Further-more, reflecting systemic inequities, African Americans are disproportionately represented at every level of sentencing in Michigan. However, these racial disparities become more pronounced as sentence lengths increase, underscoring that the issue of long-term incarceration in Michigan is inherently an issue of racial justice.[8]

Research has also cast doubt as to the utility of long sentences. A wealth of evidence suggests that individuals tend to "age out" of crime as they get older.[9] Criminal behaviors often decrease from adolescence into adulthood, and recidivism rates for older individuals are significantly lower than for younger age groups.[10] Additionally, incarceration length has diminishing returns to public safety, with long sentences often keeping individuals incarcerated far past the point that they are

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4 Gaes & Laskorunsky. "The Relationship Between Sentence Length."; "The Long Haul: Why Long Sentences Hurt Everyone in Michigan," Safe & Just Michigan. (2019). https://www.safeandjustmi.org/2019/02/27/the-long-haul-why-long-sentences-hurt-everyone-in-michigan/

5 "Truth in Sentencing Information," Michigan Department of Corrections.

6 Risko, R. "Budget Briefing: Corrections", Michigan House Fiscal Agency. (2022). https://www.house.mi.gov/hfa/PDF/Briefings/Corrections_BudgetBriefing_fy22-23.pdf

7 "The Long Haul." Safe & Just Michigan.

8 Eaglin, J. M., & Solomon, D. "Reducing Racial and Ethnic Disparities in Jails: Recommendations for Local Practice," The Brennan Center for Justice, New York University. (2015). https://www.brennancenter.org/our-work/policy-solutions/reducing-racial-and-ethnic-disparities-jails; Snyder, D. "One Size Does Not Fit All: A Look at the Disproportionate Effects of Federal Mandatory Minimum Drug Sentences on Racial Minorities and How They Have Contributed to the Degradation of the Underprivileged African-American Family," Hamline J. Pub. L. & Pol'y, 36, 77. (2015). https://digitalcommons.hamline.edu/cgi/viewcontent.cgi?article=1012&context=jplp

9 Ray, J. V., & Jones, S. "Aging Out of Crime and Personality Development: A Review of the Research Examining the Role of Impulsiveness on Offending in Middle and Late Adulthood," Psychology Research and Behavior Management, 1587-1596. (2023). doi:10.2147/PRBM.S391406; Hunt, K. S., & Easley, B. "The Effects of Aging on Recidivism Among Federal Offenders," United States Sentencing Commission. (2017). https://www.ussc.gov/sites/default/files/pdf/research-and-publications/research-publications/2017/20171207_Recidivism-Age.pdf; Laub, J. H., & Sampson, R. J. "Shared Beginnings, Divergent Lives: Delinquent Boys to Age 70," Harvard University Press. (2003). doi:10.4159/9780674039971; Farrington, D. P. "Age and Crime," Crime and Justice, 7, 189–250. (1986). http://www.jstor.org/stable/1147518

10 Steffensmeier et al. "Age and the Distribution of Crime," American Journal of Sociology, 94(4), 803–831. (1989). https://www.jstor.org/stable/2780859; Hunt & Easley. "The Effects of Aging on Recidivism."

still a risk.[11] Recidivism rates among individuals who received sentence reductions at the federal level and those who served full sentences were nearly identical.[12] Additionally, over 30 states have simultaneously reduced crime rates and prison populations.[13]

Even in the event of sentencing reforms addressing future long-term sentencing, a large population of individuals are still serving old long-term sentences.[14] These long sentences and their effects on the population, such as aging, will sustain or increase Michigan's correctional spending, which is already 2 billion dollars.[15] Finally, communities of color are disproportionately affected by long-term incarceration, and modes of early release may provide a method to address those racial inequalities in sentencing.[16] Addressing the backlog of long-term incarceration and sentences provides Michigan an avenue to demonstrate fiscal responsibility, ensure justice, and address racial inequality, all while maintaining public safety.[17]

The Second Look Sentencing Act

The Second Look Sentencing Act, introduced in the Michigan Senate in May 2023, would allow eligible incarcerated individuals—those who have served at least 10 years of a sentence of 10 years or more, including life sentences, with or without parole—to petition for a sentence reduction hearing.[18] By revising eligibility criteria under the current Truth-in-Sentencing (TIS) statutes, which mandate individuals serve the entirety of their minimum sentence, the Act aims to alleviate the strain on the state's resources and the affected

11 Mauer, M. "Long-Term Sentences: Time to Reconsider the Scale of Punishment," UMKC L. Rev., 87, 113. (2018). https://www.sentencingproject.org/app/uploads/2022/08/UMKC-Law-Review-Scale-of-Punishment.pdf; Farrington. "Age and Crime."

12 Hunt, K. S., & Dumville, R. "Recidivism Among Federal Offenders: A Comprehensive Overview," United States Sentencing Commission. (2016). https://www.ussc.gov/sites/default/files/pdf/research-and-publications/research-publications/2016/recidivism_overview.pdfMDOC

13 Durose, M. R., Cooper, A. D., & Snyder, H. N. "Recidivism of Prisoners Released in 30 States in 2005: Patterns from 2005 to 2010," US Department of Justice, Office of Justice Programs, Bureau of Justice Statistics, 28. (2014). https://bjs.ojp.gov/content/pub/pdf/rprts05p0510.pdf; Eisen, L. B., & Cullen, J. "Update: Changes in State Imprisonment Rates," The Brennan Center for Justice, New York University. (2016). https://www.brennancenter.org/sites/default/files/analysis/UpdateChangesinStateImprisonment.pdf

14 Berryessa, C. M. "A Tale of 'Second Chances': An Experimental Examination of Popular Support for Early Release Mechanisms that Reconsider Long-Term Prison Sentences," Journal of Experimental Criminology, 18, 783-824. (2022). doi:10.1007/s11292-021-09466-x; "Michigan Department of Corrections 2022 Statistical Report". Michigan Department of Corrections. (2023a). https://www.michigan.gov/corrections/-/media/Project/Websites/corrections/Files/Statistical-Reports/Statistical-Reports/2022-Statistical-Report.pdf?rev=058896496c4049df84084519a5995e50&hash=F146F8990B45C2D298B845510BBA4E02

15 "The Long Haul." Safe & Just Michigan.

16 Eaglin & Solomon. "Reducing Racial and Ethnic Disparities in Jails."; Snyder. "One Size Does Not Fit All."

17 Gelb, A., King, R., & Rose, F. "Time Served: The High Cost, Low Return of Longer Prison Terms," Pew Center on the States. (2012). https://www.pewtrusts.org/~/media/legacy/uploadedfiles/wwwpewtrustsorg/reports/sentencing_and_corrections/prisontimeservedpdf.pdf

18 The Second Look Sentencing Act, S.B. 321-325. (2023). https://www.legislature.mi.gov/documents/2023-2024/billintroduced/Senate/pdf/2023-SIB-0321.pdf

individuals and communities.

Research Objective

Following a comprehensive assessment of the sentencing landscape in Michigan and proposed reforms under the Second Look Sentencing Act, this paper quantitatively evaluates its potential cost impact. The analysis is rooted in public data from the MDOC, academic literature on sentencing and corrections policy, and projections based on established criminal justice research methodologies. We first analyze Michigan's incarcerated population to understand the descriptives of those eligible for resentencing under the Second Look Sentencing Act. We then estimate cost savings for MDOC due to implementing this legislation.

While our paper primarily examines the fiscal implications of Second Look legislation, our data and findings hold broader implications for social justice, racial equity, and public safety within criminal justice reform. By projecting the outcomes of the Second Look Sentencing Act, we not only shed light on immediate cost savings but also initiate a deeper conversation about the role of sentencing policies in shaping the future of criminal justice in Michigan and beyond. Our research provides stakeholders with the empirical evidence needed to support informed decisions about sentencing reform. Our data and findings serve as valuable resources for policymakers, advocates, and scholars, contributing to ongoing efforts to create a more equitable, effective, and humane justice system.

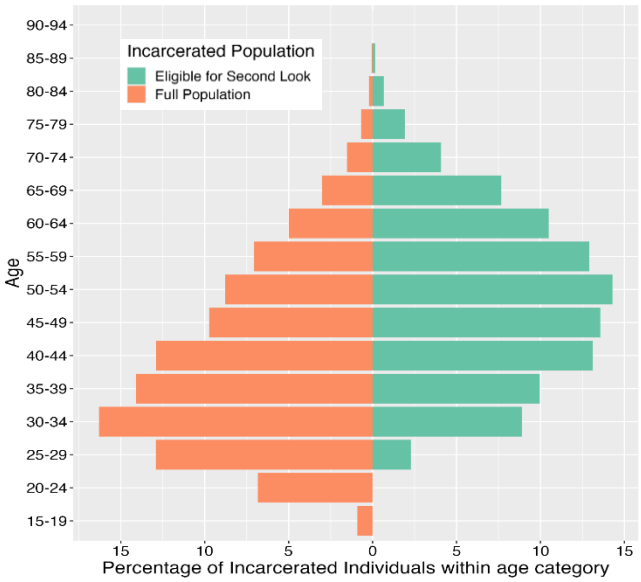


Figure 1: Age Distribution of Michigan's Current Incarcerated Population Compared to Population Eligible for Second Look

Note. Age pyramid is comparing the current age distribution of the full current incarcerated population (left) with those who are eligible for Second Look (right). Bars indicate the percent of the population that is in that age category.

Descriptive Analysis of Michigan's Incarcerated Population

We compiled individual prisoner data by scraping the MDOC Offender Tracking Information System (OTIS) public website, which serves as the basis for our analysis. This web scrape provides us with data through August 2023 and contains demographic information for incarcerated individuals and information concerning their sentences and offenses. Using this information, we determined who within this population would be eligible for resentencing under the Second Look Sentencing Act. By comparing those eligible for Second Look to the general incarcerated population, we can determine the degree to which this legislation addresses Michigan's issues of aging, long-

term sentencing, and racial disparities in sentences.

Aging Population

Since 2006, Michigan's incarcerated population has been steadily aging. From 2006 to 2023, the percentage of incarcerated individuals aged 50 and over has increased from 14.4% to 26.3%, while those aged 20-29 have declined from 29.3% to 20.3%.[19] In comparison to the broader incarcerated population in Michigan, individuals eligible for resentencing under Second Look legislation tend to be older on average (see *Figure 1*). While the mean age of the total population is 42.1 years old, the mean age for those eligible for Second Look is 51.5 years old. 70% of incarcerated individuals over 75 years old are eligible for resentencing, as well as 64% of those over 65 years old.

Longer, Older Sentences

The Second Look Sentencing Act requires individuals to have served at least 10 years on their minimum sentence before becoming eligible for resentencing. However, as illustrated in *Figure 2*, those eligible for Second Look have served significantly longer than this minimum requirement, with an average of 21.1 years served on their current sentence. In comparison, the general population has an average time served of 8.7 years. 45% of those eligible for Second Look have already served 20 years or more on their current sentence.

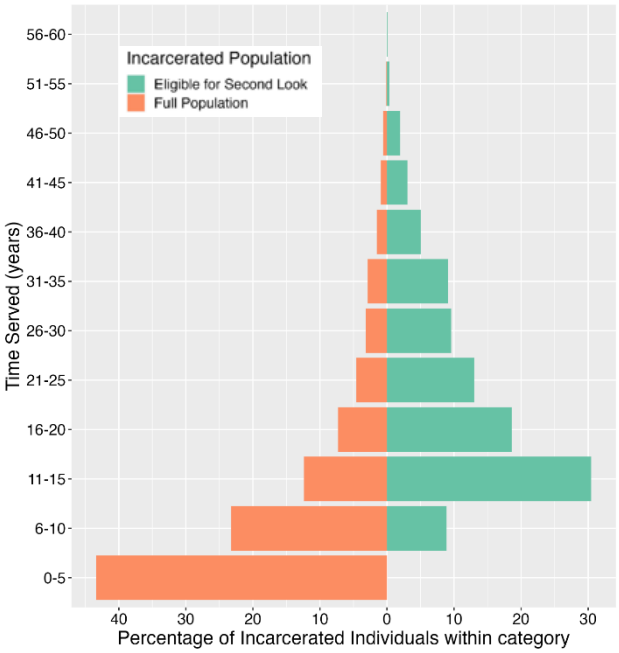


Figure 2: Time Served Distribution of Current Incarcerated Population Compared to Population Eligible for Second Look

Note. Distribution of time served of the full current incarcerated population (left) compared to those who are eligible for Second Look (right). Bars indicate the percentage of the population that is in that category.

This legislation also stands to benefit those with the oldest sentences in Michigan's incarcerated population. *Figure 3* shows the full incarcerated population's current eligibility for Second Look overlaid on the year the sentence was imposed. While most of the current incarcerated population is ineligible (orange bars), a significant portion is eligible (green bars). The long tail of sentences from the 1960s to the 1990s is of particular concern. These are individuals who were sentenced decades ago, still serving out their extremely long sentences. By comparison, Figure 4

19 Risko, R. "Budget Briefing: Corrections."

shows the minimum sentences of those eligible for Second Look overlaid on the year the sentence was imposed. Here, we see the backlog of old sentences more clearly. This is a portion of the prison population that will be aging in the coming decades, and due to that, the average costs of incarceration will increase as well.

Racial Disparities

Michigan's incarcerated population includes wide racial disparities, and this is especially pronounced for those serving long-term sentences. While Black individuals make up just 14% of the population statewide, 50.9% of those incarcerated in Michigan identify as Black (see *Table 1*).[20] Additionally, 41% of Black incarcerated individuals are serving a sentence with a 20-year minimum or longer, compared to 24% of white incarcerated individuals, and 67% of those serving life sentences in Michigan are Black.

Comparing those eligible for Second Look to the general population, a chi-square test shows a statistically significant difference in the distribution of race based on eligibility (X^2 =781.55, df = 8, $p < 0.000$). A larger proportion of eligible individuals for Second Look are Black than those ineligible. Thus, this legislation may reduce racial disparities in Michigan's incarcerated population, especially for those with long-term sentences.

Cost Savings Analysis Methods

Cost Savings Model

To understand the cost savings from implementing the Second Look Sentencing Act, we developed a stochastic model to estimate the cumulative time served saved for all individuals within the Michigan prison population as of August 2023. This model uses probabilities to determine changes from one state to another (e.g. changes from being incarcerated to being on parole) for each individual over time. We considered any time an individual spends in the state of being on parole/released as being "saved". Because these probabilities have uncertainty, we then run a Monte Carlo Simulation, which runs through the model multiple times to estimate savings from these probabilities, and the average of these model runs produces a final amount saved.

This method allows us to project the potential time of release for each individual who has completed at least ten years of their sentence, based on assumptions we have made regarding how a judge might adjust an individual's original sentence. Our estimation method includes determining the number of years saved between the hypothetical release date without the proposed sentencing act and the revised release date with a potentially reduced sentence. To predict these saved years and the associated cost reductions, we include life expectancy, the probability of parole, and the probability of recidivism in our model. The cost savings of the program are calculated through the expected years saved multiplied by the expected cost of incarceration per year for all

20 United States Census Bureau. "Quick Facts: Michigan". U.S. Census Bureau. (2022). https://www.census.gov/quickfacts/fact/table/MI/PST045222

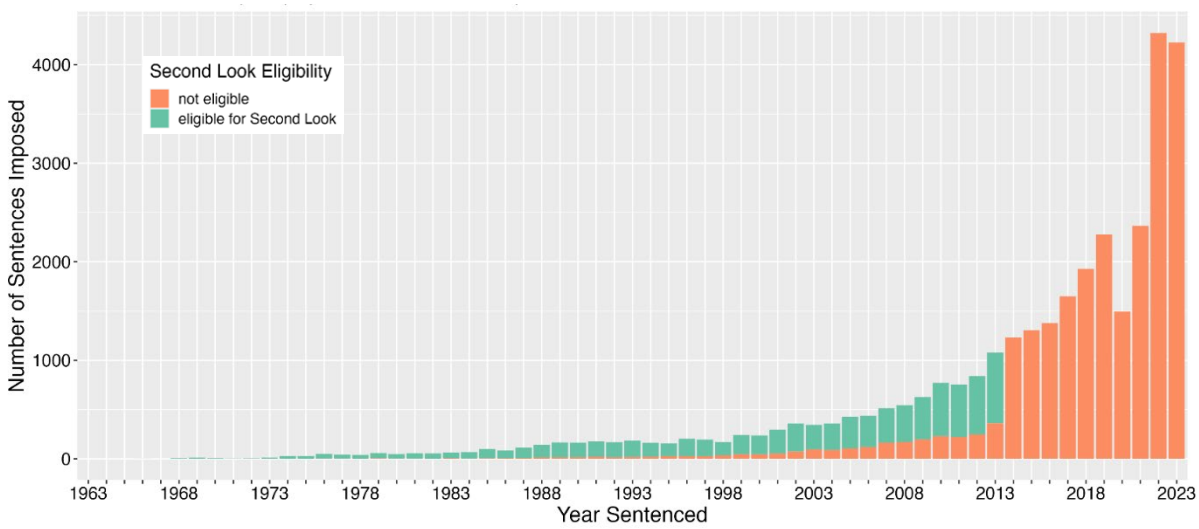


Figure 3: Second Look Eligibility by Year Sentenced for Michigan's Full Incarcerated Population

Note. Data only includes sentences of those currently incarcerated as of August 2023.

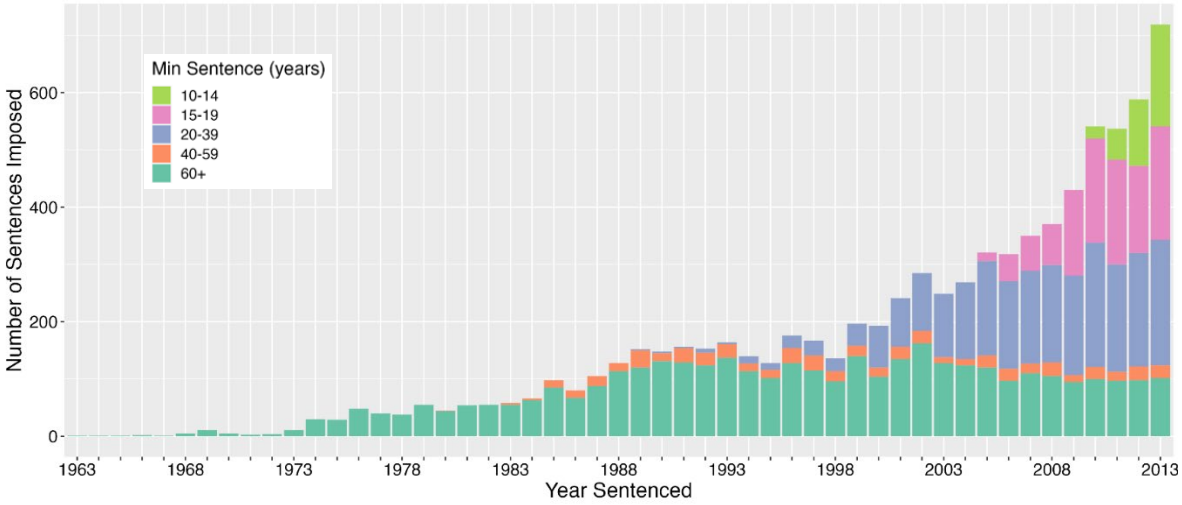


Figure 4: Minimum Sentences by Year Sentenced for Michigan's Incarcerated Population Eligible for Second Look

Note. Length of Minimum Sentences Imposed over time for those eligible for Second Look in Michigan. Data only includes sentences of those currently incarcerated.

Table 1: Descriptive Information for Current Incarcerated Population in Michigan (August 2023)

	Full incarcerated population	Population eligible for Second Look
Age (average, years)	42.1 (13.1)	51.53 (12.3)
Age at Sentencing (average, years)	33.4 (11.5)	30.5 (9.93)
Time served (average, years)	8.7 (9.76)	21.1 (9.99)
Gender		
Male	94.79%	96.45%
Female	5.21%	3.55%
Race		
White	42.10%	31.46%
Black	50.93%	63.64%
Hispanic	3.56%	1.49%
Native American	1.58%	1.22%
Latino	0.85%	1.02%
Middle Eastern/ North African	0.35%	0.38%
Asian	0.34%	0.47%
Pacific Islander	0.11%	0.07%
Unknown	0.17%	0.23%
N	32,785	8,103

Note. Standard errors are reported in parentheses.

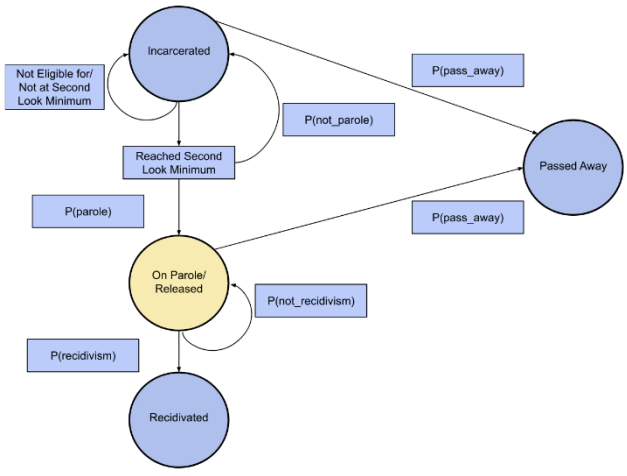
individuals within MDOC.

The model for estimating years saved is visualized in *Figure 5*. Each individual eligible for Second Look starts in the "incarcerated" state in year 0, and for each additional year, we determine the probability that the individual changes from one state to another. Once an individual reaches their new Second Look minimum (see *Table 2*), they move to the "on parole/released" state based on their probability of being paroled (see *Table 3*). Individuals who are in the "on parole/released" state move to the "recidivated" state based on their probability of recidivism (see *Table 4*), and individuals from either "incarcerated" or "on parole/released" states move to the "passed away" state based on their estimated life Several key assumptions were made when constructing our stochastic model. We assume that judges will base their resentencing decisions on the original minimum sentence of each individual, as outlined in *Table 2* of our analysis. We also use varying probabilities of parole, contingent upon the nature of the crime committed, such as non-violent offenses, drug-related offenses, and sex offenses.

