DECISION ANALYSIS IN PUBLIC POLICY: MULTI-OBJECTIVE OPTIMIZATION FOR ECONOMIC MOBILITY POLICY PORTFOLIO MIX IN LOCAL URBAN GOVERNMENTS

by

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ABSTRACT

VICTORIA WATLINGTON. Decision Analysis in Public Policy. Multi-Objective Optimization for Economic Mobility Policy Portfolio Mix in Local Urban Governments.
(Under the direction of Dr. JASON WINDETT)

In this dissertation, I take an interdisciplinary approach to improve the budget allocation process for economic mobility policy by leveraging multi-objective optimization as a decision support tool. Economic mobility is measured as the difference in income between Black and White populations, known as the racial wealth gap. Lack of quantitative data linking budget policy selections to mobility metrics hinders government efficiency and the effectiveness of public investment. I propose a novel application of multi-objective optimization[1] to identify optimal mixes aimed at increasing economic mobility in urban cities, restoring rational comprehensive decision making to the process, reducing government waste and improving resident outcomes.

The optimization model is the main contribution of my research to both the systems engineering and public policy fields. The first of its kind, it is the basis for a practical decision support tool that can be utilized to help cities determine where to direct funding for greater gains in economic mobility. It also enables cities to select true peer cities from which to benchmark, assess return on investment at various levels of spending, and identify potential private partners based on additional investment needs to achieve community aims.

The results indicate that each of the above factors plays a role in the level of aid that a city receives, and how that aid is spent. I found that while these factors do impact spending choices, budget policy alone does not drive economic mobility outcomes.

ACKNOWLEDGEMENTS

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I could not have made it through this journey without the incredible support of the University of North Carolina at Charlotte faculty and staff. In fact, had it not been for Betty Doster, I would have never even begun. Without Dr. Jason Windett, the absolute best committee chair I could have ever imagined, I had no hope of completing this work. I would never have finished without his guidance, patience, and expertise. I am forever grateful that he took on a graduate student in the middle of my dissertation and whipped me into shape without breaking a sweat! I hope to make him proud. To my committee, Dr. Jy Wu, Dr. Suzanne Leland, Dr. Wei Fan, and Dr. Xingde Dai, I am truly thankful for your support, dedication, and willingness to extend yourself whenever I called on you. I always felt your presence, your genuine interest, and most of all, your care.

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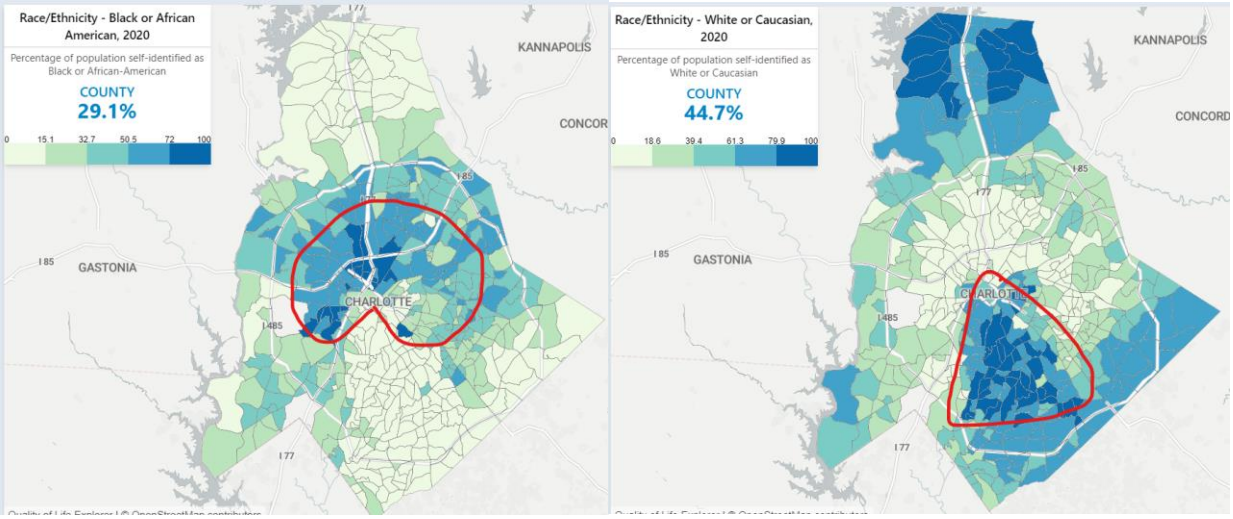
Chapter 1: Introduction

> *The test of a first-rate intelligence is the ability to hold two opposing ideas in mind at the same time and still retain the ability to function.*
>
> *-F. Scott Fitzgerald (2007)*

Despite all its promise, the story of Charlotte, NC, remains a tale of two cities. There exists a stark dichotomy in the quality of life experienced by residents. By almost every socioeconomic factor, there is a split between the haves and the have-nots. With a past marred by urban renewal, redlining, and housing discrimination, the city remains largely segregated by race and economic status. Anyone involved in community advocacy is well aware of the city's poor 50th place out of 50 largest American cities in upward mobility. That is, a person born into poverty in the city of Charlotte has a less than 5% chance of escaping it in their lifetime (Chetty and Hendren, 2015). Meanwhile, Charlotte continues to top lists of fastest growing cities in the US, attracting high-earners as industries like fintech, advanced manufacturing, and life science boom. In the race to win new business and grow our international presence, many question whether we are leaving behind our very own native-born residents. The contrast is seen most readily on a map (see Figure 1): the so-called "Crescent and Wedge," which describes the geographic areas along whose boundaries destinies are divided.

Figure 1

White and Black Population by NPA (Mecklenburg County, 2020)



The Wedge (South Charlotte) is characterized by higher household income and a largely White middle and upper class. Conversely, lower earning Black residents are heavily concentrated in the inner ring neighborhoods dubbed, “the Crescent.” As a local elected official, I and my colleagues grapple every year with the challenge of adopting a budget that demonstrates good stewardship and maximizes investment of public dollars for public good. We consider investing in various workforce development initiatives, providing capital for new affordable housing developments, granting down payment assistance to first-time homebuyers, and various other potential pathways toward upward mobility. With seemingly endless options and yet simultaneously so little information about what is *actually* working, oftentimes the prioritization process is driven by political expediency, rather than quality of outcomes. For example, we field complaints that City-funded job training programs tend to result in more useless certifications for our graduates than viable job offers. Should we continue investing? As we deliberate on programs and lobby for budget priorities, one has to wonder, ‘Does it really

matter? What role does the local government budget really play in the economic outcomes of our residents?' Certainly, the execution of the program itself will have a tremendous impact on the outcomes it seeks to influence. However, that is a matter for practitioners. Our focus, as budget policy makers, is to hone in on which investments yield the highest returns, and to direct our spending accordingly. Today, this is largely attempted without quantifiable impacts on economic mobility.