Additionally, we incorporate the likelihood of recidivism into our model, which we assume to be influenced by factors including the age and gender of the individual. Lastly, we integrate life expectancy into our analysis for all individuals, calculating years saved as a sum of all years released until their original minimum sentence or until their estimated life expectancy.

We implement a Monte Carlo simulation to iterate all current inmates' expected years saved over the next 50 years. We do not model future MDOC prisoners, so innately our model is most accurate in a 10-year scope. This is because an individual

Figure 5: Stochastic model process for estimating years saved, modeled each year



sentenced in 2023 to a 10-year minimum will be eligible for Second Look in 2033. However, we do not know how many individuals will be sentenced to a 10-year sentence in 2024 and therefore do not have an accurate representation of the prisoner population in 2034.In the context of this cost savings analysis, our focus is exclusively centered around the fiscal implications for the MDOC, and, by extension, the State of Michigan. MDOC and the House Fiscal Agency both have comprehensive reports on the annual cost of incarceration by prisoners; these estimates are then used to inform our cost savings analysis.[21]

Table 2: Model Assumptions For Resentenced Minimums

Current minimum sentence	Assumed new minimum sentence for analysis
15–20 years	10 years
20–30 years	15 years
30–60 years	20 years
60+ or Life	25 years

Note. Our model assumptions are shown in the column on the right and are based on the original minimum sentence ranges in the left column.

Inputs

i. Life Expectancy

Without knowing the life expectancy of individuals sentenced to life sentences, it is difficult to determine the cost savings of early release. There is a non-zero probability that any individual passes away before their mandatory minimum, an issue exacerbated by the lower life expectancy in state prisons (Egan, 2019).[22] Ideally, we would have health care and demographic data for each individual, which would inform an actuarial life expectancy estimate. However, without this data, we have instead used the number of and age at death from all deaths in the Michigan State Prisons 2015-2021 (see *Figure 6*), as compiled by the Custodial Mortality Project, to estimate life expectancy for currently incarcerated individuals .[23]

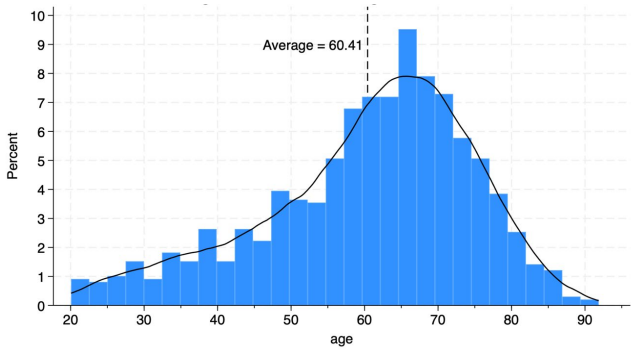


Figure 6: Observed Age of Death in Michigan State Prisons, 2015–2021

These 987 recorded deaths inform a hazard rate, the probability of death in the next year given

21 Risko. "Budget Briefing: Corrections."; "Correction FY 2024 Appropriations," House Fiscal Agency. (2023). https://www.house.mi.gov/hfa/PDF/Summaries/Corrections_Part1_Approps_Detail_fy24.pdf; "Parole Board Decisions Report," Michigan Department of Corrections. (2022). https://www.michigan.gov/corrections/-/media/Project/Websites/corrections/Files/Legislative-Reports/2022/Parole-Board-Decisions-Report-4th-Quarter.pdf?rev=f86aa79ffa3f43f09bdde0e0b0761022&hash=9B9E52E614B989492DC6E1C6FC53C890

22 Egan, P. "Michigan Prisoners Dying Behind Bars at Highest Rate in Decades," Detroit Free Press. (2019). https://www.freep.com/story/news/local/michigan/2019/05/02/michigan-prison-deaths-surged-2018/3344232002/

23 Dolovich et al. "Covid-19 Behind Bars Data Project: Prison Mortality Dataset [Data Set]," UCLA Law. (2023). https://uclacovidbehindbars.org/

reaching a certain year, and a Probability Density Function (PDF) of the life expectancy of incarcerated individuals. For each individual, we estimate age at death using the PDF of life expectancy normalized to their current age.

We note that this method has some validity concerns. Firstly, our data excludes anyone who did not die in prison between 2015-2021.[24] Given that the average age of incarcerated individuals is growing, we cannot assume that our distribution is representative of the current population. Secondly, our data includes the COVID-19 pandemic, and it has been reported that MDOC systematically underreported deaths from 2017 onwards.[25] Unfortunately, dropping data before 2017 or the pandemic severely limits our ability to estimate life expectancy, and dramatically drops the average age of death. The low frequency of the data also limits our ability to use race or gender as covariates in estimating a hazard rate.

ii. Parole Rates

Parole rates are based on two data sources: the 2023 parole approval rates listed in MDOC's Parole Board Decision Reports for 2022-2023 and the 2012 MDOC Parole Rates by Crime type.[26] The MDOC's Parole Board Decision Reports for 2022-2023 show parole by the parole hearing number, and generally, parole rates are highest between the second and third request. Following the report, our model includes up to six parole request attempts. Once an incarcerated individual has attempted parole six times (once a year for six years), they are not given parole in the model.

Parole decisions are also reflective of crime type, with violent and sexual crimes often receiving lower parole rates than non-violent and drug-related crimes. Using 2012 data, the most recent MDOC data on parole rates by crime type, we proportioned the probability of parole to the type of crime. This was achieved by calculating the odds ratio of violent, non-violent, drug, and sex crime parole rates compared to the average parole rate and applying those odds ratios to 2022-2023 data (see *Table 3*).[27] This method assumes that parole rates similarly differ by crime type in 2023 as in 2012 (*Table 3*). Type of offense for current incarcerated individuals was determined by classifying the incarcerated individual's offense based on keywords in offense titles. For example, a homicide offense is categorized as "violent," whereas a substance-based offense is categorized as "drug."

24 Dolovich et al. "Covid-19 Behind Bars Data Project: Prison Mortality Dataset [Data Set]."

25 Bliss, K. W. "Death Rate of Prisoners in Michigan Much Higher than Reported," Prison Legal News. (2019). https://www.prisonlegalnews.org/news/2019/aug/6/death-rate-prisoners-michigan-much-higher-reported/

26 "Parole Board Decisions Report." Michigan Department of Corrections.; "Michigan's Recidivism Rate," Michigan Department of Corrections. (2023b). https://www.michigan.gov/corrections/recidivism-rate; "2012 Parole Approval Rates by Offense Type Graph," Michigan Department of Corrections. (2012).

27 Reitz et al. "By the Numbers: Parole Release and Revocation Across 50 States," University of Minnesota. (2016). https://robinainstitute.umn.edu/sites/robinainstitute.umn.edu/files/2022-02/parole_by_the_numbers_updated.pdf; "2012 Parole Approval Rates by Offense Type Graph." Michigan Department of Corrections.

Table 3: Estimated Parole Approval Rates Based on Hearing Number and Crime Type

Crime Type	Number of Parole Hearings						
	1	2	3	4	5	6	6+
Total	43.00%	49.81%	44.77%	30.28%	21.63%	23.47%	16.81%
Drug	55.84%	64.68%	58.13%	39.32%	28.09%	30.47%	21.83%
Other (non-violent)	48.86%	56.61%	50.88%	34.41%	24.58%	26.67%	19.11%
Other (violent)	42.54%	49.29%	44.30%	29.96%	21.40%	23.22%	16.64%
Sex	28.67%	33.21%	29.85%	20.19%	14.42%	15.65%	11.21%

Note. Data in the "Total" row are directly from MDOC Parole Board Decision Reports, and rates by crime type are estimated using the proportion of parole approvals by crime type in 2012.

iii. Recidivism

Recidivism, as used in this model, is defined as the likelihood that a formerly incarcerated individual will be reincarcerated. Measuring recidivism can vary significantly across different agencies and institutions. Common metrics include rearrest, reoffend, reincarceration, and reconviction rates.[28] It is important to note that while some metrics, such as rearrest rates, may be relatively straightforward to track, they do not unequivocally signify re-entry into the prison system.[29]

Ideally, recidivism rates would be imputed using individual parameters such as year since release, type of offense, gender, and age. However, the MDOC does not provide a granular breakdown of recidivism by additional parameters. The state of Michigan tracks recidivism, which they define as reincarceration, over 3 years post-release, and the MDOC publishes annual estimates of the state's recidivism rates within their Statistical Reports (see section D-3 of the Michigan Department of Corrections 2021 Statistical Report). Per the 2021 report, Michigan has a 3-year recidivism rate of 24%.[30] A 2023 MDOC press release stated a reduction in the recidivism rate to 22.1%.[31]

To account for the substantial variation in recidivism based on age, gender, and prison sentence length, we estimate Michigan's 8-year recidivism rate by age and gender using national recidivism averages as references.[32] To estimate the Michigan 8-year recidivism rate, we calculate an odds ratio of likeliness to recidivate 8 years after release compared to 3 years after release nationally and apply the same ratio to the MDOC-reported

28 Hunt & Easley. "The Effects of Aging on Recidivism."

29 Hunt & Easley. "The Effects of Aging on Recidivism."; Hunt & Dumville. "Recidivism Among Federal Offenders."

30 "Michigan Department of Corrections 2021 Statistical Report," Michigan Department of Corrections. (2022b). https://www.michigan.gov/corrections/-/media/Project/Websites/corrections/Files/Statistical-Reports/Statistical-Reports/2021-Statistical-Report.pdf?rev=771589b8a67d4beab1df90d5a359b8a4&hash=6DEAF68B2521637574AE97B2416ADEA7

31 "Michigan's Recidivism Rate." Michigan Department of Corrections.

32 Antenangeli & Durose. "Recidivism Of Prisoners Released in 24 States in 2008: A 10-Year Follow-Up Period (2008–2018)," U.S. Department of Justice Office of Justice Programs. (2021). https://bjs.ojp.gov/BJS_PUB/rpr24s0810yfup0818/Web%20content/508%20compliant%20PDFs; Hunt & Easley. "The Effects of Aging on Recidivism."

3-year recidivism. The national odds ratios are then used to estimate Michigan's 8-year recidivism by age and gender (*Table 4*). This method assumes that Michigan's recidivism varies proportionally with national trends.

Table 4: Michigan's Estimated 8-Year Recidivism Rate by Gender and Age

Sex	Age Range				
	<30	30–39	40–49	50–59	60+
Male	45.25%	36.86%	30.43%	19.15%	11.21%
Female	31.22%	26.69%	19.08%	10.03%	7.87%

Note. Estimates based on Federal 8-year recidivism rates. Adapted from MDOC 2023b; Antenangeli & Durose, 2021; Hunt & Easley, 2017.

Costs Savings

We use two different measures of incarceration costs per year to estimate cost savings, marginal cost savings, and full cost savings (see *Equation 1* below). The MDOC appropriated an annual total of $1,623,017,300 for prison custody, care, and programs.[33] MDOC has reported that, on average, it costs $47,900 to keep an individual in the state prison for one year.[34] This cost estimate includes facility costs, health care, food, mental health, and transportation costs and represents the full cost of incarceration for one year per individual (*Figure 7*). Understanding that the release of one individual does not diminish the cost to operate facilities and administration, we calculated that 27% of annual costs are marginal and will be reduced as individuals are released. The 27% of annual costs represent mental health (3%) and physical health costs (17%), transportation costs (2%), and food costs (5%).[35] Under the assumption that facilities will be closed in the long term when individuals are released, the full cost per year can be used. In both measures, we also subtract $5,076 dollars from the first two years an individual is released, to account for parole costs as described by the House Fiscal Agency.[36]

iv. Medical costs by age

As older individuals generally incur higher healthcare costs, the aging prison demographic compounds the financial challenges faced by the correctional system and the state. Average healthcare costs for a 40-year-old are twice those for individuals in their early 20s, and for people in their 70s, healthcare costs are three times as

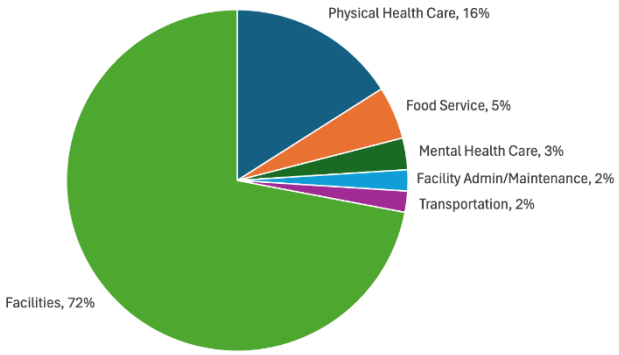


Figure 7: MDOC Custody, Care, and Programs Appropriation 2022-23

33 Risko. "Budget Briefing: Corrections."
34 Risko. "Budget Briefing: Corrections."
35 Risko. "Budget Briefing: Corrections."
36 Risko. "Budget Briefing: Corrections."

much as those in their early 40s.[37] This underscores the economic impact of an aging prison population, emphasizing the need to address the aging prison population in Michigan as a means of addressing costs and constraints on the state of Michigan.

Based on total estimates, the average prisoner's medical care cost in Michigan is $9,448.[38] It is well documented that incarcerated individuals suffer from a higher prevalence of illnesses compared to the general population, exacerbating the demand for healthcare services and increasing the overall cost to the state. As such, our model accounts for medical costs by age to estimate more precise cost savings. Medical costs in our model are based on a 2010 Michigan Senate Fiscal Agency Report, which constructs Michigan specific health care costs within the prison system.[39] The data they use comes from national-level Medicaid and Medicare data by age and gender in 2009. We use those estimates and inflate these numbers to 2023 levels to reflect current-day spending. Using health care costs by age and applying them to the current prisoner population in Michigan, our model estimates around $302 million in health care spending. This illustrates that our medical breakdown by age may be conservative, as MDOC reports that appropriations for prisoner health care costs are $305 million.[40]

Equation 1: Cost Saving Calculation

$$Full\ Savings\ = \sum_{j=1}^{n} \sum_{i=1}^{t}\ a\ +\ (c_{ji} - z) - p_i$$

$$Marginal\ Savings\ = \sum_{j=1}^{n} \sum_{i=1}^{t}\ (a * m)\ +\ (c_i - z) - p_i$$

Where n is the number of incarcerated individuals, t is the number of years saved by each incarcerated individual from our model estimation, a is the average annual incarceration cost given by MDOC ($47,900), m is the marginal cost saving rate (0.27), z is the average medical cost ($9,448), c_{ji} is the age-adjusted medical cost, and p_i is the parole cost ($5,076 for the first two years of release, $0 afterward).

v. Limitations of Methods

Due to the lack of precise up to date Michigan-specific data for many of our variables from MDOC, we recognize that our analysis relies on the assumption that Michigan incarceration trends mirror past state trends or national current trends. This is not always true as Michigan has some of the longest sentences in the country and may vary in other meaningful ways. It's worth noting that beyond the 10-year mark, our model underestimates both years and subsequent costs saved. This discrepancy arises because the savings projected beyond ten years solely reflect the

37 Risko. "Budget Briefing: Corrections."

38 Risko. "Budget Briefing: Corrections."

39 Angelotti, S., & Wycoff, S. "Michigan's Prison Health Care: Costs in Context," MI Senate Fiscal Agency. (2010). https://www.senate.michigan.gov/sfa/Publications/Issues/PrisonHealthCareCosts/PrisonHealthCareCosts.pdf

40 Risko. "Budget Briefing: Corrections."

time saved by the current incarcerated population. However, it's crucial to recognize that the Second Look Sentencing Act will also affect individuals incarcerated in the future — a demographic that is not factored into our analysis.

Lastly, our current analysis only considers costs to MDOC for incarcerating those eligible for Second Look. Still, we want to acknowledge that there are a variety of other costs and benefits that were outside the scope of this analysis and can be considered in future analyses. These include costs for resentencing, especially in counties that will be most affected such as Wayne and Oakland counties, costs for reentry, possible public costs for healthcare of released individuals, benefits of taxes from released individuals joining the labor force, and community-level benefits of reentry.

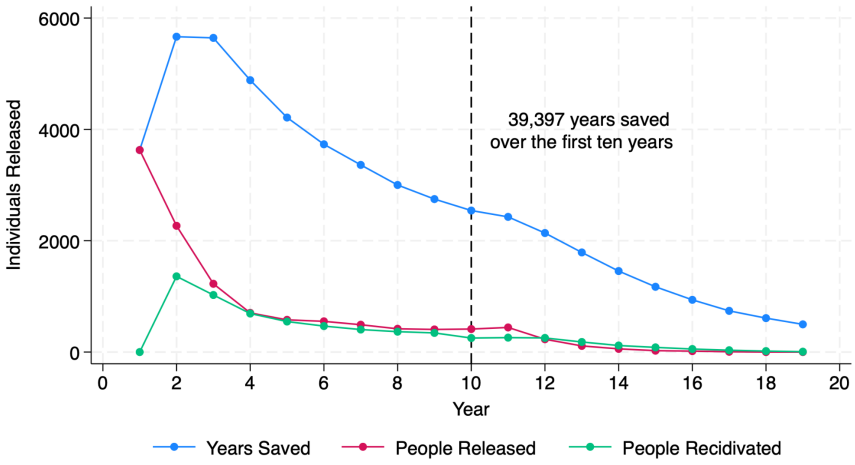


Figure 8: Impact of Second Look on Total Sentencing Years Saved in First 20 Years of Implementation

Cost Savings Analysis Results

We ran the above cost savings model 1000 times in a Monte Carlo Simulation and then averaged the results to obtain the estimates presented below.

Of Michigan's 32,758 prisoners, 8,100 are eligible for reexamination under Second Look under our sentence reduction assumptions. Over the next 10 years, that number will rise to over 10,600 individuals as more people reach the minimum sentence requirements to become eligible for review. Assuming all individuals receive reduced sentences as described in *Table 2*, the collective time served saved between all potentially prisoners is 39,397 years, an average of approximately 4 years per individual (see *Figure 8*).

Using marginal cost savings, in the next 10 years, MDOC stands to save $568,300,000 (see *Figure 9*). If we extend the estimate to 50 years, the savings are at least $856,200,000. The annual savings start low as inmates are granted parole, and after three years, the annual savings decline as the backlog of eligible inmates decreases and individuals either recidivate or pass away. Marginal savings refer only to costs to the department in housing, feeding, transporting, and providing medical care to inmates. These are not fixed costs in the same way that staffing and facility expenses are.

If we factor in fixed expenses, such as facility expenses and the costs saved from closing them, the savings is $1.962 billion over the course of 10 years, and $2.767 billion over the next 50 (see *Figure 10*). This number represents the cost savings if facilities are closed as inmates are put on parole. Figure 10 displays the total cost savings (including fixed costs), the marginal cost savings, and the medical cost savings.

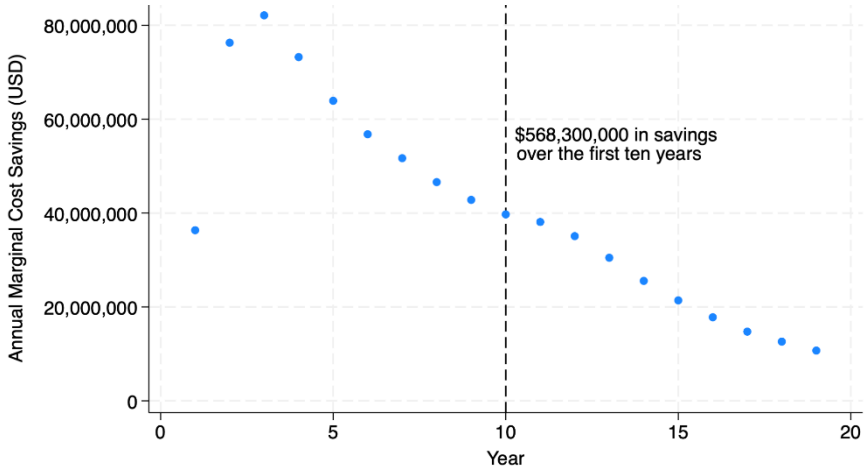


Figure 9: Annual Marginal Cost Savings from Second Look Legislation

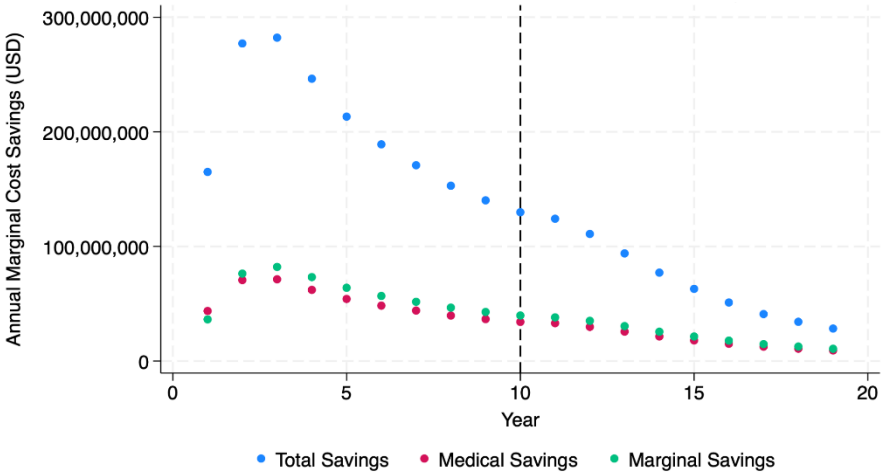


Figure 10: Annual Fixed Costs Savings from Second Look Legislation

This analysis is limited to costs and benefits within the scope of the MDOC budget. It recognizes that a large component of marginal cost savings stems from healthcare expenses, particularly end-of-life care. While access is restricted for those currently incarcerated, upon release, the majority of incarcerated individuals will become eligible for Medicaid/Medicare. Under Medicaid/Medicare coverage, the State of Michigan would be responsible for 36% of costs, while the federal government would carry the remaining 64%.[41] This means that approximately 36% of the medical cost savings would shift back to the State, assuming all released individuals seek Medicare or Medicaid programs. The state would still save $363,000,000 in medical costs in this scenario.