Charlotte is hardly unique. The chasm between the haves and the have-nots is ever widening, even as their physical boundaries get closer in an ever-densifying city. And this poses a problem, not only for Americans, but for those all over the world. Since its inception, the United States of America has been heralded as the Land of Opportunity. Immigrants from all over the world have settled in this country, hoping to realize the long-promised vision of a better life. This so-called American Dream is an enduring tenet of this country, woven into the fabric of its identity: the idea that, no matter the circumstances one finds herself in, she can rise to the heights of her ambition and effort. This concept of economic mobility has been the subject of much research in social and economic academia. The literature (Bell Policy Center, 2021; Butler, 2008; Acs, 2008; Isaacs et al, 2008) defines economic mobility as 'how someone's economic well-being changes over time.' At this point in our country's history, the promise of economic mobility is weighed against the realities of systemic racial inequity. Some of America's most prominent think tanks, including The Pew Charitable Trusts, The American Enterprise Institute, The Brookings Institution, The Heritage Foundation, and the Urban Institute, have joined forces to investigate this topic, creating the Economic Mobility Project. Disparities in mobility across race is growing, as a direct result of the American institution of slavery and its subsequent race-

based economic system (Isaacs, et al., 2008). Is it too late to turn back the hands of time? If not, where can we interrupt the cycle and how do we go about it justly?

For some, the American Dream has never lived up to its billing. Fifty-eight percent of America's poor are racial or ethnic minorities, and disproportionately Black descendants of slaves (Narea, 2019; McMurrer, 1996; Chetty, 2018; Isaacs et al, 2008; PDEandR Edge, 2022). Every year, the chasm between America's rich and poor seems to be getting wider. To exacerbate matters, the rising costs of necessities like healthcare and groceries and the ongoing globalization of our economy offer no help to stymie our rapidly diminishing buying power. As the wealth gap in America widens, it is critical to develop and deploy effective policies to ensure that the American Dream is a possibility for all residents.

From the federal to the local level, a significant amount of public money has been directed toward increasing economic mobility. However, in general, targeted efforts seem to miss their mark. Although much research has been carried out in the field of economic mobility, opportunities remain to better understand current conditions and potential solutions. Researchers are seeking additional information on the impacts of not only income, but education, family structure, family wealth, neighborhood, and other factors on the mobility gap data across demographics. As more longitudinal data becomes available from minority households, scholars can glean useful information contributing to racial differences in outcomes and better answer the question of how to direct resources in various political and social environments.

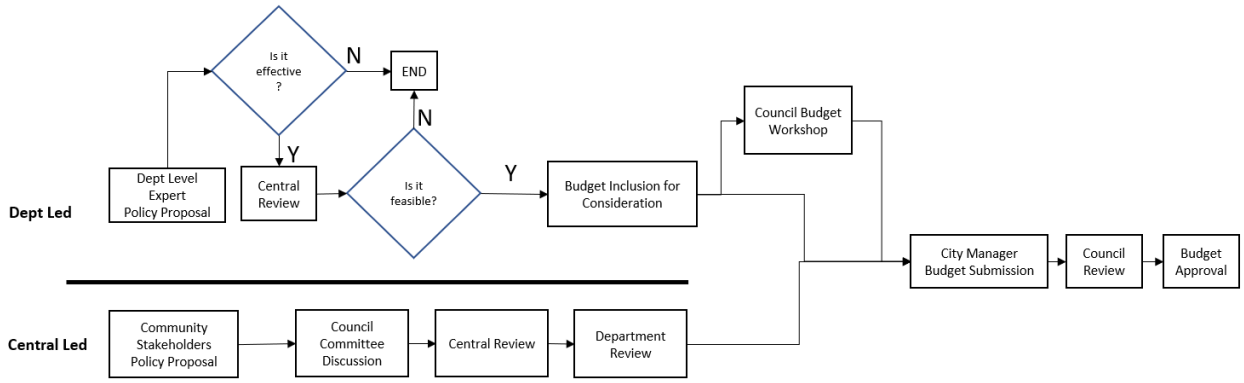
Case Study: City of Charlotte Economic Mobility Policy Selection and Budget Allocation Process

Fundamentally, this dissertation seeks to improve the budget allocation process for economic mobility policy portfolios by leveraging multi-objective optimization as a decision

support tool, accounting for political, social, and budgetary constraints. The Lean methodology (Rother and Shook, 1999) provides an excellent framework within which to describe process inefficiencies in the economic mobility policy portfolio budget allocation process. The principles of Lean management center on the elimination of waste in value streams. It begins with defining the process as it exists today. To do this, I conducted an in-depth expert interview to document the City of Charlotte, NC, economic mobility policy selection, and budget allocation process. Figure 2 illustrates the process steps and key stakeholders of this case study.

Figure 2

City of Charlotte Budget Allocation Process



Stakeholders

1. Department-level experts are policy Subject Matter Experts on staff aligned to single departments. They occupy middle management positions and are typically specialized within a function.
2. Central review resources are made up of the executive and upper management staff in the City Attorney's Office, the Strategy and Budget Office, City Manager's Office, and the

Human Resources department. As needed, data analysts and staff from other departments may be involved.

3. The City Manager is the Chief Operations Officer of the City and manages the day-to-day operations of the City and its budget, including the vast majority of 8,000 City employees. The City Manager is accountable to the City Council and the Mayor.
4. The Charlotte City Council consists of 11 elected representatives: eight from the districts and four serving at large. (The mayor presides over the Council meetings, with limited veto power and ability to vote in a tiebreaker.)
5. Community Stakeholders: residents, business owners, employers, non-profit leaders, faith community leaders, employees, special interest groups, and policy entrepreneurs.

Process Steps

For department-led proposals (so-called bottom-up proposals), the following steps are followed:

Department Level Expert Policy Proposal: In this step, a potential policy enters the consciousness of a department-level expert by means of research and benchmarking across other cities. Typically, these policies have previously been enacted elsewhere and are being evaluated for inclusion in the Charlotte toolbox. The department-level expert considers whether or not the policy is effective in achieving his or her end. Policies are generally evaluated 'as is' and typically not significantly updated or revised at this level; neither are the impacts of an individual policy necessarily considered in other functions/areas. If the policy is deemed ineffective, it is most often discarded. On the contrary, viable policies are submitted to the department leadership, where they are reviewed by central resources.

Central Review: This step is the point in the process where resources outside the department consider the general impacts of a potential policy on the broader goals and evaluate its feasibility. This feasibility analysis is focused on the cost, legal, and political environment. More often than not, if a policy requires changes to municipal authority or a change to state or federal regulations, it does not proceed past this step. In such cases where the problem which the policy is intended to address is deemed sufficiently significant, any intergovernmental requests for changes are added to the legislative agenda for future action.

Budget Inclusion for Consideration: If a policy is deemed feasible through the Central Review process, it is included in budget draft materials for the Council consideration.

Council Budget Workshops: Over the course of several months, a series of workshops are conducted in which staff present various potential policies and overarching strategies to the Council. Overarching strategies tend to focus on cross-functional execution rather than intersectional policies. The Council provides feedback for adjustments to the proposals and informal approval for budget inclusion.

For community-led proposals (top-down proposals), the following steps are followed:

Community Stakeholders Proposal: Much like the aforementioned policy theories, in this step, a societal problem (and possibly a potential policy solution) is lifted up to community stakeholders through various channels: emails to councilmembers, community meetings, social media pushes, etc. As more council members become aware of the problem, one or more council members request to place an item on the Council agenda for an upcoming meeting.

Discussion in the Council Committee: For items referred to committee, staff facilitates council discussions to understand community issue and potential policy solutions and/or

feedback to preliminary proposals. This may be a very prescriptive or general values-based discussion, depending on the previous level of stakeholder involvement. More complex policies are often crafted by a broader community stakeholder group, either formally or informally, resulting in more holistic solutions compared to bottom-up initiatives.

Central Review: As outlined above, a central review is conducted to assess the feasibility of a solution.

Department Review: As needed, effectiveness is determined by dept-level experts. In contrast to the dept-led process, the review is more cross-functional in nature, yet still takes on a more solutions-analysis approach to the policy proposal at hand (as opposed to a solutions-development approach).

Regardless of how the policy came to move through the process, viable policies are included in the official City Manager Budget Submission for Council review.

Council Review: In this stage, minor adjustments are made to the allocations of specific line items, taking care to maintain the total budget allocation for each fund. Any new policy ideas are funneled through the above-mentioned process, and are generally not included in the draft budget (unless a reasonable estimate of potential funds needed can be obtained, in which case funds may be earmarked).

Budget Approval and Adoption: The Council takes a formal vote to adopt the budget for the upcoming fiscal year. Any adjustments and execution of contracts to support the budget are then voted on at biweekly business meetings of the Council.

Process Inefficiencies

Defects. The above paths of policy development are both subject to producing a defective policy, that is, a policy that either ineffectively solves a presented problem or a policy that solves

the wrong problem. Both types of defects can occur due to a lack of community input, though less so in central-led initiatives.

Ineffective policies are prone to happen in department-led initiatives because policy interactions are not always understood, as experts tend to work in department-specific silos, which leads to a single-stream approach vs. comprehensive results-based selection. Elevated bias can exist due to the small number of experts initially involved. There is no way to see the sensitivity of the policy portfolio to results. Furthermore, there is no guarantee, for either pipeline, that the policies have undergone proper evaluations after initial implementation, and therefore no feedback on associated programs informs decision making.

Additionally, policies may ultimately be ineffective because specific Charlotte nuances, such as demographics, are not considered in the analysis.

Overproduction. Output metrics tend to be more common than outcomes metrics, so there is often no consistent relationship with program evaluation or evidence-based methodology. Policy analysis and decision rationales are sometimes hard to follow and interpret when making budget decisions at the council level. This can lead to oversubscription of staff resources to support certain policies.

Non-utilized Resources/Talent. Oversubscription of staff resources can also lead to another type of waste, non-utilized resources. Staff who might otherwise be working on other policies or programs may find themselves with additional capacity because the programs they are assigned to support are not in as high demand. Budget allocations specific to the said programs end up being unspent.

Extra Processing. no central location for analysis, information passed through emails, etc. Separate but related policy information that could be useful for analysis in another department is not available, so staff must spend time on similar investigations instead of reapplying learnings. In Council deliberations, questions concerning viability of potential policies and programs could be better answered with data, enabling more data-based decisions which could be made in a more streamlined fashion versus the current back-and-forth.

Waiting. It takes time for staff to receive council feedback, go back to individual staff members, and then return with additional input on budget items. As mentioned, a data-based approach would enable a more streamlined decision making process.

Due to the above inefficiencies in the budgeting process, policy makers, staff, and residents find themselves wrestling with not only the issues plaguing their communities, but also the consequences of well-meaning but inefficient policies meant to combat them. Employing quantitative decision support tools such as multi-objective optimization can help improve the budgeting process, as well as the quality of the outcomes overall (Shim and Lee, 2017).

Multi-Objective Optimization as a Solution

Multi-objective optimization can address several of the issues leading to waste in the policy and budget development process. By tying potential policies to evidence-based outcomes and incorporating these data into an optimization model, users can have the benefit of the input of multiple experts, as well as program evaluations from national clearinghouses. This reduces the probability that policy makers will enact ineffective policies and decreases the likelihood of solving the wrong problem. By incorporating cost data (absolute or relative), budget decisions can be made that better prioritize policies to target overall economic mobility outcomes. In

addition, including rule-based decision modeling can systematize predicted outcomes based on local nuances, such as racial and social demographics. (For example, if the average retirement income of a given population is higher than the maximum income for a tax abatement program, this policy may be underutilized despite funding. A robust model could potentially deprioritize this item in a projected budget accordingly, to avoid investing past a point of diminishing returns.) Future work will focus on creating a base model on which to build to eliminate waste in the public policy process.

Multi-objective optimization can address several of the issues leading to waste in the policy and budget development process by leveraging mathematical algorithms to conduct policy portfolio analysis, providing the computational capacity that underpins unbounded rationality. By linking potential policies to evidence-based outcomes and incorporating these data into an optimization model, users can benefit from the input of multiple experts, as well as program evaluations from national clearinghouses and / or economic mobility outcome data. This reduces the probability that policy makers will enact ineffective policies and decreases the likelihood of solving the wrong problem. By incorporating cost data (absolute or relative), budget decisions can be made that better prioritize policies to target overall economic mobility outcomes. Furthermore, including rule-based decision modeling can systematize predicted outcomes based on local nuances, such as racial and social demographics.

Open Research Questions in Economic Mobility

Although much research has been conducted in the field of economic mobility, there is a need to better understand current conditions and potential solutions. Researchers are seeking additional insight into how controlling not only income, but also education, family structure, family wealth, neighborhood, and other factors may impact mobility gap data across

demographics. As more longitudinal data from minority households become available, scholars can obtain useful information that contributes to racial differences in results. Additionally, there is a tremendous need for the use of modeling and simulation to estimate the impacts of policy initiatives on economic mobility in a given community.

Research Questions

The primary research questions of this study are as follows:

1. How does partisanship of state, local, and federal elected officials impact state and federal budget aid?
2. How do population contextual factors of a city impact aid?
3. How does aid impact economic mobility?
4. How do city institutional designs influence economic mobility?
5. How does city partisanship influence economic mobility?
6. How does aid, partisanship, and institutional design impact economic mobility?
7. How do local economic factors influence economic mobility differently for White and Black populations?
8. How can quantitative decision support modeling be used to improve the economic mobility budget allocation process?

Hypotheses

1. Cities in which local, state, and federal political ideologies are aligned will receive more aid.
2. As African American employment rates increase, federal and state aid decreases.
3. As aid increases, economic mobility increases.

4. The presence of home rule is positively correlated with an increase in economic mobility.
5. The presence of consolidation is positively correlated with an increase in economic mobility.
6. The presence of local Democratic partisanship is positively correlated with an increase in economic mobility. The presence of local Republican partisanship is negatively (or to a lesser positive degree versus Democratic partisanship) correlated with an increase in economic mobility.
7. In a comparison of cities, Democrat-led cities spend more on economic mobility-related expenditures with a given level of aid than Republican-led cities.
8. In a comparison of cities, those with legislative autonomy (or home rule) spend more on economic mobility-related expenditures with a given level of aid than those without legislative autonomy.
9. In a comparison of cities, consolidated cities spend more on economic mobility-related expenditures with a given level of aid than non-consolidated cities.
10. As African American population increases, economic mobility increases.
11. As segregation increases, economic mobility decreases.
12. As African American affluence increases, economic mobility increases.
13. In a comparison of cities, those with higher African American populations spend more on economic mobility-related expenditures with a given level of aid than those with lower AA populations.
14. In a comparison of cities, those with less segregation spend more on economic mobility-related expenditures with a given level of aid than those with greater segregation.

15. In a comparison of cities, those with greater African American affluence spend more on economic mobility-related expenditures with a given level of aid than those with less African American affluence.
16. Modeling and simulation can be used to model optimal economic mobility policy mixes for local urban governments, resulting in a more efficient and effective data-based budget allocation process.