Sensitivity Analysis

We performed a sensitivity analysis to test the assumptions we used pertaining to sentence reduction lengths under Second Look (*Table 2*). In our base model, we assume certain sentence lengths will receive specific reductions (e.g. life sentences are reduced to 25-year minimums). To test the robustness of our cost savings, we adjust the bins, only giving sentence reductions to 60+ year sentences (see *Table 5*). Here, knowing that the average life expectancy in Michigan prisons was around 60 years old, a person sentenced to life in their youth was realistically serving 30–40 years in prison before they passed away.[42] Therefore, we reduced life sentences to 35 years, rather than 25. Under this scenario, we still find significant savings. Over a 10-year period, we estimate that 3,600

41 Williams, E., Rudowitz, R., & Burns, A. "Medicaid Financing: The Basics," Kaiser Family Foundation. (2023). https://www.kff.org/medicaid/issue-brief/medicaid-financing-the-basics/

42 Dolovich et al. "Covid-19 Behind Bars Data Project: Prison Mortality Dataset [Data Set]."

Resentencing Assumptions		
Current Minimum Sentence	Original Assumption for New Minimum Sentence	Conservative Assumption for New Minimum Sentence
15-20 years	10 years	no resentence
20-30 years	15 years	no resentence
30-60 years	20 years	no resentence
60+ or Life	25 years	35 years
Cost Saving Estimates		
Type	Original Cost Savings Analysis	Conservative Cost Savings Analysis
10-year marginal savings	$568,300,000	$165,400,000
10-year estimated number of people released	10,679	3,600

Table 5: Sensitivity Analysis for Assumed Second Look Legislation Resentences

people will be released, translating to $165.4 million in marginal cost savings, with savings increasing to $233.2 million over a 50-year period. The results of our sensitivity analysis illustrate that stricter sentencing conditions still substantially reduce costs.

Conclusion

Our analysis showed significant potential cost savings for the Michigan Department of Corrections. Over the first 10 years, our estimated marginal cost saving is $568.3 million with an approximate 10,600 individuals eligible for Second Look. Over 50 years, we estimate that marginal cost savings will be at least $856.2 million. If the release of inmates is accompanied by prison closures, the potential savings are much higher at $1.962 billion over the course of 10 years, and $2.767 billion over the next 50 years.

It is crucial to recognize that those eligible for the Second Look Sentencing Act represent the oldest prisoners, serving the lengthiest sentences, and incurring the highest costs on Michigan's prison system. Even modest sentence reductions promise substantial cost savings for the MDOC, while also providing hope for release among inmates serving lengthy sentences. Our methodology and data-driven approach signify a notable advancement from prior assessments of the Sentencing Act that lacked our analysis' level of detail and analytical clarity.

By offering a pathway to reevaluate lengthy prison sentences, this Act has the potential to rectify past injustices, mitigate the disproportionate impact on marginalized communities, and foster a more equitable and just criminal justice system. Moving forward, the implementation of this legislation presents an opportunity to address the shortcomings of the past and forge a path toward a future where rehabilitation, fairness, and second chances are central tenets of our criminal legal system.

Assessing Policy Drivers and Barriers for Sustainable Groundwater Management in Michigan

Amy Van Zanen[†]*; Sarah Hughes*[*]*; Alan Steinman*[±]

Abstract

The sustainable use of Michigan's groundwater may be threatened by growing demand and climate change, but state policies are not equipped to address these challenges. Using Ottawa County's experience with increased demand and aquifer depletion as a motivating case, we leverage interviews and policy analysis to evaluate Michigan's groundwater management policy framework, identify policy gaps, and provide recommendations to address sustainability challenges. Proposed solutions include the use of groundwater management plans, coordinated land use planning, and outreach and education. Investments in data collection and local-level models are vital for effective implementation.

Introduction

Groundwater plays a crucial role in the wellbeing of residents and businesses who rely on groundwater for drinking water, irrigation, energy generation, and manufacturing. Approximately 44% of Michigan residents depend on groundwater for drinking water, highlighting the need for effective policies to ensure its quality and availability.[1] Challenges such as uneven and increasing population growth, lack of regulation, and climate change contribute to uncertainty in sustaining groundwater resources.[2]

This article explores Michigan's groundwater management framework in the context of emerging challenges. Using Ottawa County as a motivating case, we examine how the state's policy framework can support or hinder communities'

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[*] Associate Professor of Environment and Sustainability, University of Michigan.

[±] Allen and Helen Hunting Research Professor, Grand Valley State University.

[1] MI DHHS. "MI Drinking Water Sources," *Michigan Department of Health and Human Services*. (n.d.). https://www.michigan.gov/mdhhs/safety-injury prev/environmental-health/topics/care-for-mi-drinking-water/sources

[2] Costa, D., Zhang, H., & Levison, J. "Impacts of Climate Change on Groundwater in the Great Lakes Basin: A Review," *Journal of Great Lakes Research*, 47(6) (2021): 1613–25. https://doi.org/10.1016/j.jglr.2021.10.011; Taylor et al. "Ground Water and Climate Change," *Nature Climate Change* 3 (4) (2013): 322–29. DOI: 10.1038/nclimate1744; ASAP. "Climate and Demographic Change in the Great Lakes Region: A Narrative Literature Review of Opportunities and Opportunity Barriers," *American Society of Adaptation Professionals*. (2021). https://adaptationprofessionals.org/resources/climate-and-demographic-change-in-the-great-lakes-region-literature-review/

ability to ensure the long-term sustainability of their groundwater resources.

Ottawa County is the fastest growing county in Michigan. While agriculture remains a significant part of Ottawa County's economy, the county is also rapidly urbanizing.[3] Ottawa County has experienced a nearly 58% population increase from 1990 to 2020, accompanied by a 40% rise in groundwater withdrawals by major water users and over 3,000 new residential wells drilled between 2011 and 2020.[4] This surge in demand, coupled with a problematic underlying geology, have strained groundwater resources, leading to reported issues with well water supply.[5]

Hydrogeological studies commissioned by Ottawa County have shown evidence of aquifer drawdown, with the potential for detrimental impacts on human health and crops, and recharge rates. Static water levels have declined in both the shallow and deep aquifers since 1999, with the issue particularly pronounced for the deep "bedrock" aquifer beneath the four townships in the central part of the county: Allendale, Blendon, Robinson, and Olive. As the bedrock aquifer is depleted, naturally occurring brines become increasingly concentrated resulting in elevated levels of chloride in groundwater. At the same time, a thick clay layer separating the shallow and bedrock aquifers slows recharge rates in the area and low transmissivity in the bedrock aquifer means that the county cannot count on recharge from outside the area to balance withdrawals.[6]

The challenges faced by Ottawa County raise broader questions about Michigan communities' ability to manage groundwater sustainably amid changing climate conditions and growing demand and offer insights for other areas facing similar conditions. For example, as many as 17 other Michigan counties may face similar declines in static water levels and increased chloride levels due to brine upwelling, but these counties lack extensive studies to determine their actual risk of aquifer drawdown.[7] Addressing the growing demand from residential groundwater users amid these hydrogeologic vulnerabilities has generated renewed interest in the suitability of current groundwater policies in Michigan for the challenges the state will face in the future in Ottawa County and beyond.

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[3] Ottawa County Planning and Performance Improvement Department. "Focus on Agriculture," *Ottawa County, Michigan*. (2021a.) https://www.miottawa.org/Departments/Planning/pdf/Focus-on-Agriculture.pdf

[4] EGLE. "2020 Water Use Data," *Michigan Department of Environment, Great Lakes and Energy*. (2020). https://www.michigan.gov/egle/-/media/Project/Websites/egle/Documents/Programs/WRD/Water-Use/2020-water-use data.xlsx

[5] Ottawa County Planning and Performance Improvement Department. "Population and Growth Rates in Ottawa County," *Ottawa County, Michigan*. (2021b.) https://www.miottawa.org/Departments/Planning/pdf/Databooks/LUGPopulation_2020Ce%20nsus.pdf.

[6] MSU IWR. "Ottawa County Water Resource Study," *Institute of Water Research; Department of Civil and Environmental Engineering, Michigan State University*. (2013). https://miottawa.org/GroundWater/pdf/Phase-I-Water-Resouces-Study.pdf.; Curtis, Z., Liao, H., & Li, S. "Ottawa County Water Resource Study - Phase 2," *Department of Civil and Environmental Engineering, Michigan State University*. (2018). https://miottawa.org/GroundWater/pdf/phase2_report.pdf.

[7] Lusch et al. "Groundwater Sustainability Analysis of Southern Lower Michigan and Statewide Action Plan," *Prepared for Michigan Department of Agriculture and Rural Development*. (2018).; Curtis et al. "Ottawa County Water Resource Study - Phase 2."

Michigan's complex policies governing groundwater withdrawals make it challenging to identify vulnerabilities and determine the appropriate strategies for addressing them. Changes to Michigan water law in the last two decades have targeted groundwater withdrawals by major water users, but less attention has been given to the cumulative effects of residential wells on water availability or the link between changing groundwater quantity and quality.[8]

This article evaluates Michigan's current groundwater management framework using existing state legislation and administrative code, local ordinances, and policy reports. We also interviewed fifteen experts in Michigan groundwater policy and Ottawa County's challenges. We conclude with recommendations for policymakers and suggestions for future research aimed at advancing sustainable groundwater management in Michigan.

Michigan's Legal Framework for Groundwater Management

Michigan's legal framework for groundwater management follows from a combination of legislation, case law, and the Great Lakes Water Compact – a multi-state agreement governing water resources in the Great Lakes Basin. State-level legislation grants authority to make groundwater-related decisions to different levels of government. For example, local units of government have almost exclusive purview over land use decisions. These decisions have implications for drainage and groundwater recharge as well as impacts to groundwater quality through pollution and the placement of businesses, agricultural operations, and residents, all of whom might use groundwater. State agencies have almost exclusive purview over hydrologic data management, groundwater quality regulation including discharges to groundwater, and regulating the quantity of groundwater withdrawals. Local health departments, typically at the county level, have purview over well permitting. Their actions are narrowly defined by the State and dependent on township or municipal-level land use decisions.

Water law in Michigan follows the doctrines of riparian rights and reasonable use, which rests on the determination of whether one water user's actions impede the rights of others to 'reasonably use' water resources associated with their property.[9] Until 2005, Michigan distinguished between surface water and groundwater users regarding the quantity of water withdrawals. The pivotal Michigan Court of Appeals ruling in Michigan Citizens for Water Conservation v. Nestle Waters North America Inc. (2005) removed this distinction and led to the integration of riparian and groundwater users as 'water users'.[10]

This change and the passage of the Great Lakes Water Compact in 2008 prompted the creation of Part 327 of the Natural Resources and

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[8] Lautenberger, M. C., & Norris, P. E. "Private Rights, Public Interests and Water Use Conflicts: Evolving Water Law and Policy in Michigan," *Water Policy*, 18(4), 903–17. (2016). https://doi.org/10.2166/wp.2016.037

[9] Lautenberger & Norris. "Private Rights, Public Interests and Water Use Conflicts."

[10] *Michigan Citizens for Water Conservation v. Nestle Waters North America Inc.*, 269 Mich. App. 25. (2005).; Lautenberger & Norris. "Private Rights, Public Interests and Water Use Conflicts."

Environmental Protection Act (NREPA) in 2008, regulating 'large quantity withdrawals' from watersheds (i.e., users withdrawing more than 100,000 gallons per day over a 90-day period). Administered by Michigan's Department of Environment, Great Lakes, and Energy (EGLE), Part 327 marked the state's first coordinated effort to limit water withdrawals based on quantity (MCL § 324.327). The legislation sought to balance large quantity water user rights with concerns about over allocating water within watersheds, primarily by considering potential damages to stream fisheries. The Water Withdrawal Assessment Tool (WWAT) employs groundwater modeling to assess potential 'adverse resource impacts' associated with groundwater withdrawals.[11]

There are several important limitations on the state's ability to manage groundwater withdrawals. Under Part 327, large quantity withdrawal users must register their withdrawals whereas residential properties with four units or fewer are exempt (MCL § 324.32705). The legislation describes no other reason to limit the quantity of a large quantity withdrawal beyond impacts to surface waters and no reason to limit non-commercial withdrawals from residential properties with four units or fewer, as long as those withdrawals are not used for lake augmentation. The statute explicitly maintains existing Michigan common law regarding 'reasonable-use' riparian rights (MCL § 324.32728). Water Use Program materials and staff are careful to emphasize that the limits imposed through Part 327 do not supersede property owner rights; water users may circumvent regulations through the judicial system.[12] State law provides some mechanisms for conflict resolution: 1) the formation of Water User Committees (WUC) to negotiate water allocation among large quantity withdrawal users near the threshold of allowed withdrawals (discussed in more detail below), and 2) the Groundwater Dispute Resolution program which applies in circumstances where a small-quantity well experiences issues with water supply that is directly attributable to a nearby high-capacity well (MCL § 324.317). However, neither of these mechanisms address water conflicts related to aquifer drawdown that is associated with increases in residential water use.

The limitations in Part 327 require advocates and decision-makers seeking to ensure sustainable groundwater use to navigate a patchwork of policies influencing groundwater quality and quantity at multiple levels of government.

Identifying Policy Gaps for Sustainable Groundwater Management in Michigan

We reviewed existing legislation and analyzed data from interviews to evaluate how Michigan's complex groundwater-related policies may contribute to unsustainable outcomes and user conflicts. The analysis reveals three key features: 1) the absence of institutions or policies that ensure sustainable use of groundwater resources, 2) the

[11] Reeves et al. "Ground-Water-Withdrawal Component of the Michigan Water-Withdrawal Screening Tool," *U.S. Geological Survey Scientific Investigations Report* 2009–5003, 36 p. (2009).

[12] LaBaron, A., & Blazic, R. "How Michigan's Water Use Program Preserves and Manages Our Water Resources," *Michigan Department of Environment, Great Lakes and Energy*. (2022). https://register.gotowebinar.com/recording/3051915948312515854

exemption for residential water user withdrawals from existing withdrawal regulations, and 3) land use decisions that do not account for impacts to water balances.

1. *Lack of Central Authority Over Groundwater Sustainability*

In Michigan, there is no single state office or program charged with ensuring sustainable use of all types of groundwater resources found in Michigan. The Department of Environment, Great Lakes and Energy's (EGLE's) Water Use program regulates how large quantity withdrawals of groundwater impact protected surface water stream base flows, but it does not consider drawdown in aquifers that would not impact surface water. Under Part 327 there is no mechanism, authorization, or funding for the Water Use program to address aquifer drawdown that is unrelated to surface water depletion from any size withdrawal. The situation in Ottawa County demonstrates that there are conditions under which depletion of certain groundwater resources, particularly semi- or completely- confined aquifers or those with low transmissivity, can be divorced from depletion of surface water. There is no policy mechanism to prevent large quantity withdrawal or residential water users from completely depleting these kinds of water sources.

Local health departments are responsible for permitting wells (MCL § 333.127) and can possess localized knowledge about water availability conditions across their jurisdiction. However, local health departments do not have the authority to deny residential or large quantity withdrawal well permits based on concerns of long-term viability of the water supply.[13] Interviewees noted that in Ottawa County, there have been circumstances where sanitarians have approved well permits for subdivisions while also warning the developers that the wells were likely to fail in the short to medium-term due to aquifer depletion even as the wells contribute to further drawdown in the meantime.[14]

Interviewees speculated that the riparian rights and reasonable use framework forming the backbone of Michigan water law and threat of litigation under that framework may lead state officials to err on the side of requiring local health departments to permit residential wells even where groundwater quality rules might prohibit withdrawals by public water supply.[15] This means that current regulations fail to curtail withdrawals that can lead to aquifer depletion.

2. *The Residential Well Exemption*

Cumulative impacts from and impacts to residentials well withdrawals are absent from Michigan water quantity regulations. Water withdrawal regulations under Part 327 exempt both single-family residential users and multifamily

[13] Personal Interview, local government representative. (2022b)

[14] Personal Interview, local government representative. (2022a); Personal Interview, local government representative. (2022b)

[15] Personal Interview, local government representative. (2022c); Personal Interview, academic. (2022a); Personal Interview, state agency representative. (2022b)

residential users not exceeding four residential units and not more than three acres in size (MCL § 324.32727). Under Michigan Administrative Code (R 560.411), a subdivision with densely placed residences, each drawing the minimum yield of 10 gallons per minute, can quickly exceed the large quantity withdrawal threshold of 70 gallons per minute pumping rate. While the 'de minimus' approach to residential wells may be appropriate in areas where withdrawals from agricultural irrigation vastly outpace residential use, the growth and density of well-dependent residential developments in areas like Ottawa County show that the cumulative impact of these withdrawals should not be overlooked.[16]

Michigan groundwater quantity regulations do not consider the potential negative impacts that new large quantity withdrawals may have on the long-term water availability for nearby residential wells (MCL § 324.32706e). Because the WWAT is concerned only with stream depletion as it may impact fish communities, it may register large quantity withdrawals in locations that could cause water supply issues for nearby residential wells. Even in areas with abundant groundwater and rapid recharge rates, large quantity withdrawals from high-capacity wells can cause a cone of depression which draws down the water table and can impact nearby wells.[17]

3. The Disconnect Between Groundwater Availability and Land Use

Michigan's land use legislation lacks safeguards against land use changes that threaten long-term groundwater availability. Legislation on zoning and land division requires suitable groundwater for land to be rezoned for dense housing (MCL § 125.3506). However, state rules defining 'suitability' do not consider potential aquifer drawdown such that this provision does not prohibit well-dependent dense housing developments in areas with groundwater depletion.

The Land Division Act requires subdivisions of parcels to be at least 1 acre in size (MCL § 560.109). New well-dependent residential developments with parcels of this size can strain groundwater resources. For example, a 20-acre parcel of farmland could be split into 20, 1-acre residential lots each withdrawing at 10 gallons per minute. A single non-residential user seeking to withdraw an equivalent cumulative amount for the same 20-acre lot would be required to register through the WWAT and may not receive authorization for the full withdrawal amount.[18]

While public water suppliers are required to create 5-year and 20-year water demand projections for planning, there is no such requirement to ensure future availability of groundwater sources (Michigan Administrative Code R 325.11203).[19]

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[16] Mechlem, K. "Groundwater Governance: The Role of Legal Frameworks at the Local and National Level—Established Practice and Emerging Trends," *Water*, 8(8), 347. (2016). DOI: 10.3390/w8080347.

[17] MI DEQ. "Michigan's Well Water Manual," *Michigan Department of Environmental Quality Drinking Water & Municipal Assistance Division Environmental Health Section Source Water Unit Well Construction Program*. (2019). https://www.michigan.gov/documents/deq/Water_Well_Manual_2013_437334_7.pdf.

[18] Personal Interview, local government representative. (2022a)

[19] Personal Interview, local government representative. (2022c)

Without advanced planning, public water suppliers in the area may not be prepared to accommodate additional municipal water demand from rural townships with diminishing groundwater resources, like those in the central portion of Ottawa County.

Mismatched incentives at the local level and state level can also exacerbate burdens on groundwater resources. The state's required Open Space Development ordinance can incentivize housing density in the same areas where local ordinances attempt to disincentivize development by prohibiting municipal water lines. In Jamestown Township in Ottawa County, a situation like this occurred between 2020 and 2021 which resulted in a new well-dependent residential development.[20] This highlights how land use regulations do not safeguard against unsustainable groundwater use and can even inhibit attempts to limit aquifer drawdown.

While counties could play an important role in managing cross-jurisdictional aquifers, current policies place counties in a position where they must 'lead from behind' when seeking to influence groundwater-related decisions at either the state or the local level. Rather than providing formal avenues for collaboration among levels of government, the allocation of authorities suggests that levels of government can operate somewhat independently even as groundwater quality and quantity depend on the combination of decisions made under these authorities.

Working Toward Policy Solutions in Michigan

Drawing again on our review and interviews, we identify several policy solutions that can address the identified gaps. We propose three key initiatives for state, county, and local governments to foster sustainable groundwater management amid population growth and climate change: 1) groundwater management planning, 2) coordinated land use planning, and 3) education and outreach. While these changes can be implemented within the existing policy landscape, legislative support may be necessary for their full effectiveness. The subsequent section highlights the state's required improvements in hydrogeologic data collection to facilitate statewide implementation of these suggested policy solutions, which emerged as crucial during interviews.

1. Groundwater Management Planning

Groundwater Management Plans (GWMPs) are a potential solution to address the challenges of groundwater drawdown and overallocation. Gage and Milman (2021) analyzed the use of GWMPs in 12 of the 13 states whose regulatory structures include GWMPs.[21] Their study suggests that the process of developing the GWMPs requires collaboration among disparate parties that may build the political and social support necessary for management success. The process of writing a GWMP, and its implementation, can open lines of communication and provide a venue for

[20] Personal Interview, local government representative. (2022c); Personal Interview, local government representative. (2022a)

[21] Gage, A., & Milman, A. "Groundwater Plans in the United States: Regulatory Frameworks and Management Goals," *Groundwater*, 59(2), 175–89. (2021). https://doi.org/10.1111/gwat.13050

facilitating agreements.[22] The GWMP approach has the benefit of focusing on a particular groundwater resource whether a glacial aquifer within a watershed or a single confined aquifer. This allows the plan to be tailored to the specific hydrogeologic conditions of and water user demands on the groundwater resource. Interviewees discussed how the wide range of geologic features and water user demands across the state can make statewide regulations unresponsive to the needs and concerns of individual regions.[23] GWMPs could allow for greater flexibility and increased local stakeholder involvement in management decisions.

Ottawa County serves as a convenient venue for coordinating sustainable use of bedrock aquifer water in that area. The combination of groundwater discharge into the Grand and Macatawa Rivers running through the northern and southern portion of the county, respectively, and the aquifers' low transmissivity indicate that land use changes to bedrock aquifer recharge areas outside the county are less likely to impact water quantity within the county.[24] Ottawa County's Groundwater Sustainability Initiative is developing a GWMP.[25] The county has already identified several solutions currently available to county governments across the state in its Groundwater Sustainability Initiative Proactive Strategies Index (2019). These solutions range from providing training for landscape professionals and homebuilders to instituting rebate programs for water efficient appliances and fixtures. Ottawa County's Proactive Strategies Index (2019) can serve as a blueprint for actions, but limitations persist on regulatory authority and incentivizing behavioral change.

The success of GWMPs may hinge on the governing entity chosen for groundwater planning. County governments, regional planning commissions, watershed councils, and Water User Committees under Part 327 are potential entities for GWMPs. Cross-jurisdictional planning may be necessary, requiring collaboration between multiple counties and local units of government. There is precedence for this kind of collaboration in legislatively authorized regional planning commissions and watershed councils (MCL 324 § 324.312).[26] Yet, there may be jurisdictions that do not take advantage of these venues and their use in groundwater management is untested.

Water User Committees, while having potential benefits, are unlikely to serve as effective venues for groundwater management planning. Their voluntary nature, legislative constraints, focus on

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[22] Escobedo Garcia, N., & Ulibarri, N. "Plan Writing as a Policy Tool: Instrumental, Conceptual, and Tactical Uses of Water Management Plans in California," *Journal of Environmental Studies and Sciences*. (2022). https://doi.org/10.1007/s13412-022- 00754-0; Gage & Milman. "Groundwater Plans in the United States."

[23] Personal Interview, academic. (2022b); Personal Interview, local government representative. (2022d)

[24] MSU IWR. "Ottawa County Water Resource Study."

[25] Ottawa County Planning and Performance Improvement Department. "Ottawa County Groundwater Sustainability Initiative: Proactive Strategies Index," *Ottawa County, Michigan*. (2019). https://miottawa.org/GroundWater/strategy.htm

[26] Water Use Advisory Council. "Final Report of the Water Use Advisory Council," *State of Michigan*. (2014). https://www.michigan.gov/-/media/Project/Websites/egle/Documents/Reports/WRD/2014-Water-Use-Advisory Council-final.pdf

large-quantity withdrawals, and unproven track record raise doubts about their ability to address drawdown concerns effectively (MCL § 324.32725).[27] The Water User Advisory Council has a working group on Water Users Committees that is developing a Water User Committee Manual and seeks to pilot a Water Users Committee to inform the manual's developments.[28] There is opportunity for including language and guidance around confined aquifer drawdown, but at present, there is not enough evidence to discuss the utility of WUCs in addressing water conflicts.

Kraff and Steinman (2018) propose that Michigan manage surface and groundwater systems through Integrated Watershed Commissions (IWCs) with boundaries based on watersheds.[29] They provide an 'unconstrained' option requiring significant legislative changes and a 'constrained' option that would work within the current regulatory framework. Under the 'constrained' version, IWCs would be composed of local and tribal government representatives tasked with organizing stakeholders around desired objectives for the watershed and underlying groundwater systems, planning and implementing science-based integrated water management strategies, and taking on fiduciary responsibilities for externally financed activities. IWCs would be another venue under which groundwater management planning could take place. The proposal also lays out several interim steps the state could take to facilitate the adoption of IWCs including increased cross-agency coordination on hydrological data management and coordinating a pilot program.

As the Ottawa County case has shown, multi-stakeholder engagement efforts without authority to manage, and limit, both large-quantity and residential withdrawals are also likely to run into barriers in enforcement. California's Sustainable Groundwater Management Act may offer a few lessons. Under this California law, local Groundwater Sustainability Agencies are established in 'special permitting areas' which are recognized as particularly vulnerable. These agencies have the flexibility to tailor their permitting regimes to local conditions. Notably, the provisions in this act appear to supersede California common law regarding water allocation.[30] For any existing entity in Michigan to manage large and small quantity withdrawals, there would need to be legislative changes including closing the judicial system workaround for property owners and removing the exemption for residential wells, both of which Part 327 explicitly maintains. These changes would conflict with the reasonable use and riparian rights doctrines underpinning Michigan water law and likely provoke a negative response from key stakeholder groups in favor of these

[27] Water Use Advisory Council. "Michigan Water Use Advisory Council 2020 Report," *State of Michigan*. (2020). https://www.michigan.gov/documents/egle/egle-wrd-wateruseWUAC_2020_council_report_711968_7.pdf; Water Use Advisory Council. "Final Report of the Water Use Advisory Council."; Personal Interview, local government representative. (2022d)

[28] Water Use Advisory Council. "Michigan Water Use Advisory Council 2020 Report."; Personal Interview, local government representative. (2022d)

[29] Kraff, D., & Steinman, A. D. "Integrated Watershed Management in Michigan: Challenges and Proposed Solutions," *Journal of Great Lakes Research*, 44(1), 197–207. (2018).

[30] Nelson, R. L., & Perrone, D. "Local Groundwater Withdrawal Permitting Laws in the South-Western U.S.: California in Comparative Context," *Groundwater*, 54(6), 747–53. (2016). DOI: 10.1111/gwat.12469.

carve-outs.

Funding remains a critical factor, as demonstrated by Ottawa County's reliance on state grants.[31] Legislative action or tapping into existing state funding sources, like the Clean Water State Revolving Fund or Source Water Protection grants, could allocate resources for GWMPs and foster collaborative planning efforts across regions. Addressing drawdown concerns requires not only legislative support but also sustained financial backing for effective groundwater management planning initiatives.

2. *Coordinated land use planning among local units of government*

Under the current regulatory framework, local units can enhance groundwater sustainability through coordinated land use decisions. Counties and the state can facilitate coordination by providing information, staff time, or resources. Local units of government, with their role in land use planning and zoning, can slow well-dependent residential growth and alleviate aquifer pressures. Ottawa County's centrally located townships employ different approaches. Allendale Township required new subdivisions to connect to municipal.[32] Olive Township mandates public water for properties split more than five times.[33] Both counties placed moratoriums on new developments during the process of changing ordinances.[34] As of 2022, Robinson Township's draft Master Plan referenced aligning its activities with Ottawa County's Groundwater Sustainability Initiative.[35]

As demonstrated by the county's initiative, continued dialogue can build trust between township and county officials and facilitate further coordination around limiting pressures on an aquifer and promoting recharge.[36]

Under Michigan Administrative Code R 560.426, counties can require on-site water supply wells before construction on parcels less than an acre, as seen in Washtenaw County's 'well-first' program.[37] This kind of a program necessitates conversation between township staff permitting development and county health departments permitting wells, which could support better

[31] Personal Interview, local government representative. (2022c.)

[32] Personal Interview, local government representative. (2022e); Allendale Township Board of Trustees. "Charter Township of Allendale Water System Ordinance," *Allendale Township, Michigan*. (2020). https://www.allendale-twp.org/documents/1069-2020-7-water-system-ordinance-amendment/file

[33] Personal Correspondence, local government representative. (June 13, 2022).

[34] Personal Interview, local government representative. (2022e); Olive Township Board of Trustees. "Compiled 2019 Olive Township Board Meeting Minutes," *Ottawa County, Michigan*. (2019). https://www.olivetownship.com/wp-content/uploads/2019/12/Compiled Minutes-2019.pdf

[35] Ransford, G. "Memorandum Re: Revisions to Chapter Five and Chapter Six, Newly Drafted Chapter Seven, Eight, and Nine," *Letter to Robinson Township Planning Commission*. (2022). https://www.freshcoastplanning.com/_files/ugd/e5bc18_18b9e4ada4184b4cbe15fe0c64 6b562e.pdf

[36] Personal Interview, local government representative. (2022a); Personal Interview, private sector representative. (2022a); Personal Interview, local government representative. (2022f)

[37] MI DEQ. "Michigan's Well Water Manual."

coordination and build working relationships.[38] There may also be an opportunity to change the state's administrative code to extend well-first programs to larger parcels in counties facing groundwater concerns.

However, curbing new well-dependent subdivisions is both politically challenging and may not be sufficient to prevent drawdown. Township supervisors may experience pushback from developers seeking to avoid the costs of adding municipal water lines or from landowners hoping to sell their land to developers.[39] Municipal water may not be an option for some current residents due to distance or cost.[40] Municipal water hookups may not be a viable option for irrigation water use either due to location or cost.[41] This necessitates consideration of both supply and demand sides of the water balance equation.

Local land use decisions impact aquifer recharge rates. Conservation efforts among county and township planners could focus on stormwater management improvements, reducing impervious surfaces, and enhancing infiltration.[42] Collaborative efforts among township supervisors, county planners, and drain commissioners may also address recharge areas outside a jurisdiction.[43] Future research could explore payment models where a jurisdiction compensates another for preserving areas that recharge aquifers underlying the first jurisdiction. This could be done through Purchase of Development Rights programs authorized under the Michigan Zoning Enabling Act (MCL § 125.3507-09).

Research suggests that losses from urban growth can be compensated with new sources of recharge, but effects vary based on land use, geology, and human behaviors.[44] For example, the geology in Ottawa County largely prevents new sources of recharge, like lawn watering, from replenishing the bedrock aquifer even as new urban growth-related demands place stresses on that aquifer. This, once again, demonstrates the need for detailed hydrogeologic data and local-level groundwater models in order to understand water balances in a region. These data can then be used to guide land use planning across jurisdictions overlaying the relevant aquifer as has begun in Ottawa County.

3. Groundwater Management Planning

Effective collaboration and use of hydrogeologic

[38] Personal Interview, state agency representative. (2022b); Personal Interview, local government representative. (2022b.)

[39] Personal Interview, local government representative. (2022b)

[40] Personal Interview, local government representative. (2022d); Personal Interview, local government representative. (2022g)

[41] Personal Interview, local government representative. (2022f)

[42] Howard, K., & Gerber, R. "Impacts of Urban Areas and Urban Growth on Groundwater in the Great Lakes Basin of North America," *Journal of Great Lakes Research*, 44(1), 1–13. (2018). https://doi.org/10.1016/j.jglr.2017.11.012

[43] Personal Interview, local government representative. (2022c); Personal Interview, local government representative. (2022h)

[44] Howard & Gerber. "Impacts of Urban Areas."

data by local units demands adequate knowledge among local-level staff and officials. Outreach and education, led by the state and counties, are essential. Local health departments, township supervisors, and planning commissions need the skills to integrate hydrogeologic data into their workflows. Equipping decision-makers enables proactive modeling of water supply challenges and the implementation of preventive strategies. State-level outreach programs, like MSU's Water School and other Michigan Sea Grant Extension resources, have begun this work.[45] Prior to the COVID-19 pandemic, the state held regular training workshops for local health department staff on wells and hydrogeology.[46] Additional training for well drillers and county health departments, as recommended in the Water Use Advisory Council 2020 Biennial Report, enhances data accuracy, and fosters collaborative problem-solving.[47] Mediation services may be crucial for conflict resolution in scenarios like Water Users Committee negotiations or resident discussions on municipal water extension payments.[48] There are opportunities for engaging Michigan Sea Grant in both technical assistance and mediation service provision.[49]

Once again, Ottawa County's efforts can provide guidance to other jurisdictions on how to engage key stakeholders and residents at the county level. Ottawa County's Groundwater Sustainability Initiative actively engages the public through various channels, emphasizing the importance of broader outreach, although public awareness alone may not suffice to address water conservation challenges.[50] While this outreach has precipitated communication and collaboration with townships and community organizations in the case of Ottawa County, broader evidence is mixed on the impacts of public raising awareness as a mechanism for addressing water conservation challenges.[51] Public education, at the state or county level, is only one of several tools governments might employ. Outreach and education may also be expensive for county governments, necessitating state-level support such as the Michigan enhancement grant Ottawa County received as part of the 2021 Michigan State Omnibus Appropriation Bill PA 87.

Improving Hydrogeologic Data Statewide

The policy solutions suggested above require that

[45] Personal Interview, academic. (2022a)

[46] Personal Interview, state agency representative. (2022b)

[47] Water Use Advisory Council. "Final Report of the Water Use Advisory Council."; Personal Interview, private sector representative. (2022c); Personal Interview, academic. (2022b)

[48] Personal Interview, state agency representative. (2022b)

[49] Water Use Advisory Council. "Final Report of the Water Use Advisory Council."; Personal Interview, academic. (2022a)

[50] Personal Interview, academic. (2022a); Personal Interview, private sector representative. (2022a); Ottawa County Planning and Performance Improvement Department. "Ottawa County Groundwater Sustainability Initiative."

[51] Mansur, E., & Olmstead, S. M. "Use Prices to Conserve Water When Supplies Are Scarce," *Resources for the Future*. (2011). https://www.resources.org/common-resources/use-prices-to-conserve-water-when-supplies-are-scarce/; Mansur, E., & Olmstead, S. M. "The Value of Scarce Water: Measuring the Inefficiency of Municipal Regulations," *Journal of Urban Economics* 71 (3): 332–46. (2012). https://doi.org/10.1016/j.jue.2011.11.003

state, county, and local units of government have an advanced understanding of the hydrogeologic conditions and groundwater resources within their jurisdictions. This will not be possible without improving the quality and quantity of hydrogeologic data statewide. As advocates and researchers have discussed, Michigan lacks organized and detailed hydrologic data at the resolution needed to make decisions regarding sustainable groundwater use.[52] Acquiring these data will enable the state and county governments to develop more sophisticated, local-level hydrogeologic models.

Local-level groundwater models would improve Michigan's groundwater management in several ways. Determining sustainable use of a groundwater resource goes beyond establishing static thresholds of safe or sustainable yield.[53] Rather, granular groundwater models could allow decision-makers to incorporate changing hydrogeologic and land use data which would allow the model to more accurately project both future water levels and water availability in semi- or completely- confined aquifers, as well as adverse resource impacts to streams. Use of local models could also contribute to enhanced county-state data sharing and collaboration. This could have spillover effects on addressing water quality concerns and impacts to residential wells that the model used in the current Water Withdrawal Assessment Tool cannot. Developing these local models would enable counties and townships to create dynamic water budgets that respond to changing hydrological conditions. For example, they could model water use scenarios like construction of new well-dependent residential developments to predict long-term impacts on groundwater resources. This in turn could enable greater collaboration with developers and well drillers regarding where well-dependent residences are viable.[54] These models could develop 5-year and 20-year groundwater supply projections that complement the required 5-year and 20-year public water supply plans. Finally, as discussed above, local-level models can provide detailed information on recharge areas which will allow local units of government to make targeted and efficient zoning decisions that promote recharge.

Past funding allocations have proven insufficient, and ongoing structures lack the resources needed for regular hydrogeologic studies at the necessary scale. When the Michigan legislature passed Part 327 in 2008, it recognized the need for improved hydrogeologic data to populate the Water Use Program's key decision-making tool, the Water Withdrawal Assessment Tool (WWAT), and permitted technical modifications to the tool under certain circumstances (MCL § 324.32706a(6)). Data collection authorized and funded in 2003 remain key inputs to the WWAT despite concerns that the lack of granularity hampers the tool's

[52] Steinman et al. "Groundwater in Crisis? Addressing Groundwater Challenges in Michigan (USA) as a Template for the Great Lakes," *Sustainability* 14 (5): 3008. (2022). DOI: 10.3390/su14053008

[53] Groundwater Conservation Advisory Council. (2006).

[54] Personal Interview, private sector representative. (2022b); Personal Interview, private sector representative. (2022c)

purpose.[55] Changing hydrological conditions perpetuated by climate change and uneven growth make more regular updates to data inputs even more critical.[56]

While the passage of PA 53 by Michigan's legislature in 2020 injected $10 million for targeted initiatives, it falls short of sustained funding for data collection and model creation. Legislative restrictions in Part 327 on additional water withdrawal fees impede ongoing funding. Integrating existing data into decision-making tools, as recommended in the Water Use Advisory Council's 2020 report, offers a temporary solution. The creation of the Michigan Integrated Water Management Database by EGLE is a positive step. Yet, challenges persist in Ottawa County, revealing that data alone cannot resolve issues without addressing distribution of authorities. Local models under the Michigan Hydrologic Framework may guide adjustments to rules and criteria for water quantity, allowing for more effective and sustainable groundwater use.

Areas for Additional Research

The policy gaps and potential solutions identified above illuminate the need for additional research on several fronts. First, the policies reviewed as part of this report do not represent all relevant policy or case law related to groundwater management in Michigan or beyond. A more in-depth review by legal scholars could identify creative avenues for leveraging existing structures to provide state, county, and local decision-makers with the kind of legal backing they may need to enforce changes that could lead to more sustainable groundwater use. This could include a more in-depth analysis of tools available such as wellhead protection programs, nonpoint source pollution prevention and control grants, and the purchase of land or rights in land to protect aquifer recharge areas (MCL § 324.8802). Alternatively, a review of groundwater management structures in other Great Lakes basin states, including funding mechanisms for hydrogeologic data collection, could inform and support a basin-wide approach for groundwater management. This would be especially useful in light of recent efforts to compile a surface-groundwater model for the Great Lakes Basin.[57] It could also be useful to explore how groundwater governance, water conservation, water recycling, and managed aquifer recharge policies and programs from as far afield as California or Arizona, states known for both water scarcity and innovation in water governance,

[55] Water Use Advisory Council. "Final Report of the Water Use Advisory Council."; Personal Interview, academic. (2022a); Personal Interview, academic. (2022b)

[56] Luetkemeier, R., Söller, L., & Frick-Trzebitzky, F. "Anthropogenic Pressures on Groundwater," In *Encyclopedia of Inland Waters*, 548–59. Elsevier. (2022). DOI: 10.1016/B978-0-12-819166-8.00183-3; Costa et al. "Impacts of Climate Change on Groundwater in the Great Lakes Basin."; Taylor et al. "Ground Water and Climate Change."

[57] Great Lakes Science Advisory Board and Research Coordination Committee. "Great Lakes Surface and Groundwater Model Integration Review," *International Joint Commission*. (2018). https://ijc.org/sites/default/files/2019-01/Great_Lakes_Surface_and_Groundwater_Model_Integration_Review_Oct2018.pdf; Great Lakes Science Advisory Board Research Coordination Committee. "Development of a Great Lakes Groundwater and Surface Water Conceptual Framework," *International Joint Commission*. (2022). https://ijc.org/sites/default/files/SAB

might apply in the Great Lakes context.[58]

Second, for the state to best target educational and outreach activities to local government leaders, the state may need additional information on local capabilities. These capabilities include hydrogeologic knowledge, geographic information systems expertise, current water supply monitoring systems, as well as the sources of funding available to local units for developing these capabilities and the status of local unit cooperation on land use decisions. This information would allow the state to identify regions most at risk of unsustainable groundwater use due to hydrogeologic conditions and growth in well-dependent residential developments, as well as regions least equipped to deal with the kind of water supply concerns facing Ottawa County. This information could also guide revisions to funding criteria and outreach for water-related grant programs, like the Source Water Protection Fund, Freshwater Protection Fund, Safe Drinking Water State Revolving Fund and Clean Water State Revolving Fund, so that they target remedial or preventative measures aimed at groundwater depletion or even support communities in developing groundwater models.

Coordinated groundwater management planning and land use planning require cooperation and negotiation from water users, property owners, businesses, and other entities. Each of these stakeholder groups will have their own political agenda. The groups are also likely to have varying access to political resources for influencing policymakers. Public opinion and conception of groundwater may also impact the feasibility of addressing policy gaps through coordinated planning. A study describing the political landscape could identify and help to address potential political obstacles to coordinated government action like groundwater management planning or collaboration on land use decisions.

Finally, counties and other local government units may seek to address drawdown concerns through managed aquifer recharge.[59] As discussed earlier, Ottawa County simultaneously experiences problems of managing surface water runoff from heavy precipitation events alongside groundwater availability concerns. More water scarce regions, like Arizona, have invested heavily in developing managed aquifer recharge and water banking programs.[60] These can range from installing infiltration basins in areas of high recharge for collecting precipitation to aquifer storage and recovery systems that inject freshwater directly into an aquifer.[61] There is a dearth of both scientific and policy research on managed aquifer recharge applications in Michigan. More studies are needed to determine which managed aquifer recharge options could play a role in addressing

[58] Eden et al. "Opening the Black Box: Using a Hydrological Model to Link Stakeholder Engagement with Groundwater Management," *Water*, 8(5), 216. (2016). https://doi.org/10.3390/w8050216; Nelson, R. L., & Perrone, D. "Local Groundwater Withdrawal Permitting Laws in the South-Western U.S.: California in Comparative Context," *Groundwater*, 54(6), 747–53. (2016). DOI: 10.1111/gwat.12469

[59] Personal Interview, local government representative. (2022f)

[60] Megdal, S., & Dillon, P. "Policy and Economics of Managed Aquifer Recharge and Water Banking," *Water*, 7(12), 592–98. (2015). DOI: 10.3390/w7020592

[61] Alam et al. "Managed Aquifer Recharge Implementation Criteria to Achieve Water Sustainability," *Science of The Total Environment*, 768. (2021). https://doi.org/10.1016/j.scitotenv.2021.144992

Michigan's groundwater sustainability concerns. Should the science support use of these programs, a more in-depth exploration of the options available to county and local governments under the current regulatory framework could open up new policy solutions. This could include greater exploration of the Groundwater Discharge Permitting program at the state level and authorities afforded under the Michigan Drain Code and federal Clean Water Act.

Conclusion

Michigan's groundwater regulatory framework faces three key policy gaps that hinder effective management of residential groundwater withdrawals. Firstly, there is no central authority governing groundwater sustainability. Secondly, the 'de minimus' approach exempts residential well users from withdrawal regulations. Lastly, existing land use regulations offer limited protection against threats to long-term groundwater sustainability.

Feasible solutions within the current legislative context include the collaborative exploration of Groundwater Management Plans for vulnerable areas like Ottawa County and engaging in coordinated land use planning at the state and county levels. Education and outreach initiatives can enhance communication between stakeholders and across jurisdictions. However, effective implementation requires substantial investment in collecting and maintaining high-resolution hydrogeologic data and supporting sophisticated local-level groundwater models.

Given Michigan's reliance on groundwater, effective management is crucial, especially in the face of impacts from climate change and uneven population growth. Our findings emphasize the urgency for coordinated decision-making and increased investment in rigorous data to address policy gaps and ensure long-term, sustainable groundwater use.

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Transforming How We Fund Public Educational Infrastructure: An Innovative Proposal to Complement Social Security Reform

Stephen Callaway[†]

Abstract

The Social Security trust fund program's unfunded liability was estimated to be over $12 trillion in 2017. In response, there have been various proposals to reform Social Security involving some combination of tax increases, benefit cuts, or partial privatization. However, to protect retirement, I suggest raising the national savings rate, thus increasing our capital stock. Raising the national savings rate should lead to greater productivity and vibrant economic growth in the coming decades. As such, our national retirement system needs a new dimension – private claims on public infrastructure, specifically human capital infrastructure. Public education institutions could underwrite income share agreements with their graduates – the ultimate performance-based system; current workers can invest in those institutions through payroll deduction, and the employers of their graduates pay back the return through retirement savings accounts.