Purpose of the Study

Creating the most effective policy portfolio (and funding it appropriately) is a tall order and requires significant computational capacity. Despite a growing body of literature that outlines economic mobility issues in America, policymakers still struggle to address the gaps. Why? Challenges in addressing household economic mobility rates are largely due to a few phenomena, including falling wages and employment rates among low-skilled workers, an increase in single-parent households (Berlin, 2007), a decrease in business creation rates, weaker competition in industries, ongoing racial and socioeconomic segregation perpetuated by market forces. In addition, the *public policy process itself* contributes to ineffectively addressing the issue, due to shortcomings in data validity (lag, attrition, selection/reporting bias) (Theodoulou, 1995; Clarke, 2021), political will in the lawmaking process, and limited resources for program evaluation personnel (J-PAL, 2021).

In his seminal work, Lindblom (1959) and others (Olshfki, 2008; Gregory and Keeney, 1994; Dale, 2005; Parnell, 2009; Nils, 2019; Milward, 1983; Niskanen, 1971; Miller, 1983; Kingdon, 1984; Knaggard, 2015) have documented the impracticality of rationalism in policymaking chiefly for two reasons: because goal alignment was unlikely, and people are not smart enough (or enough information is not available) to assess all possible outcomes. In this

dissertation, I focus on economic mobility through the lens of agenda setting, policy formulation, and policy adoption. I draw on literature regarding decision theory, the public policy process, and punctuated equilibrium to predict economic mobility relationships (Howard, 1966 and 2007; Theodoulou, 1995; Clarke, 2021; Lindblom, 1959 and 1979; Munger, 2000; Harsanyi, 1953; Briggs, 2019; Klein, 1993; D'Zurilla and Nezu, 1980; Gajduschek, 2003; McGuire, 2010; Baumgartner and Jones, 1993; Kuhlmann and Heijden, 2018; Allen, 2020; Baumgartner, Jones and Mortensen, 2014).

Building upon operations research and public policy engineering literature (Ferretti et al, 2019; Norese and Ostanello, 1989; Ozernoy, 1985; Farquhar and Pratkanis, 1993; Considine, 2012; Hatchuel and Weil, 2009; Colorni, 2018, Pluchinotta, 2019; Solo, 2017; Abdulgader et al., 2018; Schwaab, et al, 2018; Hamarat, 2014; Guo, 2020; Armas, 2017; Chen et al, 2017; Jiang-Ping, et al, 2019; Ascione, 2016; Matott, 2012; Huber, et al, 2020; Pakdel, et al., 2020; Nyahora, 2020; Zhong, et al, 2018; Jing, et al, 2018; Lubida, 2019; Sharmin, 2018; Wang, 2021; Johnson, 2001), I will establish a preliminary decision support model based on economic, social, political, and institutional pressure. This model will enable a more efficient budget allocation process and a more effective economic mobility policy mix (Ghazinoory, 2019; Ring and Schröter-Schlaack, 2011; Lehmann, 2012; Rogge and Reichardt, 2013; S. Ghazinoory et al., 2013; Flanagan, Uyarra, and Laranja, 2011; Boonekamp, 2006; Fischer and Preonas, 2010; Givoni et al., 2013; Justen et al., 2014; Taeihagh, Baares-Alcántara, and Givoni, 2014; Howlett and Rayner, 2013; Del Rio and Howlett, 2013; Konidari and Mavrakis, 2007).

In regards to political factors, this dissertation is concerned with understanding how ideological alignment of state, local, and federal elected officials impacts state and federal budget allocation aimed at improving economic mobility across various city-state power

dynamics. Turning my attention to societal factors, I suspect the same underlying adage governs: it's not what you know it's who you know, and who likes you. Therefore, in addition, I will investigate how a city's diversity and racial demographics impact the selection of policy instruments and expenditures (and, therefore) economic mobility) in large US cities, specifically African American percent of population, segregation and African American affluence. Finally, this research explores how quantitative decision support modeling (multi-objective optimization) can be employed to improve the budget allocation process for economic mobility policy portfolios for large cities, and provides a preliminary tool to enable local governments to set directional targets for budget allocation.

Significance of the Study

I seek to contribute by taking a systems engineering approach to public policy and developing a modeling and simulation tool to restore features of rational comprehensive decision making to the budgetary process. I will expand the understanding of the trends in economic mobility investment across local urban governments in the United States and leverage those learnings to provide a quantitative basis for budget discussions. I endeavor to enable resource-constrained cities to streamline their budget process and accelerate positive economic mobility outcomes for their residents.

Research Design

The research in both Chapters 4 and 5 consists of a quantitative longitudinal and cross-sectional correlational study of the top 50 US cities (by population as of 2020 US Census). I will use secondary data collected from the US Census, the Lincoln Institute of Land Policy, the Department of Housing and Urban Development, the American Community Survey, state

government archives, and the US Congressional Archives. I will use regression analysis and moderated mediation analysis to perform descriptive (exploratory) and diagnostic analyses to establish relationships between variables in the research questions. Finally, in Chapter 6, I will conduct, based on the relationships identified in the previous chapters, predictive (mechanistic) and prescriptive analyses as part of the multi-objective optimization model development.

Organization of the Study

In Chapter 4, I seek to examine the impact of political ideological differences between the levels of government on city grant allocations, as well as the impact of local authority on specific types of spending. I argue that political ideological alignment lends itself to more concurrence rather than compromise, and, in the case of Democratic majorities, leads to more investment in economic mobility-related policy, due to the propensity of the party membership to prioritize a social justice focus. This, in turn, will result in a decrease in the racial wealth gap. Furthermore, I expect that Democratic-led home-rule cities will spend more overall and invest in more innovative policies than Dillon-rule cities, resulting in a greater decrease in the racial wealth gap.

In Chapter 5, I will investigate the correlations between African American population, segregation, and investment in affluence and local economic mobility. I anticipate that greater percentages of African American population correlate with higher economic mobility spending. I also hypothesize that the more people live and work around each other, the better appreciation they have for each other's needs, which is then reflected in policy. I expect that less segregated cities will spend more on economic mobility policy, resulting in a greater decrease in the racial wealth gap. I anticipate that cities in which African Americans have higher starting median incomes (using 2010 as the baseline) will spend more on economic mobility policy, resulting in a

greater decrease in the racial wealth gap. With these data, I will determine a preliminary correlation between these changes and the outcomes of economic mobility.

In Chapter 6, I will use the full model from the previous chapters as the objective function in the multi-objective optimization. I anticipate that the model can forecast economic mobility outcomes based on the optimal budget portfolio mix given unique characteristics of a city. I'll conduct several sensitivity analyses to understand how various factors influence the budget policy selection.

Chapter 2: Literature Review and Theoretical Framework

At its core, government exists to ensure a stable and productive society. At every level of government, issues impacting constituents are raised, debated, and ultimately addressed through policy. Successful policy influences people to act in ways that produce more desirable outcomes for the collective. As we have seen throughout history, social, economic, institutional, and political dynamics often influence what policymakers consider desirable, and these preferences are reflected in the policy that is created. If we can improve the public policy process by providing relevant and quality data as input into the process, we can increase the quality of decision making and ultimately improve the effectiveness of the policy. As we have seen throughout history, social, economic, institutional, and political dynamics often influence what policymakers consider desirable, and those preferences are reflected in the policy that is created. This chapter covers the policy process and decision making theoretical framework, provides an overview of the economic mobility gap in America, and proposes multi-optimization as a decision support tool solution for improved economic mobility budget policy.