Social Security and Retirement

Social Security is an essential federal program in the U.S. established in 1935 to provide retirement benefits and disability income to those qualified. However, it is important to note that Social Security was not designed to be an individual's only retirement source. A common metaphor for retirement planning is the three-legged stool. The three legs represent an employer pension, individual savings, and a nationalized pension (i.e., Social Security). You need each leg to build a strong retirement foundation. If one leg is weakened, this three-legged stool will not stand.[1] Unfortunately, Social Security is not fully funded, jeopardizing the retirement prospects for millions of Americans. To protect our retirement security, I recommend a plan to raise the national savings rate, increasing our capital stock, which should lead to higher productivity in the future, ensuring vibrant economic growth. This could be done by adding a fourth leg to the retirement stool: private claims on public infrastructure. Adding this leg should offer greater retirement security going

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[1] Phipps, M. "The 3-Legged Stool of Retirement Planning," *The Balance*. (2021)

forward.

In 2017, the Social Security trust fund program's unfunded liability over the next 75 years was estimated to be over $12 trillion.[2] This estimation means that funding has not kept pace with promises. There have been various proposals to reform Social Security. In his second term, President George W. Bush proposed fundamental Social Security reform as a top priority, suggesting that the Social Security System could not be sustained unless individuals were allowed to invest part of their payroll tax themselves. He declared that "We should trust Americans by giving them the option of investing part of their Social Security contributions in private accounts."[3] However, a policy like this merely transfers resources from one leg to another, from the nationalized pension to individual savings, making the overall retirement stool even more unstable. This proposal was a non-starter. However, we already use public funds to subsidize retirement accounts in the private sector. With substantial private investments, the Roth IRA, the Traditional IRA, and 401Ks offer tax deductions. However, prioritizing the fourth leg – private claims on public infrastructure – is critical in the modern economy.

Hacker and Pierson (2016) state that public investments in science and technology have led to breakthroughs in medicine, transportation, and technology. Central to that was the dramatic expansion of public education, which not only increased individual opportunity but also the economic potential of entire societies. [4] Private investment generates new technologies and industries, creating something uniquely valuable. Yet they couldn't have done it without considerable investments in knowledge from the government, which is embodied in science, technology, and the skilled workforce.[5] One of the most essential things a government can do is educate its citizens.[6] A nation's economic growth derives from the increased productivity of its citizens. The ideas and innovations that expand the productivity of the people rely on widespread public education, seed scientific advances, and equip workers with new skills.[7] Indeed, many economists have concluded that about one-third of productivity increases are directly related to expanded education.[8]

While public infrastructure is essential for long-term economic growth, this paper focuses solely on one specific kind of public infrastructure – human capital investments. This Social Security reform must not crowd-out funding for the other legs. This plan must raise the national savings

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[2] "Social Security and Medicare Are In Worse Shape Than You Think," *Investors Business Daily*. (2017)

[3] Galston, W. "Why the 2005 Social Security Initiative Failed, and What it Means for the Future," *Brookings Institute*. (2007)

[4] Hacker, J. & Pierson, P. "Making America Great Again: The Case for the Mixed Economy," *Foreign Affairs*. (2016)

[5] Hacker & Pierson. "Making America Great Again."

[6] Hacker & Pierson. "Making America Great Again."

[7] Hacker & Pierson. "Making America Great Again."

[8] Hacker & Pierson. "Making America Great Again."

rate, hence only crowd-out consumption, not private investment, other public investment, or funding the current Social Security pension. However, simply investing more in public education is not sufficient. Rather, it is essential to invest only in specific educational initiatives that will create the most economic value in the long term and ensure that those initiatives are efficiently managed.

Public educational infrastructure

While physical infrastructure is the traditional focus of national infrastructure priorities, human capital investments (e.g., education) may be far more critical for the economy in the 21st century, having implications for overall economic growth and equity issues regarding disparities in wealth generation. Philosopher John Rawls argued that a just society requires that individuals possess productive means, not just financial and physical capital, but human capital as well, including knowledge and an "understanding of institutions, educated abilities, and trained skills."[9] Therefore, a dynamic and just economy needs a well-developed public K-12 and higher education system.

Historically, the US has had precisely that. Nonetheless, a downward trend in student test scores and recent debates about the value of a college degree are concerning. There is also substantial debate about how much funding should go into public education and what we get from that investment. Perpetual disparities in funding between higher education institutions, families, and public school districts are a consistent source of contention. Another critical question is whether this funding is allocated to functions that will create the most economic value. We need a national funding system that directs investments increasingly toward marginalized students and school districts, but with the expectation and demand that this investment make a difference by improving the fortunes of those most economically disadvantaged in a long-term sustainable way.

Consistent funding for public education is a necessity. Thus, investments in public education can be connected directly to payroll withholding of the Social Security system. Public education institutions could underwrite income share agreements with their graduates, with current workers investing in those institutions through payroll deduction. Employers of their graduates can then pay back the return through retirement savings accounts.[10]

Higher Education Funding and Accountability

College costs are skyrocketing in America today. The total amount of student debt outstanding in the United States currently is over $1.7 trillion, and 43 million student borrowers hold an average

[9] Rawls, J. "Justice as Fairness: A Restatement," Cambridge: Harvard University Press. (2001); Tong, Z. "Rawlsian Property-Owning Democracy: An American Historical Interpretation," *American Political Thought: A Journal of Ideas, Institutions, and Culture* vol. 4. (2015)

[10] Callaway, S. "Performance-Based Crowdfunding of Public Higher Education: A Populist Proposal," Chacko Chennattuserry, J., Deshpande, M., Hong, P. (eds) *Encyclopedia of New Populism and Responses in the 21st Century*. (2023)

of $39,351 in debt, accounting for inflation.[11] Moreover, an average of 7% of student loans are in default at any given time.[12] Higher education in America has struggled to remain affordable. Since 1997, tuition costs have nearly tripled in the United States.[13] These prices result in many students, especially those most economically disadvantaged, having limited access to higher education. Even those with access to higher education struggle to pay off student debt and may delay marriage, home purchases, and other life choices.[14] A major policy debate today revolves around student loan forgiveness. However, this policy merely transfers the problem. It does not address and solve the root causes of the problem. The root causes are the overall cost of college, completion rates, institutional quality, and the value of a degree.[15]

In response to the college accessibility crisis, various philosophical approaches have addressed the high cost of college. One option is to have "free" taxpayer-funded college, which builds on the idea of free or low-cost community college being critical for equality and access and driving economic growth overall.[16] A second option is for universities to be more accountable to the 'students as customers' model, requiring a greater percentage of the universities' budget to be funded privately through tuition. This option forces universities to address their cost structures and only make investments that create the most value.

A third option is state-directed performance-based funding. Performance management emphasizes adaptability as important for improving public sector performance.[17] Performance management reforms seek to create incentives and sanctions for public sector managers to foster a more results-oriented and entrepreneurial environment. While managers do face more pressure to achieve results, they also typically enjoy greater autonomy over their own work processes.[18] In exchange for a greater focus on outcome controls,

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[11] Hanson, M. "Average Student Loan Debt by Year," (2021a). https://educationdata.org/average-student-loan-debt-by-year

[12] Hanson, M. "Student Loan Default Rate," (2021b). https://educationdata.org/student-loan-default-rate

[13] Phillips, C. "Student Debt Mounts to Scary Levels, But America Just Shrugs," *Investors Business Daily*. (2018)

[14] Baum S., Saunders D. "Life After Debt: Results of the National Student Loan Survey: Selected Text from the Final Report," *Journal of Student Financial Aid* vol. 28 (3) pages 7–23. (1998)

[15] Phillips, C. "Student Debt Mounts to Scary Levels, But America Just Shrugs," *Investors Business Daily*. (2018); Cellini, S. & Nicholas Turner, N. "Gainfully Employed?: Assessing the Employment and Earnings of For-Profit College Students Using Administrative Data," *Journal of Human Resources* vol. 54 (2) (2019): 342-370.; Kim, D. "The Effect of Loans on Students' Degree Attainment: Differences by Student and Institutional Characteristics," *Harvard Educational Review* 77 (2007): 64–100.; Loonin, D. & Morgan, J. "Aiming Higher: Looking Beyond Completion to Restore the Promise of Higher Education," *Journal of Law & Education* vol. 48 (4) (2019): 423-486.; Sawhill, I. & Goldrick-Rab, S. "Should Pell Grants Target the College-Ready?" *Education Next* vol. 14 (2) (2014): 58-64.

[16] Gilbert, C., & Heller, D. "Access, Equity, and Community Colleges: The Truman Commission and Federal Higher Education Policy from 1947 to 2011," *Journal of Higher Education* vol. 84 (3) (2013): 417–443.

[17] Moynihan, D. "The Dynamics of Performance Management: Constructing Information and Reform," *Washington, DC: Georgetown University Press*. (2008)

[18] Rabovsky, T. "Support for Performance-Based Funding: The Role of Political Ideology, Performance, and Dysfunctional Information Environments," *Public Administration Review* vol. 74 (6) (2014): 761-774.

these public sector organizations face fewer bureaucratic controls.

Moreover, besides improving internal processes, performance management also endeavors to assist external stakeholders in their oversight responsibilities. Performance management aims to strengthen oversight activities and expand information accessibility by providing stakeholders and decision-makers with critical information about organizational performance to improve the ability of these external actors to hold organizations accountable for achieving results.[19] Therefore, as these stakeholders have access to more objective performance data on the organization, one might expect political deliberations to become less ideological and partisan and policymaking to become more grounded in evidence-based arguments about what policies are most effective in achieving the outcomes that are socially desired.[20] This approach is increasingly emphasized in the case of public higher education, as policymakers are less inclined to take a hands-off approach and are increasingly demanding accountability for student learning outcomes and college spending.[21]

Unfortunately, in the case of higher education, there may be unintended consequences with state-directed performance-based funding and state appropriations. Performance-based funding may encourage colleges to focus on short-term, measurable learning gains at the expense of critical thinking or may incentivize colleges to invest less in at-risk students.[22] Nonetheless, there is no guarantee that spending more money on disadvantaged students will pay off in any measurable way for those students in the long term. Also, greater state appropriations (e.g., "free" college) may render colleges and students less accountable, as they would have less 'skin in the game.' For example, a higher education bill stipulated that colleges improve their students' financial aid options by assuming some of the risk of default in their students' federal loans – thereby requiring that these institutions have more "skin in the game".[23] A college funding system that incentivizes students, universities, and employers to make the wisest investments with an eye toward the future is needed. Perhaps the income share

[19] Thomas, V. "Restoring Government Integrity through Performance, Results, and Accountability," Forsythe, D (eds) "Quicker, Better, Cheaper? Managing Performance in American Government," *Rockefeller Institute Press* (2001): 113–142.

[20] Van de Walle, S., & Bovaird, T. "Making Better Use of Information to Drive Improvement in Local Public Services: A Report for the Audit Commission," *Birmingham, UK: School of Public Policy, University of Birmingham*. (2007); Rabovsky, T. "Support for Performance-Based Funding: The Role of Political Ideology, Performance, and Dysfunctional Information Environments," *Public Administration Review* vol. 74 (6) (2014): 761-774.

[21] Zumeta, W. "Public Policy and Accountability in Higher Education: Lessons from the Past and Present for the New Millennium," "The States and Public Higher Education Policy: Affordability, Access, and Accountability," Donald E. Heller (eds) (2001): 155–97 *Johns Hopkins University Press*.; Rabovsky, T. "Support for Performance-Based Funding: The Role of Political Ideology, Performance, and Dysfunctional Information Environments," *Public Administration Review* vol. 74 (6) (2014): 761-774.

[22] Li, A. "Lessons Learned: A Case Study of Performance Funding in Higher Education", *Third Way*. (2018). https://www.thirdway.org/report/lessons-learned-a-case-study-of-performance-funding-in-higher-education; McKinney, L. and Hagedorn, L. "Performance-Based Funding for Community Colleges: Are Colleges Disadvantaged by Serving the Most Disadvantaged Students?", *Journal of Higher Education* vol. 88 (2) (2017): 159–182.

[23] Thomason, A. "Colleges Would Have 'Skin in the Game' Under Democrats' Student-Debt Proposal," *The Chronicle of Higher Education*. (2013)

agreement is the ultimate performance-based system that is not short-sighted, looks to the future, and maximizes institutional accountability.

Income share agreements

Income share agreements (ISA) offer an innovative way to finance education. ISAs are financial instruments that offer financing for a college education. An investor provides a student with college funding. In exchange, the investor is promised a percentage of the student's future income for a set period after graduation. An ISA differs from a loan because there is no principal balance to repay. The student may end up paying more or less than the amount financed, depending on the level of economic success after school.[24] In this sense, ISAs seem more like equity financing than debt financing. Possible investors may include for-profit companies, not-for-profits, educational institutions, alumni groups, or governments.[25] Each university typically determines ISA payback rates and years, which may vary by college major. Majors with lower starting salaries may have higher payback rates and longer terms. Majors that fall into the Science, Technology, Engineering, and Mathematics (STEM) fields often will have higher starting salaries and, thus, have better payback terms.[26]

The benefits of ISAs include efficiently allocating education resources by focusing those resources toward future potential rather than past performance. Ideally, ISAs should fund all economically viable plans and be less risky for students, passing risks to whoever underwrites or funds the agreement. ISAs constitute the ultimate performance-based funding system.[27] A nearly identical concept is the income-contingent loan. The only difference is who gets caught holding the bag in the case of a failed investment. For the income-contingent loan, it may be taxpayers who had nothing to do with that higher education transaction who are seen as responsible for failed investments. In the case of the ISA, stakeholders – those who chose to be part of that investment, established a priori by whoever was willing to underwrite and fund the ISA – are deemed responsible.

So, how is the ISA superior to tuition? Private tuition reflects the "legacy problem." While past performance does not guarantee future results, the nature of tuition charges seems to exist under that premise. Legacy provides a college its reputation, which increases its attractiveness to potential students and offers universities a justification for charging high tuition. However, high tuition favors the past for students, their parents, and wealthy elites who have typically attended better-funded secondary schools and universities. Both

[24] Palacios, M., DeSorrento T., & Kelly, A. "Investing in Value, Sharing Risk. Financing Higher Education Through Income Share Agreements," *American Enterprise Institute Paper and Studies. Washington: American Enterprise Institute*. (2014)

[25] Palacios et al. "Investing in Value, Sharing Risk."

[26] Farrington, R. "Be Careful With Income Sharing Agreements (ISAs) To Pay For College," Forbes. (2019). https://www.forbes.com/sites/robertfarrington/2019/04/12/income-sharing-agreements-to-pay-for-college/?sh=6c2c9daa52e0

[27] Callaway, S. "Performance-Based Crowdfunding of Public Higher Education: A Populist Proposal," Chacko Chennattuserry, J., Deshpande, M., Hong, P. (eds) *Encyclopedia of New Populism and Responses in the 21st Century*. (2023)

situations reinforce the privileged access to resources for the wealthy. Financial aid and Pell Grants only mask this problem and fail to transform this structural bias. The current system rewards the past more than makes wise investments toward the future. Having taxpayers fund tuition charges does not solve this problem; it merely transfers it.

One concern with ISAs is that graduates are "indentured" to investors. Wealthy people possess substantial money and could benefit disproportionately from this system. Therefore, to address this, the best option is to have people crowdfund people. Specifically, current workers financially support students (i.e., future workers). Educational institutions would underwrite income share agreements with their graduates. Individual workers would direct their payroll withholdings – the original investment – into the public educational institutions of their choice. The return is based on job placement from these institutions, as employers would pay the ISA rate to the educational institutions, providing the return. Since the payback takes decades, this plan is best offered as a retirement system. It would create a national retirement system of private claims on public educational infrastructure.

Some ISAs are already in use. However, this proposal differs from current ISA programs in several ways. First, the employer pays back the investment rather than the graduate. Second, existing ISAs have a limited time horizon, typically about ten years.[28] This proposal could entail lifetime earnings, reducing the yearly payment. Third, this could be incorporated into the current Social Security system through a type of crowdfunding, so there is no "investor class" in this system. The way to combine this with Social Security, without raising the withholding rate, is to eliminate the withholding cap. This is necessary to fund both this system and the current pension. However, how much withholding goes into the private account should vary inversely with income level. Lower incomes pay mostly into private accounts, while higher incomes pay mostly into the nationalized pension. Fourth, educational institutions granting ISAs could become primarily funded this way. This system could create a 'tuitionless' model for many college students. However, a potential pilot launch might only replace Pell Grants and Stafford Loans.[29]

Local Government and K-12 Public Education Funding

This idea could also be extended to finance the entire K-12 public school system. The K-12 system needs reform, as many of the problems of higher education still apply – high but inconsistent funding (especially between rich and poor districts), low graduation rates at many schools, and declining achievement scores [the inconsistent funding & low graduation rates should also be cited]. For example, recent results from the National

[28] Palacios, M., DeSorrento T., & Kelly, A. "Investing in Value, Sharing Risk. Financing Higher Education Through Income Share Agreements," American Enterprise Institute Paper and Studies. *Washington: American Enterprise Institute*. (2014)

[29] Callaway, S. "Performance-Based Crowdfunding of Public Higher Education: A Populist Proposal," Chacko Chennattuserry, J., Deshpande, M., Hong, P. (eds) *Encyclopedia of New Populism and Responses in the 21st Century*. (2023)

Assessment of Educational Progress showed declines in student test scores across the United States in reading and math, with just 37% of high school seniors attaining the level of academic preparedness that would qualify them for entry-level college courses.[30] Therefore, each school district could underwrite ISAs with their graduates. Unfortunately, the challenge is that education's value or benefits are dispersed beyond those derived by the student or the student's family. As such, this K-12 public school financing system must be carefully designed. Explaining why that is the case and how this might be done requires an explanation of the public economics behind education.

Central to this debate is whether education is a public good. A public good is a good that demonstrates the characteristics of non-rivalry of consumption and non-excludability.[31] Non-rivalry of consumption indicates that if one person consumes (utilizes or enjoys) a good, the total value of that good is not reduced for others.[32] For example, roads may be considered public goods, as one individual driving on a road usually does not reduce its value for others, except in the case of congestion. Non-excludable goods refer to goods where one cannot exclude anyone from consuming these goods. Therefore, restricting access to the consumption of these goods is nearly impossible.[33]

However, a good may be rivalrous but not excludable (i.e., common pool resources), or it could be excludable but not rivalrous (i.e., club goods or local public goods). A common pool resource is a good, naturally occurring, or human-made. It is challenging to exclude potential beneficiaries from benefiting from its use, such as in the case of fisheries, forests, pastures, or clean air and water. These resources do face the problem of overuse.[34] On the other hand, public goods with benefits restricted to a specific group may be considered club goods, such as a members-only private park.[35] Co-operatives, associations, or local governments may provide them. Each new local member helps reduce the average cost of the club goods, so there will be an optimal size of the goods provision that maximizes the benefit for its members. The focus of management or local leaders is to determine the size of the club, with the most desirable cost and consumption sharing arrangement.[36] Therefore, the local school district could be viewed as providing a club good. Nevertheless,

[30] Camera, L. "Reading Scores Fall Among U.S. High School Seniors," *U.S. News and World Report*. (2020). https://www.usnews.com/news/education-news/articles/2020-10-28/reading-scores-fall-among-us-high-school-seniors

[31] Samuelson, P. "The Pure Theory of Public Expenditure," *Review of Economics and Statistics*, vol. 36 (4) (1954): 387–389.; Varian, Hal R. *Microeconomic Analysis* (3rd edition) New York, NY: Norton. (1992): 414.

[32] Samuelson, P. "The pure theory of public expenditure," *Review of Economics and Statistics*, vol. 36 (4) (1954): 387–389.

[33] Samuelson. "The pure theory of public expenditure."

[34] Ostrom, E., Gardner, R., & Walker, J. "Rules, Games, and Common-Pool Resources," *University of Michigan Press*. (1994)

[35] Buchanan, J. "An Economic Theory of Clubs," *Economica* vol. 32(125) (1965): 1-14.; Mankiw, N. G. *Principles of Microeconomics* (6th edition), Mason, OH: South-Western Cengage Learning (2012): 219.

[36] Buchanan, J. "An Economic Theory of Clubs," *Economica* vol. 32(125) (1965): 1-14.

even though the individual school district is relatively small in terms of population and geography, many of the benefits of human capital investments would be dispersed beyond the boundaries of that school district, still resulting in substantial under-investment. To solve this problem, a geographic cluster of school districts could cooperate around K-12 education and jointly underwrite ISAs.

The reason for this relates to the economic concept of externalities. Externalities occur when producing or consuming a good causes an impact on third parties not directly related to the transaction.[37] Externalities may be positive or negative. In the case of education, externalities are positive since the benefits of an educated individual are dispersed to other parts of the community. When addressing externalities, most economists reference private benefit (or cost) vs. social benefit (or cost), but that binary needs to be more complex because the magnitude of the externality can vary. They may impact third parties closer to the original economic transaction or activity more than those further. Imagine throwing a rock into a lake. The ripple effect is more noticeable closer to the source of the splash (signifying the economic transaction), with the waves (signifying the externalities) becoming smaller the further from the source.

Similarly, many externalities are most impactful in a local region. That is, regional externalities are a specific subset of externalities where space plays a dominant role.[38] For example, Moretti (2004) found that geographic regions with a higher concentration of college degrees experience economic spillover benefits or regional externalities.[39] Regional externalities may be considered club goods. Hence, by expanding the boundaries of a club, the social benefits become internalized in that club.

The Responsibility Center

The first critical issue for designing this national educational funding system would be establishing the size or boundary of the local area of responsibility. Essentially, this defines a *responsibility center* (RC). The RC is self-governed.[40] Responsibility center management (RCM) is the management process that reflects this budget model.[41] As such, the overall goals of RCM are to enhance revenues, control costs, and improve decision-

[37] Heijman, W. "Regional Externalities: an Introduction," Heijman, W. (eds) Regional Externalities. Springer, Berlin, Heidelberg. (2007). https://doi.org/10.1007/978-3-540-35484-0_1

[38] Heijman. "Regional Externalities: an Introduction."