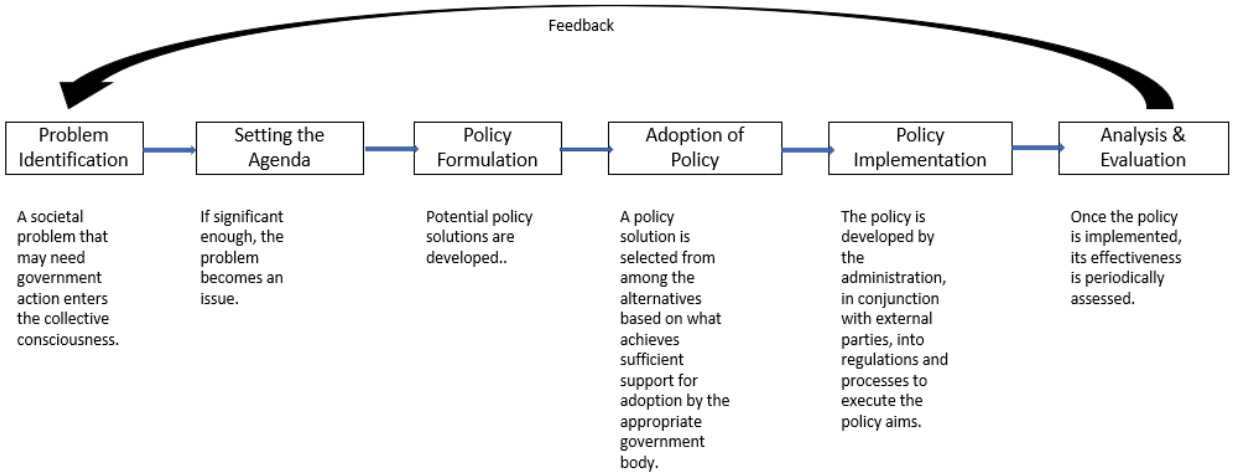
In this chapter, I begin with a general overview of the policy process and the theoretical framework for decision making, then converge on an analysis of the economic mobility gap in America, the area of focus of this dissertation. Next, I outline the political and social factors that influence economic mobility-related budget allocation and policy instrument selection for local urban governments. Next, I introduce the concept of multi-objective optimization applied to public policy provides a basis for understanding the methodological approach. Finally, I conclude with an investigation into a local urban government case study, presenting a theory of the policy selection and budget allocation process to describe how multi-objective optimization can be used to improve the economic mobility gap via data-based decision making as input into policy selection.

Decisions in the Public Policy Process

The public policy process is a framework used to describe the evolution from the emergence of a problem in a society through the development and implementation of its solution. Theodoulou (1995) outlines the public policy process framework in six steps:

Figure 3

The Public Policy Process



Howard's (1966, 2007) decision theory, widely regarded as the foundation of the discipline, begins with defining the decision. Theodoulou's model, however, goes further upstream by including problem identification as Step 1 of the public policy process. This is significant because one of the most important aspects of decision making (and one of the most important factors in the quality of the decision) is maximizing the decision-maker's utility. Without a thorough understanding of the problem, there is no guarantee that a decision ultimately improves one's position, in which most cases then, I argue, no decision needs to be made.

Even at this early stage of the process, it is clear that the threat of a fatal error immediately presents itself. Although not specifically outlined in Step 1, a common understanding and alignment of collective values of a constituency are inherently required to support the successful execution of Steps 2-3. The values reflect what residents value the most, how they identify, what they intend to preserve, and what they believe is at risk if no intervention is made. Given historical and cultural experiences, these values are often nuanced, and a lack of understanding in policymaking can result in unanticipated outcomes; for example, as observed in cases of crime and policing in urban neighborhoods, oftentimes law enforcement struggles to find cooperative witnesses even when crimes occur in broad daylight. Intra-community loyalty due to a history of oppression at the hands of the criminal justice institution has led to a 'code of silence' in which it is taboo (and even dangerous) to be seen as disloyal to criminal members of the community who are themselves compromising the safety of the collective (Akerlof and Yellen, 1994).

In her study of executive and middle managers in Tennessee state departments, Olshfki (2008) found that policy development often proceeds exactly this way, without a formal investigation of collective values before developing solution alternatives. It is an alternative-focused thinking. However, one could argue that values are fundamental to any problem definition or decision analysis; otherwise, how could one select an alternative without understanding its impact on utility (Keeney, 1996)? If *values* are clarified, policy *goals* can be more properly defined, and better alternatives can be developed that lead to true pareto-efficient solutions; that is, everyone is better off as a result of the implementation of the decision (Munger, 2000).

Unfortunately, in public policy, goals are often contradictory, even when they are defined. Milward (1983) outlines an example in which government transportation engineers are given a mandate to build a roadway at the lowest possible cost. During the course of the project, they were in disagreement with the Sierra Club, an environmental advocacy organization, because the road was intended to pass through protected wetlands. It could be argued that the lowest cost was a short-sighted goal in the first place. Better stakeholder management could have prevented this conflict and would have informed agenda setting to address both transportation and environmental preservation needs.

Taking a closer look at Step 2 of the process, Theodoulou defines two types of agenda: one more broadly focused and abstract (the systemic agenda– ” Jobs for All,” for an example) and the other more concrete and specific (the institutional agenda, usually documented in the form of bills and/or policy–the Workforce Investment Act, for example). Theodoulou ascribes the viability of a given political system to the speed with which items move from the systemic agenda to the institutional agenda. That is, how long does it take for something generally recognized to be important to receive serious attention moving into the policy formulation phase? The success of this process and subsequent policy selection and implementation depends on several factors that begin to take shape as early as the agenda setting stage. Here, Theodoulou notes that political actors begin searching for a solution in the agenda-setting stage as a first pass of feasibility or risk of a solution being developed that would ultimately be adopted.

During policy formation, objectives must be mutually (albeit tacitly) agreed on by the majority of voting members in a legislative body to determine what should be done in general. This is the second part of the most critical undertaking in the policy process, setting the decision frame (National Research Council, 2001). The decision frame consists of the issue (defined in

Step 1), the options, and the desired results. Again, it is imperative that the issue and the desired outcomes are readily understood to prevent a 'Type III error', solving the wrong problem (Olshfki, 2008). Even when broader stakeholder management strategies are employed in Step 1, this can happen when experienced policymakers engage in pattern matching problem solving and heuristics, in which they rely on their existing knowledge and previous experience to 'sort' issues and index to solutions based on their similarities to past challenges. When applied too haphazardly, this could lead to public administrators not even meeting the conditions to satisfy the worst variation of "muddling through[1]". In the case of economic mobility policy, this can lead to policy mixes that not only hinder people from moving up, but may set the stage for a reversal of economic gains. Different methods and means of managing stakeholder engagement throughout the public policy process have been explored toward this end (Gregory and Keeney, 1994; Dale, 2005). However, theorists have focused much of their attention elsewhere; namely, on the decision making approach of political actors. As a result, we have a better understanding of when and how policy changes occur but have comparatively less knowledge about how to improve the quality of the policy portfolio itself.