[39] Moretti, Enrico. "Estimating the Social Return to Higher Education: Evidence from Longitudinal and Repeated Cross-Sectional Data," *Journal of Econometrics* vol. 121 (2004): 175–212.

[40] Nahum D. Melumad, Dilip Mookherjee, & S. Reichelstein. "A Theory of Responsibility Centers," *Journal of Accounting and Economics* December vol. 15 (4) (1992): 445-484.

[41] Hearn et al. "Incentives for Managed Growth: A Case Study of Incentives-Based Planning and Budgeting in a Large Public Research University," *Journal of Higher Education* vol. 77 (2) (2006): 286–316.; Jaquette, O., Kramer, D. A., & Curs, B. R. "Growing the Pie? The Effect of Responsibility Center Management on Tuition Revenue," *The Journal of Higher Education*, vol. 89 (5) (2018): 637–676.

making by lower-level managers.[42] The RC manages its revenue and expenses, indicating that it is neither a cost center that relies on external funding nor a revenue center that generates funds for the benefit of others. As such, it is responsible for and motivated to create more value and control its expenditures.

Clustering multiple similar school districts into a single RC is essential for internalizing geography-related externalities arising from formal education and job placement. One RC could be an entire metropolitan city – perhaps 3-4 counties. The goal is to internalize both production and consumption externalities associated with education. Externalities connected to education constitute spillover social effects that benefit others in society, and even future generations, and may include lower public health costs, lower crime, improved citizenship behavior, lower poverty, etc.[43] Production externalities might consist of the actions of teachers, administrators, involved parents, and students themselves, as they work hard to create educational value in schools, where there may be additional spillover benefits to others in the classroom, school, and neighborhood. Consumption externalities might include the actions of employers as they hire graduates from the local schools, where there may be spillover benefits beyond the hiring firm itself to other local firms, families, and the broader community. As a result, the local communities could work together to coordinate their education initiatives, perhaps establishing their own Common Core at a local level to internalize some production externalities. (The Common Core State Standards "provide clear and consistent learning goals to help prepare students for college, career, and life. The standards demonstrate what students are expected to learn at each grade level so that every parent and teacher can understand and support their learning.")[44] Moreover, many high schools may place graduates for hundreds of local employers – with overlapping geographic domains, which would help to internalize consumption externalities.

This regional system could be partially combined with higher education crowdfunding. Graduates from community colleges could easily be placed into these regions with a priority on local placements. The 4-year universities could participate in a separate public higher education financing sector, where you cannot regionalize the externalities. There could be two separate investment opportunities: 1) the regional RCs, which include public schools and community colleges, and 2) large national universities.

However, one critical point regarding the regional RCs is that externalities are not just geographic. Investments in public schools also affect crime and poverty, which affect local welfare and police spending, among other local governmental functions. Moreover, public libraries and museums

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[42] Curry, J. R., Laws, A. L., & Strauss, J. C. "Responsibility Center Management: A Guide to Balancing Academic Entrepreneurship with Fiscal Responsibility," *Washington, DC: National Association of College and University Business Officers*. (2013); Jaquette, O., Kramer, D. A., & Curs, B. R. "Growing the Pie? The Effect of Responsibility Center Management on Tuition Revenue," *The Journal of Higher Education*, vol. 89 (5) (2018): 637–676.

[43] McMahon, W. "The External Benefits of Education," *International Encyclopedia of Education* (3rd ed.), Elsevier, (2010): 260-271.

[44] Common Core State Standards Initiative, (2021). https://www.thecorestandards.org/read-the-standards/

will also help foster a local, educated citizenry so that imperative is not solely the domain of public schools. Therefore, this RC does not comprise public education alone but includes all the local public institutions working together; that is, the entire local government. So, besides these RCs making investments in their residents' future earnings, they may also be responsible for sustainable crime and poverty reduction over the long term. Current workers might invest in local communities while these communities invest in their residents' education, welfare, public safety, etc. As a result, this local government funding system, operating at the national level, may constitute an application of the Tiebout Model.

Tiebout Model and K-12 Education

The Tiebout Model argues that if various local governments offer a variety of goods (i.e., local government services) at various prices (i.e., local tax rates), then people will move to those jurisdictions that best meet their preferences and values.[45] Some locales may have high taxes and high service, while others have low taxes and low services, offering choice to residents. As local governments manage local public schools, those schools should also reflect the values and wishes of the residents.

The core problem is that central governments struggle to deliver the optimal level of public goods. Charles Tiebout (1956) examined why private markets might succeed in delivering private goods, whereas a government may need to deliver public goods more efficiently or at optimal levels. His insight was to identify the needed factors – shopping and competition.[46] It is difficult to shop for public goods unless they are local public goods delivered by cities and towns. If a city fails to provide the right basket of goods, at the right quantity, and the right price, people can vote with their feet.[47] If this model were true, the ramifications for public education would be beneficial. This model indicates that residents will reveal their preferences and demands from their local governments through relocation.[48] Local governments will then spend the right amount of money on the right goods as they adapt to the preferences expressed by residents, as indicated by their decisions and choice of residence.[49] Local government officials will represent residents' interests because they must. Citizens will get what they pay for. A key insight of this model is that competition between jurisdictions incentivizes fiscal discipline by local governments. As one example, public schools should fulfill the mission for which they were created and do so efficiently.

Furthermore, if residents are viewed as consumers of good local government and producers, this model is even more profound. A well-designed local community may motivate citizens to actively participate in the provision of goods, which in

[45] Tiebout, C. "A Pure Theory of Local Expenditures", *Journal of Political Economy* vol. 64 (5) (1956): 416–424.

[46] Tiebout. "A Pure Theory of Local Expenditures."

[47] Tiebout. "A Pure Theory of Local Expenditures."

[48] Tiebout. "A Pure Theory of Local Expenditures."

[49] Tiebout. "A Pure Theory of Local Expenditures."

turn may result in even greater attractiveness to residents and potential residents, holding that government leaders themselves are not corrupt. Egoism can lead to seemingly altruistic behavior in this model. Citizens would not just contribute through taxes but through participation as well. As a result, it is important to separate those two critical functions – taxes (contributing capital to local government functions) and participation (contributing labor to local government functions).

This model relies on some critical assumptions:[50]

1. **Perfect information**—you know what all the municipalities offer and how effectively and efficiently they offer it. You have objective data on which to make informed decisions before you relocate.

2. **No transaction costs** – you can relocate yourself and your family at zero cost, both in time and money, without inconvenience.

3. **No externalities** – decisions in one community do not affect other communities, positively or negatively.

4. **Many communities from which to choose** – if these club goods can be provided efficiently by multiple jurisdictions. Communities will achieve an optimal size or level of decentralization.

5. **There is equal financing of public goods by all residents** – you pay for what you get.[51]

In a geographically large and populous country like the United States, you can form large enough jurisdictions to internalize most of the externalities (regionalize – realize the full value locally) yet still have competition between these jurisdictions. So, the assumptions about externalities and communities may be somewhat realistic. The other assumptions, however, are unrealistic, as perfect information rarely exists and the relocation costs are quite high. Besides, one may not fully internalize human capital, as those benefits may be diffused as externalities. As such, perhaps the federal government has a role in designing a system where the assumptions of the Tiebout model are closer to being fully realized.

This performance-based crowdfunding of public education ISAs does that. First, since resident relocation presents significant transaction costs, we need local government financing to be a different mechanism than relocating and paying local property taxes. Money moves more easily than people. Also, the ISA payback rates, measuring the return on human capital investment, would provide objective data about where to invest our retirement dollars and help with long-term relocation decisions. Performance-based funding also helps to internalize and fully value human capital. All public and private investments within the RC, which create economic value, will be measured,

[50] Tiebout. "A Pure Theory of Local Expenditures."; Boadway, R., & Tremblay, J. "Reassessment of the Tiebout Model," *NBER Conference on Fiscal Federalism*. (2010). https://conference.nber.org/confer/2010/FFs10/Boadway_Tremblay.pdf

[51] This is more of a limitation because it is highly unlikely, and even if it were possible, it would be very inequitable.

and educational investment dollars will chase those economic value-add opportunities. This system also separates the 'what' (outcome controls) from the 'how' (bureaucratic controls) of performance management. The preferences and values of residents (relocation) constitute the 'how,' while the standardized returns (national financing) indicate the 'what.' Jurisdictions would compete according to how efficiently they can translate current (input) wages into future (outcome) wages.

Regarding the equal funding limitation, linking this to the nationalized social security pension, which has some income redistribution, would at least substantially improve upon the status quo (i.e., a regressive payroll tax along with unequal funding of local government services). Lower incomes paying mostly into private accounts and higher incomes paying mostly into the nationalized pension would allow for equal financing of local government relative to the current system.

Possible Challenges for a Pilot Launch

Several questions would have to be addressed by the trustees responsible for this system to implement a pilot launch of this proposal. First, would the ISA rate be a standard rate, or should it be individually negotiated and varied between regions? During any economic downturn, the trustees would have to maintain a consistent education funding level or increase it. They would need to maintain a residual fund to draw from during downturns and augment during boom times. Second, how would student transfers and relocation be handled during the years in school? The simplest system is to only withhold for the institution from which the student graduated, so the receiving institution might "purchase" those credit transfers. Third, how would we treat international students, workers, and graduates from private or non-participating institutions? One option is that they would pay a low rate into this residual fund. This policy would also acknowledge possible national positive externalities from education.

However, the critical problem is relocation, the net migration between regions. There are two reasons migration is a challenge for this proposal: (1) Cost of living differences between regions, and (2) measuring the educational investment provided in one region, which is then exploited in another region. For example, there is some migration from California to Texas. From the 2010 to 2020 census, Texas' population rose 15.9%, while California's rose 6.1% – a relative decline that resulted in the first congressional seat loss in California history.[52] Also, according to *U.S. News and World Report*, Texas was ranked #8 in Economy – which considers the business environment, labor market, and overall economic growth by state, while California was ranked #29.[53]

Does this mean that Texas has better economic policies than California? One has to be careful about this conclusion. This is a question of trickle-down economics vs. trickle-up economics, confounded by net migration. Correlation is not

[52] Frey, William H. "Census 2020: First results show near historically low population growth and a first-ever congressional seat loss for California," *Brookings Institute*. (2021)

[53] "Best States Rankings," *U.S. News and World Report*. (2024)

necessarily causation. Is this an adverse selection, like choosing an insurance policy? Are wealthier and more productive people attracted to Texas to pay less in taxes, while people who are struggling are attracted to California to receive more income support? Is it a moral hazard where people are incentivized to work harder in Texas, or are some people getting educated in California and then getting jobs in Texas? To illustrate, let's say a company invests heavily in long-term employee training. Then, that employee goes to another company that pays a higher salary because that company did not invest all that money in training. In this scenario, the first company may ask that employee to sign a non-compete agreement or pay a fine.

The key to this system is handling relocation from a high-tax state like California, with well-funded public education, to a low-tax state like Texas. In this case, the Texan employer should pay the ISA return to the Texas region based on current wages. In contrast, Texas' region could pay California's region based on an estimate of its human capital investment (e.g., prior wages if there is a track record, perhaps family (e.g., parental) income if not). This payment would also be adjusted upwards or downwards according to the relative cost-of-living differences between these two regions.

This proposal addresses the underfunded Social Security problem, raises the national savings rate, and transforms our public education institutions. It makes educational institutions accountable for results, replacing governmentally imposed artificial bureaucracy and the typical short-term performance metrics of traditional performance-based funding with actual success – lifting people economically. With its decades-long investment horizon, the connection to retirement funding emphasizes the needed long-term orientation for education. It also turns underrepresented students and underfunded educational institutions into actual investment opportunities.[54] By making investments that focus on the future today, we may reduce the need to offset inequalities tomorrow.

[54] Callaway, S. "Performance-Based Crowdfunding of Public Higher Education: A Populist Proposal," Chacko Chennattuserry, J., Deshpande, M., Hong, P. (eds) *Encyclopedia of New Populism and Responses in the 21st Century*. (2023)

Comparative Analysis of Degree Pathways that Benefit Black Students that Attend College

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Abstract

The research of Hill, Kurban, Spriggs, and Swinton (2022) strongly supports the findings that, for the average Black student, HBCU status is a positive factor in increasing the likelihood of graduation.[¤] This is true for Black students across all GPA ranges. To extend this previous research, our findings further suggest that HBCUs are increasingly important to Black student's ability to graduate in a STEM discipline. Utilizing a multinomial logistic model, this research finds that attending an HBCU increases the likelihood that a student will (1) graduate versus not graduate, (2) graduate in a STEM discipline, (3) graduate in a STEM discipline even if different than the original STEM discipline selected, and (4) graduate when changing from non-STEM to a STEM degree. Moreover, this research suggests that attending an HBCU has positive impacts for students, providing them a pathway to completion, even in other majors outside of STEM.

Motivation and Background

The value-added of historically Black colleges and universities (HBCUs) for students who attend them and the factors that influence students to attend HBCUs has been previously examined in the literature. There are various reasons for high school students of all races to choose majors and colleges. For example, Byun et al. (2017) and Koricich et al. (2018) found that rural high school graduates more frequently enrolled in two-year institutions as opposed to four-year institutions.[1] Early research suggests high school GPA, ACT/SAT scores, college enrollment, and college graduation statistics are often used as predictors of college match (i.e., students' admission and

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[¤] This research extends from the sponsored research title "Excellence in Research: A Comparison of Educational Outcomes at Institutions of Higher Education" for the HBCU-UP (EIR) with the National Science Foundation.

[1] Byun, S.-y., Meece, J. L., & Agger, C. A. "Predictors of College Attendance Patterns of Rural Youth," *Research in Higher Education*, 58(8), 817-842. (2017). https://doi.org/10.1007/s11162-017-9449-z; Koricich, A., Chen, X., & Hughes, R. P. "Understanding the Effects of Rurality and Socioeconomic Status on College Attendance and Institutional Choice in the United States," *The Review of Higher Education*, 41(2), 281-305. (2018). https://doi.org/10.1353/rhe.2018.0004

acceptance).[2] Advanced Placement courses or Honors courses help increase the probability of college match.[3] Some of these factors were examined in the work by Hill et al, (2022) which found similar results that suggest GPA, number of honors courses, SAT scores determine whether a student attends 4-year college or 2-year college.[4]

Furthermore, for STEM-related majors, the variables for the student characteristics of ACT/SAT scores, race/ethnicity, school type (public/private), living location (urban, suburban, and rural) and whether the student is considered gifted, influences their choice of college.[5] Data from the Integrated Postsecondary Data System (IPEDS) shows that, although only about 14 percent of African-American college students attend HBCUs, 40 percent of all African-American engineers received their degrees from these institutions. Gender was a significant predictor in STEM major choice among these gifted students, with the odds ratio of choosing STEM majors for males being 5.124 times that of females, while race/ethnicity was not an important predictor of gifted students' STEM major choice.[6] For first-generation college students, female students are less likely to choose male-dominated majors and those who do choose the major have more difficulty matriculating in STEM-related discipline.[7]

Given the literature above that showcases the factors that influence college choice, provides a pathway to examine the college choice literature for African American students. The research of Hill et. al, (2022) and is supported by Koch and Swinton (2023), who established that HBCUs increase the likelihood that Black students will graduate from a 4-year university versus those who attended a PWI.[8] This result is robust to controlling for GPA, SAT score, and college choice. To further these findings, our research analyzes the path of students' matriculation to earn their degrees. This analysis includes a sample of Black college

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[2] Lee et al. "Which Type of High School Maximizes Students' College Match? Unequal Pathways to Postsecondary Destinations for students from Varying High School Settings," *The Journal of Higher Education*, 88(4), 529-560. (2017). https://doi.org/10.1080/00221546.2016.1272327; Allensworth, E. M., & Clark, K. "High School GPAs and ACT Scores as Predictors of College Completion: Examining Assumptions About Consistency Across High Schools," *Educational Researcher*, 49(3), 198-211. (2020). https://doi.org/10.3102/0013189X20902110

[3] Lee et al. "Which Type of High School Maximizes Students' College Match?"

[4] Hill et al. "An Empirical Analysis of HBCU Attendance on Black Student's Graduation Rates," *Journal of Negro Education*. (2022).

[5] Vu et al. "Why STEM? Factors that Influence Gifted Students' Choice of College Majors," *International Journal of Technology in Education and Science*, 3(2), 63-71. (2019).

[6] Tran et al. "College Enrollment and STEM Major Choice in a Rural State: A Statewide Examination of Recent High School Cohorts," *Theory & Practice in Rural Education*, 11(1). (2021).

[7] Wright, A. L. "What is in a Major? Habitus, class, gender, and major choice among first-generation college students," *Ohio State University*. (2019). http://rave.ohiolink.edu/etdc/view?acc_num=osu155500065738355; Mau, W.-C. J. "Characteristics of US Students that Pursued a STEM Major and Factors that Predicted their Persistence in Degree Completion," *Universal Journal of Educational Research*, 4(6), 1495-1500. (2016). https://doi.org/10.13189/ujer.2016.040630

[8] Hill et al. "An Empirical Analysis of HBCU Attendance."; Koch, J. V., & Swinton, O. H. "Vital and Valuable: The Relevance of HBCUs to American Life and Education," *Columbia University Press*. (2023).

students in the US that took the SAT, their intended major from high school, their major declared in college, and their major at graduation.

Much of the literature on college selection for Black students examines their college choice experience in relation to white students that attend PWIs.[9] This includes family influence, socioeconomic status, and higher educational aspiration. The research that has been examined showcases the influence that parents have on the college choice process of their Black children.[10] Furthermore, studies have also shown these results for Black students, along with other minorities, being influenced by parents, peer groups, and academic self-efficacy.[11] Similarly, Bowen and Bok (1998) focused on several outcomes for Black undergraduates who attended elite institutions and found similar results.

Although college choice varies in the literature, this research is interested in whether outcome factors are influenced by that choice. Hill et. al, (2022) and Koch and Swinton (2023) find that Black students attending an HBCU are more likely to graduate and select STEM as a major.[12] This research extends the work previously discussed by providing an overview of the pathways and outcomes for Black students who choose different majors. Prior to this research, there were limited studies that estimated the probability of graduating in a specific major, given university characteristics for Black students.

Data

This research uses a combination of datasets from the College Board, the National Student Clearinghouse (NSC), and IPEDS. The College Board and NSC datasets are provided at the individual student level, while the IPEDS data is at the institution level. The College Board data provides pre-college student characteristics such as SAT score, whether or not the student took Honors classes, whether they wanted to attend college, whether they played sports, participated in the arts program, expected to get financial aid, the number of years of Science, English, and Math in high

[9] Cabrera, A. F., & La Nasa, S. M. "Understanding the College-Choice Process," In A. Cabrera & S. La Nasa (Eds.), *Understanding the college choice of disadvantaged students. New Directions for Institutional Research*, 107. San Francisco: Jossey Bass. (2000).; Freeman, K. "African-American College Choice and the Influence of Family and School," *Albany: State University of New York Press*. (2012).; Freeman, K., & Thomas, G. "Black Colleges and College Choice: Characteristics of Students Who Choose HBCUs," *The Review of Higher Education*, 25(3), 349-358. (2002). https://www.jstor.org/stable/40197562

[10] Brown, C. M., & Freeman, K. "Guest Editors' Introduction," *The Review of Higher Education*, 25, 237-240. (2002).; Chapman, T. K., Contreras, F., & Martinez, E. "African American Parents and Their High-Achieving Students: Issues of Race, Class, and Community in the College Choice Process," *Journal of African American Studies*. (2018). DOI:10.1007/s12111-018-9392-x

[11] Bergerson, A. A. "College Choice and Access to College: Moving Policy, Research, and Practice to the 21st Century," *ASHE Higher Education Report*, 35(4), 1-141. (2009).; Ng, J., Wolf-Wendel, L., & Lombardi, K. "Pathways from Middle School to College: Examining the Impact of an Urban, Precollege Preparation Program," *Education and Urban Society*, 46(6), 672-698. (2014).

[12] Hill et al. "An Empirical Analysis of HBCU Attendance."; Koch & Swinton. "Vital and Valuable."

school, an ordinal measure of parental income, self-reported GPA ranges, expected college major, and which colleges they sent their SAT scores to.

This data is then matched with NSC data that provides information on which colleges the students attended, their high school graduation date, their undergraduate degree completion date, their major, and whether the student attended an in-state institution. Lastly, the data is merged with IPEDS data to gather information on school characteristics such as FTE student basis, student expenditures, whether a school is an HBCU or not, and academic support expenditures in quartiles, which was necessary to suppress school identity. Data at the university level is put in quintiles so that individual schools cannot be identified. This means that for all universities the raw numbers

Table 1: Descriptive Statistics

	Data Set	Mean	SD	Min.	Max.
Bachelor Degree	NSC	0.2448052	0.429972	0	1
Associate Degree	NSC	0.2772426	0.4476377	0	1
HBCU Attend	NSC	0.2113908	0.4082954	0	1
Female	College Board	0.5769742	0.4940399	0	1
First Generation	College Board	0.3602204	0.4800647	0	1
Flagship Attend	NSC	0.0705945	0.2561466	0	1
Institutional Size	IPEDS	3.596456	1.20692	1	5
FTE Quintile Attend	IPEDS	4.803216	0.4501148	2	5
Student Ratio Quintile Attend	IPEDS	3.719338	1.071517	1	5
Institution Dist Tuition Quintile Attend	IPEDS	2.582448	1.351745	1	5
Out state Tuition Quintile Attend	IPEDS	3.361271	1.304272	1	5
Percentage Pell Quintile Attend	IPEDS	2.606633	1.224578	1	5
SAT Verbal	College Board	43.28149	9.841443	20	80
SAT Math	College Board	42.95829	9.853608	20	80
Honors Tag	College Board	0.2716928	0.4448328	0	1
Sports Tag	College Board	0.6550665	0.475347	0	1
Art/Music Tag	College Board	0.8025432	0.3980802	0	1
Financial Aid	College Board	2.743996	0.651069	1	3
Years of Science	College Board	3.305964	0.9323982	0	5
Years of English	College Board	3.796163	0.6506088	0	5
Years of Math	College Board	3.690856	0.7482485	0	5
Income Combined	College Board	6.21542	3.711368	1	13
GPA	College Board	7.983523	1.983655	1	12
N		558583			

Note: This table provides a summary of our full sample of 558,583 Black SAT test takers from 2004 to 2007 who attended college.

are ranked and then divided into 5 groups based on being in the following percentiles (0% to 20%), to (80% to 100%). FTE Quintile is full-time equivalent (FTE) enrollment. Student Ratio Quintile values are student-to-faculty ratios put in quintiles. Institution Dist Tuition is the in-district average tuition for full-time undergraduates in quintiles.