For decades, there were initially two major schools of thought: rationalism and incrementalism. The rational comprehensive approach, developed in the field of economics, is one that is more closely aligned with normative decision theory: identify and rank goals; develop alternatives to achieve them, conduct a best value option analysis, and select the solution that maximizes utility. (Lindblom, 1959) In the realm of public policy, expected utility is applied in a variety of instances. For instance, expected utility theory is applied to welfare economics with a variation: individual utility is analogous to total societal welfare, which should be maximized

[1] Klein indicated that less experienced professionals tend to follow a more rational comprehensive approach, perhaps cross-pollination in the public sector could lead to more mixed-model decision making?

(Harsanyi, 1953). Briggs (2019) covers additional examples of use to maximize the best results in health policy, mortality rates, and altruism.

The rational approach to decision making in public policy is not without its critics. In his seminal work, Lindblom (1959) declared the so-called rationalism impossible in policymaking because goal alignment was unlikely and people are not smart enough (or enough information is not available) to assess all possible outcomes. However, due to the lack of intersectionality between academia and industry, until his publication, the rational approach to value-maximizing policy [and its bounded rationality offshoot (Wheeler, 2020)] was the norm (Timmer, 2019).

Given the shortcomings of rationalism, scholars continued to search for a more comprehensive and normative theory of policy change. As such, scholars developed successive limited comparisons, later called incrementalism (Lindblom, 1979). This approach more closely models the continuous improvement process in that it is intended to be iterative and responsive to feedback. It results in small changes based on existing or previous policy and proceeds without much thought to goal identification or relative effectiveness of alternatives. The process has been described as 'scientific muddling' (Lindblom, 1959).

Incrementalism has its benefits. Similar to Recognition-Primed Decision Making, in which people rely on experience and situational awareness to determine next steps, incrementalism enables the experienced practitioner to arrive at decisions with limited cues and less effort, more quickly and cost-effectively than a rational choice method would require (Klein, 1993). In addition, incrementalism is grounded in the immediate reality, so solutions are often low-risk and more politically feasible, conserving organizational effort on solutions that will actually come to fruition. Often, incremental solutions are less complex and functionally specific, like choosing between offering a tax rebate or cash assistance to subsidize property

taxes, avoiding the cumbersome effort of broad stakeholder participation and navigating multilevel decision authority.

Incrementalism also has its share of challenges. As an explanation of political behavior, incrementalism fails to explain large shifts in policy. As a practice, while incrementalism is useful in converging quickly on a decision, it is quite possible that this can result in an overreliance on experience and a lack of recognition of when it is necessary to move to a higher level of cognitive control in order to reach a more aspirational goal. (Klein, 1993). Incrementalism tends to focus on selecting among alternatives that are readily available, in some cases, the path of least resistance. This is in contradiction to the more-alternatives-the-better-quantity principle of social problem solving (D'Zurilla and Nezu, 1980). At the practitioner level, individual decision makers also maximize their utility (Gajduschek, 2003). People want to do less work and will make decisions to enable this by employing a number of strategies, including distracting, pseudo realigning, and doing nothing (McGuire, 2010). For these reasons, incrementalism can be especially vulnerable to the risk of solving the wrong problem, since solution development is often implicit in problem definition (Olshfki, 2008).

In addition to the risk of solving the wrong problem, incrementalism can be overused in areas that require more complex study due to institutional imbalances in information and decision authority. On the one hand, legislatures have the ultimate authority to decide policy, whether sweeping reform or minor adjustments to legislation. On the other hand, bureaucrats have all the pertinent information for the said decision. For example, Niskanen (1971) used the example of budget adoption to demonstrate how budget-maximizing department heads who had a monopoly on cost information could influence the legislature’s budget decisions.

Administrators often provide a single alternative, framing legislative decisions as ‘all or nothing’ (Miller, 1983).

Probably the biggest issue with the incrementalism model is that there have been policies throughout history that have been decidedly non-incremental. The Tax Reform Act of 1986, for example, has been studied for its novelty as a non-incremental policy passed during a period of split government (Bowling et al, 2001). Banthin and Miller (2006) found that Medicaid nursing facility reimbursement could be modeled from an incremental and non-incremental perspective and attributed non-incremental change to several factors, including a state’s vulnerability to federal policy changes and internal socio-political conditions.

As rationalism and incrementalism began to seem too limited in their description of governmental decision making, additional theories were introduced. Garbage can theory (Cohen, 1972) posits that there is no real organized approach by which problems, solutions, and decision makers are created; rather, they exist separately and apart from each other. They only come together in an organized fashion when an opportunity arises and are assessed together as a potential option to meet the opportunity. Adapting this approach, Kingdon (1984, 2011) introduced multiple streams theory[3], which comprises three streams: problem, policy, and politics. As an organizational theory, it is characterized by problematic preferences, unclear technologies, and fluid participation. Generally, the policy passes to adoption when the following is true at the same time (‘window of opportunity”):

1. A problem enters public consciousness.

2. A policy is available that addresses the problem championed by a policy entrepreneur.

3. There exists a political will to adopt the said policy.

Multiple-stream theory research has focused more on the policy and politics streams, with extensive research only relatively recently being focused on the problem definition stream (Knaggard, 2015; Allen, 2020). I argue that the policy and problem streams are inextricably linked in that defining high-quality policy alternatives is a means of better defining the problem. Although formal comprehensiveness may always fall short of the theory, it is still possible that even incomplete comprehensiveness yields better solutions than expertly executed aimless muddling.

It has been noted that the smart policy entrepreneur can use any of the problems that are solved by a new policy solution to build coalitions and increase the likelihood of getting a matter included on the agenda. How much more could this be realized if policies were inclusive of multiple values and stakeholders, as a matter of course? Larger and more complex problems could be addressed with more holistic solutions, positively impacting the quality of life of more residents, while enabling more efficient government and saving critical resources.

Given the idiosyncrasies in the public policy processes, Olshfski (2008) concluded that state-level public administrators (managers and executives) exhibited behavior best modeled by multiple-stream theory, rather than rationalism or incrementalism.

However, in cases where the ‘density’ (complexity of the decision as it relates to the number of stakeholders, the level of authority to act, etc.) is sufficiently low, public administrators more often display a more rational-comprehensive approach (Olshfski, 2008).

This mix of periods of apparent incrementalism, with moments in which there exists a dramatic change in a certain policy area, is described in yet another theory of public policy analysis: punctuated equilibrium theory (PET), developed by Baumgartner and Jones in 1993. While multiple streams theory is concerned with explaining how individual actors intersect to

produce policy change, punctuated equilibrium focuses on the “overlap and interaction between the politics of issue-specific policy subsystem(s) and the macropolitics of the Congress and presidency (for national-level policies in the U.S.)” (Baumgartner, Jones, and Mortensen, 2014). Unsurprisingly, PET scholars acknowledge that the public agenda changes much more frequently than the institutional agenda, and if the institutional agenda reflected the public agenda more closely, it would experience much more intense punctuations within policy areas. High performing, stable administrations are especially resistant to the whims of the public (Flink 2017). However, Yildirim (2022) attributed this disconnect between the two agendas as a function of 'the cognitive limits of decision makers and formal and informal arrangements of groups of decision makers... [which] affect the dynamic of information processing.' Simply put, political actors–elected and appointed officials, special interest groups, policy entrepreneurs, political parties, etc.—receive an ongoing barrage of information about many different topics, and it is virtually impossible to investigate, react, and respond to the public consciousness in near-real time (Baumgartner and Jones, 1993, 2009; Breunig and Koski, 2006; Givel, 2010; True et al., 1999; Andrews and Boyne, 2010). As a result, the tide within the political ecosystem exhibits ‘stick-slip dynamics’ in that the balance of political actors either does not innovate (equilibrium periods) or overacts on particular issues (punctuations), in the rare cases in which the forces at work within the system align on a singular focus (Jones and Baumgartner, 2005). Take, for example, the social justice movement of 2020. The murder of George Floyd sparked international outrage across the country, kickstarting unprecedented corporate commitment and private investment in equity programs across the country. Floyd was hardly the first Black man murdered at the hands of law enforcement. However, a once-in-a-generation external shock contributed to a window of opportunity for a focus on social justice reform: the coronavirus

pandemic. With people largely confined to their homes and their attention less divided, they rallied around a cause and brought significant policy changes to fruition around the world.

In the absence of a pandemic, studies have identified a correlation between a broader sphere of influence and more sweeping policy reforms. Fagan (2021) found that more federalized systems (i.e., higher institutional friction) produce more severe budget punctuations. Access to more resources, broader powers, and a wider reach enables a more bounded and comprehensive rationalism in practice, yielding more dynamic results. Although they must overcome greater resistance from institutions, these dramatic changes make their way through the policy process when the mobilization of interested parties overcomes the reinforcement of the status quo by the institution. Elections, in particular, present an opportunity to tilt the balance in one direction or another, since most political parties in government entities can act as amplifiers or 'checks' for political agendas.

In practice, I argue that both rational and incremental approaches are used to make policy decisions, with each approach selected depending on the particular situation. Ultimately, rationalism and incrementalism are most useful when understood in the context of PET theory, and either approach can be leveraged in practice once awareness of the relevant factors influencing the institutional agenda is acquired. To accurately anticipate (and subsequently seize) window of opportunity for step-change improvements, data-based decision support tools must be designed to reflect the values, goals, and constraints of the community within a given community.

Improving the Policy Process

Despite the myriad of theories that explain the policy process, the application of the process itself leaves much to be desired. As such, the question remains: Why is there a gap in the satisfaction of the general public with policy responses by elected officials? What can be done about it?

Parnell (2009) emphasizes stakeholder and decision maker interaction as a key enabler for improving decision making and ultimately outcomes. There have been attempts to understand how to increase stakeholder participation. Nils (2019) found that continuous participation and motivation were the key factors in maintaining participation in the process. However, even then, stakeholder participation focused mainly on establishing criteria and relative weights against which to assess alternatives. Once again, this assumes a given set of alternatives or that the alternatives analyzed in any of the models are already sufficient.

The construction of alternatives itself is argued to be a decision problem. Policymaking has intrigued experts in all disciplines (including operations research, management science, and economics, among others) interested in improving different phases of the public policy process. In an effort to improve decision making in public policy by replacing chaotic government exercises with more rational methods, a new field of research has emerged. Public policy engineering is the ‘application of engineering, computer science, mathematics, or natural science to solving problems in public policy’. This new discipline has been applied to determine criminal sentencing policies, for example, through computational intelligence. Public policy engineering uses methods like fuzzy logic to quantify qualitative concepts like stakeholder values, and environmental, social, and economic conditions. This information can then be used in conjunction with optimization algorithms to model decision sequences, helping human decision makers facing complex decision frames (Solo, 2017).

Ferretti et al. (2019) provide an overview of various tools and methods (Problem Structuring Methods, System Dynamics, Data Envelopment Analysis and Performance, etc.) which have been developed to assist decision makers in evaluating alternatives and selecting the right combination of variables to quantify the decision problem. Although design theorists and operation research experts both seem to acknowledge the need for decision aids in the early phases of the public policy process (Albouy and Luè, 2015), there is little research around policy alternative design itself, except for a few investigations into ways to formalize multicriteria analysis (Norese and Ostanello (1989); Ozernoy (1985).

Several studies focused on how to structure the decision problem more than how to develop alternatives [Farquhar and Pratkanis (1993), for instance] (Ferretti et al., 2019). Considine (2012) focused on the individual characteristics of policy makers to standardize professional development to allow more policy innovation. Hatchuel and Weil's (2009) C-K design theory has become the foundation on which to build in recent research, including Colorni's 2018 paper and Pluchinotta et al. (2019) adaptation of Concept-Knowledge theory for policy design. It is an iterative innovation-centered approach in which new concepts are defined by the creation or selection of attributes informed by existing knowledge. As the concept is expanded, new knowledge is sought (through research, for example), which, in turn, expands upon the existing concept. C-K design theory relies on both bounded rationality and incrementalism, forcing creativity beyond the typical incremental solution development space, while focusing the comprehensive knowledge quest on a specific concept iteration.

Consistent with several previously mentioned public policy theories, Ferretti's research team identified two catalysts for policy innovation (dissatisfaction with relevant stakeholders and the opportunity to change an input constraint, such as the budget). However, they only focus on

two case studies, while I seek to expand their findings more broadly across local urban governments in the United States, by identifying the conditions under which said catalysts have the most impact on budget policy. In addition, a preliminary correlation between these shifts and the results of economic mobility will be determined.

Although Steensma (1999) acknowledged that policy-making models are often used together in the policy process, there seems to be a lack in model description for governing bodies to proactively develop an agenda. In addition, there is an opportunity to define under what circumstances each policy development model (or a hybrid of several) should be used.

In the case of economic mobility policy, academic study has historically been driven by contributions from White male scholars. However, in urban cities, the population is significantly more diverse than America as a whole (Frey, 2020), resulting in various sociopolitical environments. Therefore, a rational approach to policy making (and expected outcomes) must be informed by the nuances of social and political factors within a given city. To date, public policy investigations of the impacts on Black residents have been largely qualitative and limited in scope. I seek to contribute a more quantitative analysis useful for general application.

The Plight of the Black Worker

Several studies have explored the rate of mobility over time in the United States, consistently concluding that relative mobility rates have remained stable across generations, with between 58-62% of individuals moving to a higher income quintile (McMurrer, 1996). On its own, this is not alarming. Unfortunately, an increase in inequality without an increase in mobility contributes to a greater disparity in the wealth gap (McMurrer, 1996). As Isaacs et al. (2008) noted, “42% of children born to parents in the bottom fifth of the income distribution remain in

the bottom, while 39% born to parents in the top fifth remain at the top." Compared to other countries, some scholars have found that mobility rates seem to be quite similar between countries.

However, in a much-heralded study led by economist Raj Chetty, another conclusion was drawn. Researchers measured intergenerational mobility by assessing children's relative income rank versus their peers against their parents' relative income rank versus their peers, taken at points in time approximately 15 years apart. They concluded, 'Your chance of achieving the American Dream is nearly twice as high in Canada relative to the United States (PDEandR Edge, 2022).'

Taking a closer look at the differences in outcomes for residents living in different regions within the United States revealed that where one lives can have a significant impact on mobility. Residents of New York, New Jersey, and Maryland enjoy greater upward intergenerational mobility and lower downward mobility compared to national averages on three measures: absolute mobility, relative mobility, and regional relative mobility. Other states in the Northeast performed well on at least two of the measures. On the contrary, residents of Louisiana, Oklahoma, and South Carolina experience the lowest economic mobility in all three measures, while their neighbors in other states in the region perform lower than the national average in two of the economic mobility measures (Economic Mobility Project, 2012).