One of the more interesting facts in the table is we pick up the 850 average SAT score of Black students. Additionally, a large percentage of the students in our sample participate in sports and art/music, while a much smaller percentage take honors classes. The average income range is between $30,000 and $40,000.

Some interesting facts about our sample that are not in the table are that 39% of the students sent their SAT scores to an HBCU. Interesting as well is that 36% of the students attended a school that they did not send their scores to while 37% attended a college they sent their scores too. Lastly, 75% of our sample attended school in their home State.

Methodology of Analysis

To estimate the relative probabilities of each student outcome, we apply a multinomial logistic regression model. These coefficients are then interpreted as the probabilities of each outcome given the set of independent variables. If the dependent variable, Y, is a categorical outcome with k classes, with $k \in \{1,2,3,4,5\}$and X is a set of explanatory variables $X = \{x_1, x_2, \ldots, x_n\}$, then the logit for each non-reference probability are the following outcomes. In the multinomial logistic regression model, the coefficients represent the probability of graduating with major outcome variables:

1 = Goes to college but does not graduate;
2 = Graduate in the same intended major in HS;
3 = Graduated in a STEM discipline but different than the STEM major wanted in HS;
4 = Graduated in a STEM major but didn't want STEM major in HS;
5 = Graduated in a non-STEM major but wanted STEM major in high school.

The following expression can be derived as a direct example.

$$ln(k_2) = \alpha_k + \sum_{k=1,2,3,4,5} \beta_k x_k \quad (1)$$

$$ln(k_n) = \alpha_k + \sum_{k=n} \beta_k x_k \quad (2)$$

Where $ln(k)$ is the logit function of the class k against the reference group(outcomes 1 thru 5), α is the intercept, and β is the regression coefficient for the group k.

The conditional probability of each class can be expressed in equation (3) as:

$$Pr(Y = k_1|X) = \left[\frac{1}{1+ e^{ln(k_1)} + e^{ln(k_2)} + e^{ln(k_3)} + + e^{ln(k_4)} + e^{ln(k_5)}}\right] \quad (3)$$

such that

$$Pr(Y = k_n|X) = \left[\frac{e^{\ln(k_n)}}{1 + e^{\ln(k_1)} + e^{\ln(k_2)} + e^{ln\,(k_3)} + + e^{ln\,(k_4)} + e^{ln\,(k_5)}}\right]$$

$$(\square_1)\left[\frac{\square}{1 + \square^{\ln(k1)} + \square^{\ln(k2)} + \square^{ln\,ln\,(\square)} + + \square^{ln\,ln\,(\square)} + \square^{ln\,ln\,(\square)}}\right]$$

$$(\square_n)\left[\frac{\square^{ln\,(kn)}}{1 + \square^{ln\,(k1)} + \square^{ln\,(k2)} + \square^{ln\,ln\,(\square)} + + \square^{ln\,ln\,(\square)} + \square^{ln\,ln\,(\square)}}\right]$$

These results will be reported using the marginal effects.

Results

We estimate the regression above separately for each intended major. In this research, we focus our analysis on Biological Sciences majors as an illustrative case study of the academic paths followed by STEM majors.

Figure 1 shows the actual major outcomes for students who declared their intention to major in Biological Sciences and completed their degree in any major. As shown in Figure 1, of the incoming students who selected Biological Science as their intended major, only 14% graduated in Biological Science. The next top four selected majors were in Agriculture (16%), Social Science (8%), Health Professions (10%), and Psychology (11%). This highlights the fact that the majority of students with the intention to major in Biological Science students who change their majors go from STEM-related disciplines to something that is not a STEM major.

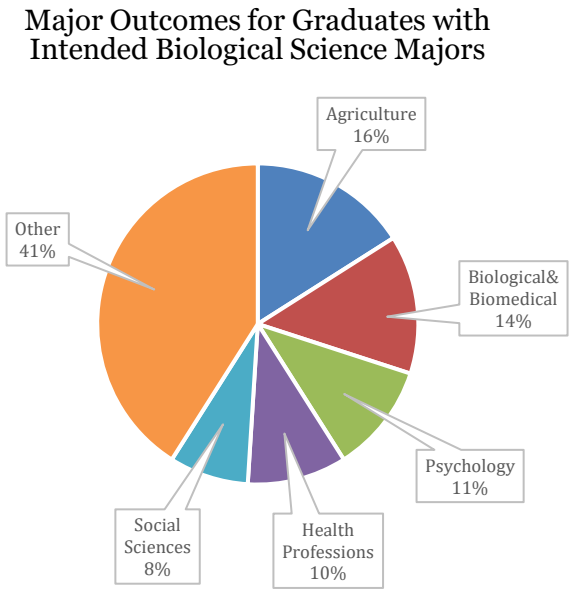

Figure 1: Major Outcomes for Graduates with Intended

Note: This figure highlights the top 5 majors of students who intended to major in Biology but graduated in a different major. The figure represents a has a sample size of 6,619 and showcased the impact of the HBCU Attend variable on the model.

Results from estimating the multinomial logistic regression in Equation (1) for those who selected Biological Science as their intended major are shown in Table 2. We report each coefficient based on each outcome, j = 1, 2, 3, and 5, omitting outcome j = 4 because every student in this subsample selected a STEM major.[13] The coefficient suggests that students who graduate in Biological Science from HBCUs significantly decrease the likelihood of not graduating (-0.116) versus not

[13] Table 2 has a sample size of 6,619 and showcased the impact of the *HBCU Attend* variable on the model.

attending. Secondly, graduating in the intended major at the time of submitting their SAT scores, was not significant when attending an HBCU versus not graduating. It also shows that HBCU attendance significantly increases the likelihood of graduating in another STEM-related degree different than Biological Science versus not graduating (0.126). Lastly, there was not a significant relationship between wanting a STEM degree and graduating with a non-STEM degree when attending an HBCU.

Table 2: Multinomial Logistic Regression reporting Marginal Effects coefficients for each outcome for the Biological Science Major.

	(1)	(2)	(3)	(5)
	Do Not Graduate	**Graduate in Intended Major**	**Wanted STEM Graduate Different STEM**	**Wanted STEM Graduated Non-STEM**
HBCU Attend	-0.116***	-0.009	0.126***	-0.001
Y = Pr (Outcome)	0.5	0.057	0.243	0.199

*** p < 0.10, ** p < 0.05, *** p < 0.01**

Finally, we consider the full set of 38 intended majors in our sample. Table 3 below shows the sign of significant coefficients on the "HBCU Attend" variable for different intended majors and outcomes. Coefficients that are not significant are omitted from the table, and all control variables from the regression specification are omitted Cells with "N/A" represent outcomes for which there were no observations.

For the majority of the sample, those who intended to major in a STEM-related field (2: Architecture, Computer Science, Engineering, Physical Science, and Health Professions) have a positive impact on graduation for students who attend an HBCU. Furthermore, HBCUs had a more positive impact on the probability of graduation for students pursuing STEM degrees compared to those not graduating in STEM Degrees (1: Architecture, Computer Science, Engineering, Biology, Mathematics, Physical Science, and Health Professions.) However, in some cases the number of students that end up graduating in a different STEM major than originally intended is increased (3: Architecture, Computer Science, Engineering, Biology, Physical Science and Health Professions.). The sample also shows that students who did not express an intention to major in STEM fields originally but graduated in a STEM major (4: Education, English, Visual Arts, Business, and History.) In Architecture, we see significant effects on the probability of remaining in the major for the students who intended to pursue a STEM degree and graduated in a non-STEM major. However, this is not the case for all other STEM majors, and there is heterogeneity in the effect of HBCU attendance across majors.

Table 3: Reporting Significant coefficients and direction for each response of the Multinomial Logistic Regression reporting Marginal Effects for each sample based on the variable HBCU Attend.

Majors	HSCIP	1	2	3	4	5
Agriculture,	1		N/A		N/A	
Natural resources	3	N/A	N/A	N/A	N/A	N/A
Architecture	4	-	+	+	N/A	-
Area, ethnic, cultural, gender,	5	-	N/A	+	N/A	
Communication,	9	-	+	N/A		N/A
Computer and information science	11	-	+	+	N/A	
Personal and culinary	12		N/A	N/A		N/A
Education	13	-	-		+	
Engineering	14	-	+		N/A	
Engineering technologies	15	-		+	N/A	+
Foreign languages, literatures	16	+	-	N/A		N/A
Family and consumer sciences	19	N/A	N/A	N/A	N/A	N/A
Legal professions and studies	22			N/A		N/A
English language and literature	23	-		N/A	+	N/A
Liberal arts sciences, general studies	24		N/A	N/A		N/A
Library science administration	25	N/A	N/A	N/A	N/A	N/A
Biological biomedical science	26	-		+	N/A	
Mathematics statistics	27	-			N/A	N/A
Military technologies applied	29	N/A	N/A	N/A	N/A	N/A
Multi/interdisciplinary studies	30	N/A	N/A	N/A	N/A	N/A
Parks, recreation,	31	-			N/A	+
Philosophy and religious s	38	-	N/A	N/A	N/A	+
Theology religious vocation	39	N/A	N/A	N/A	N/A	N/A
Physical sciences	40	-		+	N/A	
Psychology	42	-			N/A	+
Homeland security, law enforcement	43					
Public administration and social work	44				N/A	
Social sciences	45	-	+		N/A	
Construction trades	46	N/A	N/A	N/A	N/A	N/A
Mechanic and repair technologies	47	N/A	N/A	N/A	N/A	N/A
Precision production	48		N/A		N/A	
Transportation and materials mo..	49	N/A	N/A	N/A	N/A	N/A
Visual and performing arts	50	-		N/A	+	N/A
Health professions	51	-	+	+	N/A	
Business management, marketing,	52	-	+		+	
History	54	-		N/A	+	N/A
Other	999		N/A	N/A		N/A
Undecided	1000	N/A	N/A	N/A	N/A	N/A

(N/A – denotes not a selection for the sample that attended an HBCU and/or not a selected outcome for the sample that attended and HBCU)

Conclusion

This research provides an overview of the impact of HBCUs on degree completion and major completion for Black students. We extend the existing literature to explore the path that students take to earn their degree. Our findings more specifically point out the important role of HBCUs in providing pathways to graduation when a STEM degree is identified earlier by the student. We show that HBCUs have a positive impact on a student's probability of graduating in a different STEM-related degree when a student's intended major is STEM. Furthermore, if the student is to change to a non-STEM degree, HBCUs are associated with a greater likelihood of graduation versus not graduating. The observed patterns within the discipline of Biological Sciences, as well as across diverse academic majors in the examined sample, indicate that Historically Black Colleges and Universities (HBCUs) serve as conduits for fostering favorable educational trajectories among Black students. Additional inquiry is imperative to elucidate the underlying mechanisms through which HBCUs foster such outcomes, as well as to explore potential variations in effectiveness among different HBCUs.

Measuring the Impact of Regional Inflation Control Teams (TPID) on Food Inflation Rates in Indonesia

Muhamad Rifki Maulana[†]

Abstract

In response to inflationary pressures in Indonesia, the government has initiated the formation of Regional Inflation Control Teams (TPID). The main purpose of TPID is to address local issues that contribute to high inflation in the region, particularly food inflation, which tends to be consistently high. Food inflation rates are spatially variable due to patterns of food production, distribution, and consumption across 34 provinces in Indonesia. This paper uses two approaches to examine the impact of the successful performance of TPID at the provincial level on taming food inflation. The first approach utilizes fixed-effect panel data regression, while the second approach employs the matching method. Both methods reveal that provinces recognized for high-performing TPID have, in fact, achieved lower levels of food inflation and that this relationship is statistically significant.

I. Inflation in Indonesia

Inflation, which is the general increase in the overall price level of goods and services in the economy, has become a global issue.[1] It stems from various factors, including supply-side pressures (cost-push inflation), demand-side pressures (demand pull inflation), and consumers' expectations of future prices.[2] In many countries, including Indonesia, inflation is measured through changes in the Consumer Price Index (CPI), either from month-to-month (*mtm*) or year-on-year (*y-o-y*). In Indonesia, inflation is calculated by the Central Bureau of Statistics of Indonesia (BPS), which also uses CPI as the leading indicator. CPI is measured based on the Classification of Individual Consumption by Purpose (COICOP) 2018; the Consumer Price Index (CPI) is divided into the following 11 (eleven) categories:

- Food, beverages, and tobacco

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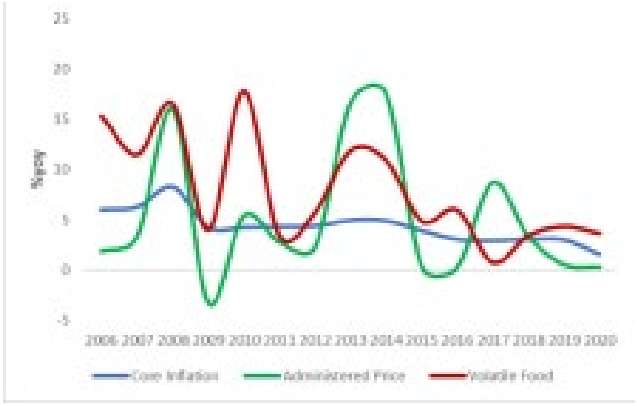
[1] "What is inflation and how does the Federal Reserve evaluate changes in the rate of inflation?" Federal Reserve Board. (2016). https://www.federalreserve.gov/faqs/economy_14419.htm

[2] "Inflation". *Bank Indonesia*. (n.d.) https://www.bi.go.id/en/fungsiutama/moneter/inflasi/default.aspx

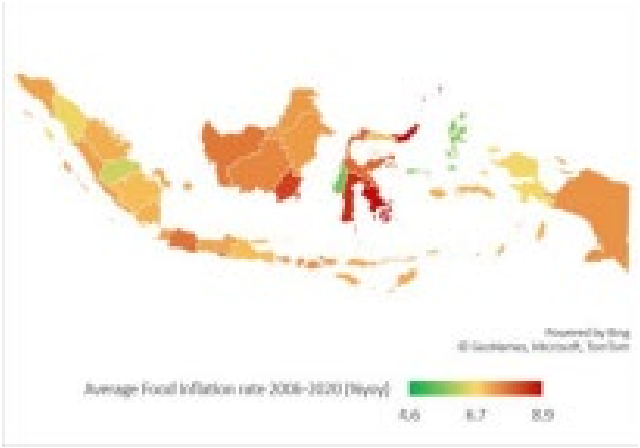
- Clothing and footwear
- Housing, household water, electricity, and fuel supply
- Household equipment, appliances, and routine maintenance
- Health
- Transportation
- Information, communication, and financial services
- Recreation, sport, and culture
- Education
- Food service activities
- Personal care and other services

In Indonesia, inflation is disaggregated to produce indicators reflecting the influence of fundamental factors, resulting in the segmentation of CPI into Core Inflation, Volatile Food (VF) inflation, and Administered Price (AP) Inflation. Based on historical data, VF inflation is very volatile (Fig 1.1). VF is not only volatile; it also often remains high over time in many Indonesian provinces (Fig 1.2).



Source: BPS, 2006-2020

Figure 1.1: Figure 1.1 Core Inflation, Administered Price Inflation, and Volatile Food Inflation in Indonesia 2006-2020



Source: BPS, 2006-2020

Figure 1.2: Average Food Inflation Rate of 34 Provinces in Indonesia 2006-2020

This is mainly attributed to high demand and limited food supply.[3] At the national level, food demand is often met by imports. According to data obtained from the International Trade Administration (ITA), Indonesian agricultural imports surpassed $28 billion in 2022, with wheat, soybeans, rice, beef, fresh fruit, and various feed ingredients being the main categories.[4] Australia, the U.S., Brazil, China, and India are the top five suppliers of agricultural products to the market, representing about 58% of the total imports by value. Therefore, disruptions in the

[3] Ismaya, B.I. & Anugrah, D.F. "DETERMINANT OF FOOD INFLATION." *Bulletin of Monetary Economics and Banking*: Vol. 21: No. 1, Article 4. (2018). https://doi.org/10.21098/bemp.v21i1.926

[4] "Indonesia—Agriculture". *International Trade Administration*. (2024). https://www.trade.gov/country commercial-guides/indonesia-agriculture

distribution of food imports from abroad can indirectly affect the level of food inflation in Indonesia. At the regional level, food production is concentrated in only a few areas, so inter-regional food imports are a common practice to meet the food needs in regions with limited food resources.

Moreover, in Indonesia, inflation often happens because of supply shocks. Regional Inflation Control Team (TPID) guidance in 2014 elucidates that unexpected factors or shocks greatly influence the characteristics of inflation in Indonesia.[5] These shocks can disrupt production due to natural disasters such as floods and prolonged dry seasons, significantly impacting inflation in the food inflation category. Supply shocks like that are even more relevant currently, considering the more unpredictable climate conditions that often result in extreme events capable of damaging food production. Shocks can also come in the form of increases in domestic fuel prices, affecting the inflation of commodities regulated by the government (administered prices).

In addition to production disruptions, there are frequent disruptions in the food distribution process, such as long dwelling times for goods at port and delayed shipments due to storms or damaged road infrastructure. These distribution factors are especially important because not all regions can produce their own food needs; thus, many regions rely on central production areas in other provinces, in which that finding is consistent with the results reported in the study conducted by Farandy (2020).[6] Brojonegoro's (2005) analysis also stated that non-monetary factors, such as different local regulations, infrastructure conditions, and also the efficiency of trade and distribution policies, were relatively dominant as the source of regional inflation rather than monetary factors. Given these conditions, inflation cannot be solely addressed by monetary policy, which is the central bank's responsibility. To reduce inflation to a low and stable level, it is necessary to gain support from the government, which has the authority to address shocks from the supply side, including fluctuations in food prices.

Furthermore, Indonesia, which consists of 34 different provinces, faces unique challenges in the context of controlling food inflation because each region has specific food commodities that often experience high demand in certain periods. The variation in food prices at the provincial level can generally be observed in the National Strategic Food Price Information Center (PIHPS) monitoring.[7] For instance, in February-29-2024, it is apparent that only the provinces of Papua, Maluku, and Central Kalimantan experienced significantly higher prices for shallots, while other provinces

[5]Kelompok Kerja Nasional Tim Pengendalian Inflasi Daerah. Buku Petunjuk Tim Pengendali Inflasi Daerah (TPID)/ TPID Guidelines. (2014). https://tpin.id/wpcontent/uploads/TPIN/Publikasi/Legacy/Buku%20Petunjuk%20TPID.pdf

[6] Farandy, A.R.. "Analyzing Factors Affecting Indonesian Food Price Inflation." Jurnal Ekonomi Dan Pembangunan, 28 (1), 65-76. (2020). https://doi.org/10.14203/JEP.28.1.2020.65-76

[7] *Informasi Harga Pangan Antar Daerah*. Pusat Informasi Harga Pangan Strategis Nasional. (n.d.). https://www.bi.go.id/hargapangan

did not. Conversely, for red chili, the situation is reversed, with low prices recorded in Papua and Maluku. In contrast, prices in other provinces, especially in Sumatra and Java Island, are observed to be high. This price variation also applies to other strategic food commodities.[8] The difference in price levels across provinces is mostly driven by varying levels of demand and production capacity in each province.

Food inflation has also become increasingly salient because of climate risks, with extreme summer temperatures contributing to soaring food prices.9 In Indonesia, based on the latest report from the Central Bureau of Statistics (BPS), volatile food inflation as of January 2024 reached 7.22% (y-o-y), significantly higher than the other two inflation components: Core Inflation and Administered Price, which are only 1.68% (y-o-y) and 1.74% (y-o-y), respectively.[10] The main contributors to food inflation come from commodities such as rice, tomatoes, and red chili, typically stemming from production disruptions caused by El-Nino.[11]

Amidst these challenges, inflation control needs strong coordination between the Central Bank of Indonesia (BI) and the government at both the central and regional levels. At the central level, the coordination between Bank Indonesia and the government for inflation control has been strengthened by forming the Inflation Control Team (TPI) in 2005, consisting of BI and several government agencies. Meanwhile, at the regional level, coordination between BI and local government stakeholders is carried out through the TPID, which began forming in 2008 in several regions. This paper aims to examine the extent of TPID's influence in controlling food inflation at the regional level.

At this time, extant literature on the impact of TPID performance in Indonesia is limited, and most studies concentrated at the local level use only descriptive analysis. For example, Sembiring et al. (2022) find that the TPID in Central Kalimantan Province has been working effectively, while Lubis, S. N. and Soemitra, A. (2022) report good performance of the TPID in Medan

[8] "Importance of reviewing strategic food commodities". *Antara Indonesian News Agency*. (2024). https://en.antaranews.com/news/303309/importance-of-reviewing-strategic-food-commodities

[9] Masterson, V. "6 Projects Helping to Tackle Food Insecurity". *World Economic Forum*. (2023). https://www.weforum.org/agenda/2023/11/tackle-food-insecurity-food-prices/

[10] Indonesia, B. P. S. Inflasi year-on-year (y-on-y) pada Januari 2024 sebesar 2,57 persen. Inflasi provinsi tertinggi terjadi di Provinsi Papua Tengah sebesar 4,76 persen dan inflasi kabupaten/kota tertinggi terjadi di Kab Toli Toli sebesar 6,76 persen. Badan Pusat Statistik. https://www.bps.go.id/id/pressrelease/2024/02/01/2300/inflasi-year-on-year--y-on-y--pada-januari-2024-sebesar-2-57-persen--inflasi-provinsi-tertinggi-terjadi-di-provinsi-papua-tengah-sebesar-4-76-persen-dan-inflasi kabupaten-kota-tertinggi-terjadi-di-kab-t.%20Accessed%201%20March%202024

[11]"SusulBeras, Harga Cabai dan Telur Ikut Meroket". *Media Indonesia*. (2024) https://mediaindonesia.com/ekonomi/653600/susul-beras-harga-cabai-dan-telur-ikut-meroket

City.[12] This paper will enrich the literature on TPID impact in Indonesia by adopting quantitative analyses to determine the relationship between high TPID performance, proxied using the indicator of TPID awards winners, and regional food inflation rates. This paper lays the foundation for recommendations to the central government to enhance future performance of TPID across regions.

II. Regional Inflation Control Teams (TPID)

TPID Formation Process

Controlling inflation requires strong coordination between BI and the government at the central and regional levels. Recognizing the importance of coordination in achieving low and stable inflation, the Government and BI established the Inflation Monitoring and Control Team (TPI) at the central level in 2005. Coordination was further strengthened by forming the Regional Inflation Control Team (TPID) in 2008. To coordinate the tasks and roles of TPI at the central level and TPID at the regional level, the National Working Group (Pokjanas) TPID was formed in July 2011 and was expected to catalyze and strengthen the effectiveness of TPID's role. Finally, TPID gained a legal basis for its management in the Minister of Home Affairs Instruction (Inmendagri) No. 027/1696/SJ dated April 2, 2013, regarding *"Maintaining the Affordability of Goods and Services in the Region."*[13] The ministerial instruction outlines the steps that regions must take to maintain the stability of prices for goods and services. These include forming TPID with the purpose of:

- Maintaining and increasing productivity, supply availability, and smooth distribution of agricultural products, especially staple food commodities.
- Promoting infrastructure development that supports the smooth production and distribution of agricultural products, especially staple food commodities.
- Encouraging the creation of a competitive and efficient market structure and trade system, especially for commodities that are essential to the community.
- Managing the impact of price adjustments set by the central and regional governments, including the prices of oil, electricity tariffs, liquefied petroleum gas prices, minimum wages (UMP/UMR), vehicle registration fees, cigarette taxes, toll tariffs, port tariffs, and transportation tariffs.
- Promoting the availability of credible, up-to-date, and easily accessible information related to the production, availability (stock),

[12] Lubis, S. N., & Soemitra, A. "Evaluation of the Regional Inflation Control Team's (TPID) Performance on the Medan City Economy". *Jurnal Ekonomi, Manajemen, Bisnis dan Akuntansi Review*, *2*(1), 191- 200. (2024). https://doi.org/10.53697/emba.v2i1

[13] Kelompok Kerja Nasional Tim Pengendalian Inflasi Daaerah. Buku Petunjuk Tim Pengendali Inflasi Daerah (TPID)/ TPID Guidelines. (2014). https://tpin.id/wp-content/uploads/TPIN/Publikasi/Legacy/Buku%20Petunjuk%20TPID.pdf

and prices of staple food commodities for the public.

- Coordinating intensively among Regional Work Units (SKPD) within one region and collaborating with SKPD in other regions, Bank Indonesia representative offices, representative offices of other ministries/agencies in the region, and various relevant parties to ensure the production, availability of supply, and smooth distribution of essential food commodities.

TPID Membership

The composition of TPID membership, as referred to in the Minister of Home Affairs Instruction, is structured as follows:

Director	Head of The Region[14]
Chairman	Regional Secretary
Vice Chairman	Head of the BI Representative Office
Secretary	Assistant to the Regional Secretariat in charge of economic affairs
Members	• Head of the Regional Work Unit (SKPD) Responsible for agriculture • Head of the SKPD in charge of transportation affairs • Head of the SKPD responsible for trade and industry affairs • Other related stakeholders

SKPD participation as TPID members should be aligned with the local economic characteristics. For instance, if the local economy is predominantly agricultural, the Department of Agriculture is expected to be a member of TPID. Similarly, if the manufacturing sector dominates the local economy, the Department of Industry is expected to play an active role in TPID. In regions where the tourism industry supports the economy, the Department of Tourism is anticipated to be a TPID member.

The arrangement of TPID membership should also reflect the priorities in addressing inflation issues faced by the region. If distribution constraints primarily cause inflation in a city, the presence of the Department of Transportation in TPID membership is crucial. If inflation in a region is more attributed to a non-competitive market structure, market trade associations are expected to be part of the local TPID membership.

The Best TPID Assessment

The Best TPID assessment is intended to measure the effectiveness of regional inflation control coordination in each area. Additionally, this is also meant to recognize the active role of TPID in maintaining price stability, both at the provincial and city/regency levels. The performance measurement of TPID is focused on various aspects of price stabilization coordination carried out by TPID to maintain price stability in their respective regions throughout the assessment year. This assessment began in 2011 when the award for the best TPID was announced at the High-level TPID coordination meeting (Rakornas TPID) in 2012,

[14] At the province level: governor, at the city level: major, at the regency level: regent

and this tradition has continued to the present day.

The measurement considers two general aspects: process and output. In assessing the process, the evaluation team considers two components: the intensity of TPID processes/activities and the quality of implementation. Meanwhile, the output or the outcome of inflation control is assessed based on the realization of year-end inflation and the monthly inflation volatility that occurs. For the assessment, Pokjanas TPID involves external expert teams as external reviewers to apply the principle of objectivity in the evaluation. External assessment, especially for evaluating the process, focuses on the quality of the main activities carried out in the region for price stabilization.

Based on the data gathered from various sources *(as attached in the appendix),* the following is the list of the best TPIDs at the provincial level from 2011 to 2020:

Year	Best TPID
2011	TPID North Sumatera, TPID South Sulawesi, TPID West Java
2012	TPID East Nusa Tenggara, TPID North Sumatera, TPID West Java
2013	TPID Central Kalimantan, TPID South Sumatera, TPID Yogyakarta
2014	TPID East Java, TPID East Nusa Tenggara, TPID North Sumatera
2015	TPID Bali, TPID Central Java, TPID North Sumatera
2016	TPID Bali, TPID DKI Jakarta, TPID West Sumatera
2017	TPID Central Java, TPID East Nusa Tenggara, TPID North Sulawesi, TPID West Kalimantan, TPID West Sumatera
2018	TPID Bengkulu, TPID East Kalimantan, TPID Gorontalo, TPID Jakarta, TPID West Nusa Tenggara
2019	TPID Central Java, TPID East Kalimantan, TPID Gorontalo, TPID Papua, TPID West Sumatera
2020	TPID North Sumatera, TPID Papua, TPID West Kalimantan, TPID Yogyakarta, TPID Gorontalo

III. Data and Method

Data

The data used in this observation is annual data collected from across 34 different provinces ranging from 2006-2020. Food inflation represents

the dependent variable, Best TPID represents our main explanatory variable, and the other variables act as control variables. All observations start from 2006 except the Best TPID award, which started in 2011.

Considering the objectives and characteristics of the available data, the author performs two analysis methods. The first is panel data analysis using a fixed effect model, and the second is a matching method. The slight difference between the two methods is that in the former, the model treats the data as panel data, using observations from 2006-2020. In the second method, the model treats the data as cross-sectional.

Panel Data Analysis: Fixed Effect Model

Panel data analysis provides researchers with a higher level of statistical validity in policy analysis and program evaluation, utilizing more sophisticated research designs than statistical techniques based on cross-sectional data.[15] A panel constitutes a cross sectional time-series dataset, ideally offering repeated measurements of specific variables over a period of observed units. Panel data offers increased observations for analysis which improves efficiency in pooled OLS models with reduced standard errors. This boosts estimation efficiency, increasing the likelihood of statistically significant results. Panel data's primary advantage lies in its effectiveness in studying cause-and effect relationships through before-and-after observations.

This paper employs a fixed effects model, which is commonly utilized to account for omitted variables that remain constant over time and vary across units. In this observation, the author seeks to eliminate unobservable factors often present in the different characteristics of the 34 provinces in Indonesia, focusing on the impact of TPID's success on the movement of regional food inflation rates. In addition to the TPID success variable, the model includes control variables known to influence inflation rates, including population growth, household consumption growth, and natural disaster frequencies in each province.[16]

In order to solidify the fixed effect models, the author conducts a Hausman test to determine whether fixed effects are necessary. Hausman's (1978) specification test is used to investigate the appropriateness of using Fixed Effect (FE) and Random Effect (RE).[17] Specifically, we test the

[15] Xu, H., Lee, S. H., & Eom, T. H. "Introduction to panel data analysis." *Miller/Handbook of Research Methods in Public Administration*, 571-590. (2007).

[16] High population growth logically increases demand for goods and services. Weiske (2019) found declining population growth reduced natural and inflation rates by 0.4%. Household consumption proxies demand and, in theory, should positively correlate with food inflation. Natural disasters could be ideal proxy for supply shocks since it can disrupt food production and distribution, although sometimes this can also be a demand-side shock because it can suddenly decrease people's purchasing power due to the significant material losses experienced.

[17] Hausman, J. A. "Specification Tests in eEonometrics". *Econometrica: Journal of the Econometric Society*, 1251-1271. (1978).

null hypothesis that the unobservable, individual-specific effects and the regressors are orthogonal, and if the null is true, the set of coefficient estimates obtained from the fixed-effects estimation – taken as a group – should not differ systematically from the result of random-effects estimation. Therefore, if the outcomes indicate a rejection of the null hypothesis, we are confident that we can make conclusions relying on the fixed-effects estimation.

Matching Method

The second method utilizes the matching method, a popular causal inference technique for cross-sectional data. Stuart (2010) states the importance of replicating a randomized experiment when estimating causal effects from observational data, and this involves selecting treated and control groups with similar covariate distributions to minimize bias.[18]

In general, there are various options for implementing matching methods, and in this paper, the author utilizes the Mahalanobis-distance matching method. Pruzek (2012) discusses the use of Mahalanobis distance as a conventional method for matching.[19] It measures the distance between two N-dimensional points scaled by the statistical variation in each component. For example, if Xi and Xj are two points from the same distribution with covariance matrix C, then the Mahalanobis distance can be expressed as:

$$D(Xi, Xj) = \{(Xi- Xj)^{t} C^{-1}(Xi- Xj)\}^{1/2}$$

The method is commonly used for bias reduction in observational studies. This paper's matching process involves several adjustments compared to the previous panel data analysis. First, with this matching method, the author treats the dataset as cross-sectional. Second, the treated and non-treated groups are distinguished by the indicator 1 or 0 in the TPID awards variable. Lastly, control variables (covariates) in this method remain the same as in the previous method, including population growth, household consumption, and natural disaster.

The matching method is an ideal method to use in this context, considering we want to observe the average treatment effect (ATE) of the TPID performance on regional inflation within our dataset, which previously did not undergo randomization. Randomization is crucial for eliminating selection bias, where in this case, there may be systematic differences between one province and another that could affect the inflation rate of the province, thus biasing the effect of TPID. Here, the matching method can replicate the randomization process, by creating comparable treatment and control groups.

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[18] Stuart, E. A. "Matching Methods for Causal Inference: A Review and a Look Forward". *Statistical Science*, 25(1), 1–21. (2010). http://www.jstor.org/stable/41058994

[19] Model, R. C. Background of Matching. https://propensityscoreanalysis.pbworks.com/f/Viola_Match_Final.pdf

IV. Results

Panel Data Regression: Hausman Test

As previously mentioned, the Hausman test determines the necessity of adopting fixed effects in the panel regression model. The null hypothesis of the Hausman test is that both the random and fixed effect estimates are consistent. Otherwise, the alternative hypothesis is that random effect estimates are inconsistent; thus, running fixed effects is highly recommended.[20] Based on the output presented in Table 4.1 in the appendix, we may conclude that the null hypothesis is rejected since the p-value (0.0016) is less than 0.05. This indicates that the fixed effects model test is highly recommended.

Panel Data Regression: Fixed-effect model

To examine the impact of TPID performance on the food inflation rate, the author ran a panel regression with fixed effects. In this model, the author used a success indicator of TPID performance as the main explanatory variable (X), where a score of 1 indicates TPIDs winning TPID awards and a score of 0 indicates TPIDs not winning TPID awards. The author includes other explanatory variables as control variables, which include the annual growth rate of consumption spending by province, population growth in Indonesia by province, and frequency of disasters in each province of Indonesia during the year. Lastly, the response variable (Y) is the annual growth of food inflation by province.

Based on our output in table 4.2 in the appendix, we conclude that holding other variables constant, on average, provinces whose TPID win the award are associated with a 3.953436 percentage point (p.p) lower food inflation rate than those not. This result is statistically significant at the .05 level. Based on this model, we may see that the goal of TPID to tame food inflation in the region is achieved due to the negative association between the improved performance of TPID and the lower level of inflation.

Furthermore, the direction of association from control variables also aligns with preliminary assumptions, where an increase in population and household consumption is consistent with an increase in food inflation. On the other hand, the model provides information that natural disasters tend to decrease the inflation rate. This can be interpreted as the impact of natural disasters being more significant in disrupting the demand side, which makes the demand for food decrease rather than giving a shock on the supply side. In the context of statistical significance, natural disasters are statistically significant at the 5% significance level, and household consumption is statistically significant at the 10% significance level. Population growth is not statistically significant due to its large p-values.

Matching Method

[20] Muck, J. "Econometrics of Panel Data". https://web.sgh.waw.pl/~jmuck/EoPD/EoPD3_2020.pdf.

The matching method approach follows the same principle as the previous panel regression, where food inflation serves as the dependent variable and TPID award is the main explanatory variable, while the other three variables act as control variables. However, as mentioned earlier, in this matching method, the model assumes that the data used is cross-sectional, thus eliminating the time variable.

Based on the output in the appendix (table 4.3), we conclude that holding other variables constant, on average, provinces whose TPID win the award are associated with a 3.643884 percentage point decrease in food inflation. The Average Treatment Effect (ATE) is also statistically significant at the .05 level. Furthermore, the result in Table 4.4 also reveals that the matching process provides a balanced distribution for covariates. This is evident from the fact that, after the matching process, the standard difference in means approaches 0, and the variance ratio approaches 1. For example, we can see the standard difference in means of natural disaster is changing from 0.322 to 0.04, and its variance ratio changes from 3.724 to 0.8196.

However, it can be seen that many observations from both the treatment and control groups are not utilized. Thus, we may argue that the matching process has a drawback, which could reduce the statistical power of the available dataset.

V. Discussion

Overall, both methods indicate that the outcome of the best TPID is associated with lower levels of regional food inflation. Additionally, both models highlight the statistical significance of the best TPID variable at the .05 level. This also indirectly suggests that provinces winning TPID awards are indeed deserving of being recognized as the best TPIDs, given the significant relationship between the award and low inflation. The advantage of the first method lies in the greater statistical power of the fixed effect panel data model compared to the second method, which treats the dataset only as a cross-section. Moreover, by employing a fixed effect, we can effectively eliminate the influence of unobserved factors that may be present given the diverse characteristics across the 34 provinces. This allows for a more accurate estimation of the TPID impact, especially after conducting the Hausman test, which indicates that a fixed effect is indeed preferable. On the other hand, the second method's advantage lies in how the matching method can be a good approach for the crucial randomization process when measuring causal inference from a treatment. This is evidenced by the covariate balance shown in Table 4.4. However, we must admit that the second method has less statistical power.

Given the limitations of data collection and observation time, there are many aspects of both models that need improvement in future research. First, it would be better to conduct the research at a more micro-level, focusing on the formation of TPID at the district/city level. At the district/city level, the timing of TPID formation varies more, making the comparison between the treatment group and control group more robust, since there are 416 districts and 98 cities across Indonesia. The challenge of this approach lies in the data collection process, as economic indicator data at the district/city level is less available compared to data at the provincial level. Thus, it would be

more challenging for researchers to determine representative control variables in the model.

Another area for future research could be to narrow down the scope of the research to the "innovations"/"programs" implemented by one TPID and compared to other provincial TPIDs that did not adopt those "innovations"/ "programs." From an econometric analysis perspective, this approach would be much easier and more robust as there are various approaches, such as synthetic models or comparative interrupted time series, that could be more suitable. The analysis will be more robust if there is a specific program aimed at controlling inflation in a certain commodity. One example of this is measuring the impact of innovation on controlling the inflation of tomato commodities by TPID in a particular province and comparing it to other provinces that have not adopted the program. If the analysis can be conducted and the results prove to be significant, then TPIDs in other provinces, especially those with high tomato consumption, could replicate the program. This analysis can also be replicated for other commodities. Despite diverse consumption patterns in each province, overall food inflation in Indonesia is concentrated on several types of strategic food commodities, as outlined in PIHPS.

Further analysis could sharpen and complement the results of the analysis presented in this paper by focusing on innovations implemented by TPIDs that have won awards. For instance, given the significant impact of TPID's success in controlling food inflation in this study, future studies could initially focus on innovative programs in TPID North Sumatera, as it is the TPID with the most TPID awards during the observation period. However, the biggest challenge with this approach is finding a list of programs that only occur in one region. In the context of Indonesia, inflation control programs often occur uniformly and are replicated in many regions. Another challenge is the consistency of these programs over a long period since an important condition for using synthetic models/comparative interrupted time series is having many observations in both pre- and post-treatment periods. One way to address these challenges is to involve all TPID representatives in the data collection process, where each TPID representative could provide a detailed report of the innovations that have been implemented in their respective areas. Therefore, researchers in the future would be expected to coordinate with the Pokjanas TPID because this process would be more efficient if conducted at the central level.

VI. Conclusion & Policy Implication

The results of both analyses indicate that the better performance of TPID, proxied by the TPID awards indicator, is associated with lower levels of food inflation in the region. Both models also show statistical significance at the .05 level. From the results of these two models, it can be concluded that the better the performance of TPID in a region, the more positively it impacts the reduction of food inflation in that area. However, there are still some challenges associated with both approaches, and there are still many unobservable factors in the inflation formation in the 34 provinces of Indonesia that have not been captured yet.

This paper acts as an initial recommendation for

the central government to encourage the performance of TPID at the regional level, especially for regions with high inflation rates but whose TPID performance is not yet optimal. TPID has a crucial role in controlling inflation in regions with unique characteristics in each area. Therefore, the role of regional institutions is vital in addressing local issues that may arise from production, demand, and distribution aspects. Controlling food inflation will become even more critical, considering the increasing risks of climate change affecting the food supply.

Based on these results, there should be a more in-depth study on TPID innovations in handling inflation for specific strategic food commodities in the future. Deeper research into this matter can serve as a reference for other TPIDs or the central government in replicating programs that have proven to have a significant impact on other regions. Ultimately, it is hoped that inflation control policies in Indonesia can operate more effectively, efficiently, and precisely by adhering to the principle of being research driven.

Appendix A: Stata Output Tables

Table 4.1 Hausman Test Output

```
. hausman fixed random
```

	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	Coefficients			
tpid_award-v	-3.953436	-3.354775	-.5986604	.3400435
cons_house-y	.1619182	.1503043	.0116139	.0258985
population-y	.1426265	.1070303	.0355962	.0244032
naturaldis-e	-.012425	-.0033295	-.0090955	.002643

```
                b = consistent under Ho and Ha; obtained from xtreg
        B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(4) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =       17.44
                Prob>chi2 =      0.0016
```

Table 4.2 Panel Data Regression Output

```
. xtreg food_inflation_yoy tpid_award_prov cons_household_yoy population_yoy naturaldisaste, fe

Fixed-effects (within) regression               Number of obs     =        499
Group variable: code_provi~e                    Number of groups  =         34

R-sq:                                           Obs per group:
     within  = 0.0752                                         min =         11
     between = 0.0339                                         avg =       14.7
     overall = 0.0335                                         max =         15

                                                F(4,461)          =       9.37
corr(u_i, Xb)  = -0.5614                        Prob > F          =     0.0000
```

food_inflation_yoy	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
tpid_award_prov	-3.953436	1.099278	-3.60	0.000	-6.113653	-1.793219
cons_household_yoy	.1619182	.0846612	1.91	0.056	-.0044516	.3282879
population_yoy	.1426265	.096669	1.48	0.141	-.04734	.332593
naturaldisaste	-.012425	.0034155	-3.64	0.000	-.0191368	-.0057132
_cons	7.224503	.6077028	11.89	0.000	6.030292	8.418714
sigma_u	2.045952					
sigma_e	6.1478128					
rho	.09970862	(fraction of variance due to u_i)				

Table 4.3 Matching Method Output

```
.  kmatch md tpid_award_prov cons_household_yoy naturaldisaste population_yoy (food_inflation_yoy )
(computing bandwidth for ATT ... done)
(computing bandwidth for ATC ... done)

Multivariate-distance kernel matching           Number of obs     =        499
                                                Kernel            =       epan

Treatment   : tpid_award_prov = 1
Metric      : mahalanobis
Covariates  : cons_household_yoy naturaldisaste population_yoy

Matching statistics
```

	Matched			Controls			Bandwidth
	Yes	No	Total	Used	Unused	Total	
Treated	35	3	38	417	44	461	1.019574
Untreated	437	24	461	35	3	38	1.450011
Combined	472	27	499	452	47	499	

Treatment-effects estimation

food_infla~y	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
ATE	-3.643884	.7147729	-5.10	0.000	-5.048226	-2.239542

Table 4.4 Summary of Matching Process

```
. kmatch summarize
(refitting the model using the generate() option)
```

Means	Raw Treated	Raw Untreated	Raw StdDif	Matched(ATE) Treated	Matched(ATE) Untreated	Matched(ATE) StdDif
cons_household_yoy	4.03872	4.951583	-.2879388	4.657153	4.888221	-.0728843
naturaldisaste	110.9474	60.58134	.3220287	58.61319	49.9385	.0478617
population_yoy	1.93737	1.796611	.0365076	1.352694	1.569716	-.0562873

Variances	Raw Treated	Raw Untreated	Raw Ratio	Matched(ATE) Treated	Matched(ATE) Untreated	Matched(ATE) Ratio
cons_household_yoy	7.847044	12.255	.6403138	3.701225	4.250834	.8707056
naturaldisaste	51793.73	13905.6	3.724667	4609.13	5623.618	.8196022
population_yoy	22.03183	7.699558	2.861441	1.333222	1.174227	1.135403