Interestingly, while children in higher-income households saw relatively similar mobility[3] regardless of location, economic mobility varies significantly within the United States for low-income children (PDEandR Edge, 2022). Lower mobility in the Southeast coincides with larger African American populations, underscoring the reality that 58% of America's poor are racial or ethnic minorities. On the contrary, Hispanic, Asian, and White Americans experience higher

levels of economic mobility on average than both African Americans and Indigenous people (Chetty, 2018). Interestingly, adult children of immigrants outperform their peers in upward mobility, probably due to two things (besides potential participation bias in the study): Their parents' skillsets are higher than the jobs they have access to in America, and a willingness to relocate to places of increasing opportunity (Narea, 2019). However, it should be noted that scholars have found that in these areas White children are equally likely to rise through the economic ranks as their African-American counterparts (Gold, 2014). Still, others have found that Blacks and female-headed households are more likely to be living in poverty consistently (Ruggles, 2020; McMurrer, 1996).

In Charlotte, NC, a child born in poverty had the lowest chance (4.4%) in large cities of achieving a top-20% income by adulthood (compare this with 12.9% in San Jose) (Chetty, 2014). [As a result, city leaders set out to formulate a policy agenda to address the many factors that influence economic mobility, culminating in the Leading on Opportunity report (2017). They ultimately decided to focus their efforts on career readiness, early child education, and child and family stability. This is one example of policy mix development designed to drive upward mobility.]

Like Charlotte, cities in which there are higher degrees of racial segregation reflect lower economic mobility, and the differences between rich and poor neighborhoods are more pronounced (Sharkey, 2013). Neighborhoods with higher mobility rates for low-income children demonstrate higher median incomes, lower poverty rates, higher employment among adults, higher percentage of college graduates, higher performing schools, higher levels of social capital, and greater family stability (Charlotte Opportunity Initiative, n.d.).

For Black children, these neighborhoods are few and far between. In fact, when it comes to neighborhoods with a poverty rate below 10% that also have more than 50% of Black fathers present, only 5% of Black children grew up in a neighborhood in which both of these are true (Chetty et al., 2018). Exacerbating matters, Black children are more likely to live in food and health deserts, without both transit and social networks to facilitate job access. Often devoid of social and real capital, low-income residents lack the political power to advocate for more equitable outcomes in their communities (Turner et al., 2017). But what if they had allies in high places? This research explores economic mobility budget policy choices (and corresponding outcomes) in cities with larger populations of high-earning minorities to help answer the question: Does solidarity, shared experience, and advocacy matter? Do upwardly mobile Blacks "lift as we climb"? How could these learnings be used to optimize budget policy based on the demographic makeup of a city?

Washington, DC, is an example of a nationwide problem. There, researchers found that between 2008 and 2012, 38% of African-American teens and young adults were unemployed, compared with 5% of their White counterparts in the same age range. Those who work do not doing much better, with 1 in 4 earning less than $25,000 a year. This is a major source of concern in the US. According to Pew research (Isaacs, et al., 2008), more than half of Black children who grew up poor in the 1960s remained there as adults. Even more striking, 50% of Black children who grew up middle class in the same period reported incomes in the bottom quintile as well. This is disproportionate to their White counterparts, who came in at 16% and 31%, respectively.

As young adults move into prime-earning years, even in higher-paying jobs, mobility for Black workers indicates that trends remain consistent throughout working adulthood. Black

workers are underrepresented in higher-wage jobs and industries, and facing a lack of sponsorship and advocacy from executive management, they are less likely to rise through the corporate ranks. This disparity appears in the wage gap, which correlates with the mobility gap. In fact, the Mckinsey Institute findings suggest that 'addressing disparities in less than 4% of occupational categories' - mainly those in management and professional roles - 'could close more than sixty percent of the aggregate wage gap for black workers' (Hancock, 2021)

Black Americans in the Workforce

So where are the Black workers? To the tune of more than 50%, 'Black workers are concentrated in healthcare, retail, and accommodation food service (Stewart et al., 2021).' These jobs tend to be entry-level in industries that increasingly require higher educational attainment to progress. As the world transitions to a post-pandemic reality, the outlook is grim for Black workers: According to Mckinsey (2001), the MGI scenarios for post-pandemic changes, including increased automation and disruptions of the business model, show that "demand [is] falling for four of the top ten occupations with the highest absolute numbers of Black workers today (cashiers, janitors, cooks and retail salespeople)."

Education continues to be widely recognized as a path to economic mobility. Therefore, it follows that differences in school quality impact outcomes, with higher quality schools leading to higher income and educational attainment (Chetty et al., 2010). For example, Rothwell (2012) notes that 'the average low-income student attends a school that scores at the 42nd percentile on state exams, compared to the average middle / high-income student, who attends a school that scores at the 61st percentile on state exams.'

As it turns out, a closer look at the salaries of Black and White women reveals an interesting story. In general, the income gap is prominent. However, when comparing Black and

White girls of similar family means, it turns out Black and White women continue to earn relatively equal incomes as adults. Therefore, much of the income gap between Black and White women is largely attributable to the fact that so many Black girls are born into poor families (Narea, 2019).

It is an altogether different story when it comes to Black and White men. Interestingly, 'Black boys have lower rates of upward mobility than White boys in a whopping 99% of census tracts (Chetty, et al., 2018)'. This is true in poor *and* affluent neighborhoods, suggesting that environmental factors attributed to shaping boys' experiences, such as family environment, school quality, and neighborhood poverty, cannot fully explain the disparity (Reeves and Nzau, 2021). The largest contributor to the difference in mobility between Black and White men is wages of full-time workers, with Black men earning only 78% of White men's earnings in 2004. Second, employment rates between Black and White men varied significantly in 2004: 59.3 and 70.4 percent, respectively (Isaacs et al, 2008). In recent years, the Black unemployment rate has reached a historic low of 6.1% in 2019. However, Black workers are still more likely to be unemployed than White workers at all levels of education (Economic Policy Institute, 2020).

Lack of upward mobility for Black men, the decline of marriage rates, and neighborhood factors all contribute to declining intergenerational mobility at the household level, a disturbing trend (Isaacs, et al., 2008).

When it comes to business owners, analogous themes emerge. As documented in a report by the McKinsey Institute, revenue differences between Black-owned businesses vs. non-Black businesses can be attributed to a lack of representation in higher growth industries. In fact, 70% of the revenue gap is 'concentrated in just five industries': wholesale trade, real trade, construction, manufacturing, and professional/scientific/technical services (Stewart et al., 2021).

What prevents Black entrepreneurs from entering these industries? Most often, there is a lack of real and social capital. ‘White entrepreneurs start their businesses with $107,000 in capital on average, but the corresponding figure for Black founders is $35,000,” the findings noted (Stewart et al., 2021).

The Impact of Institutional Control on Policy Making

As the wealth gap in America widens, it is critical to develop and deploy effective policies to ensure that the American dream remains a possibility for all residents. From the federal to the local level, a significant amount of public dollars has been directed toward increasing economic mobility. Although an in-depth policy review at the local level is included in the research methodology, it is appropriate to cover how the institutional structure impacts policy at the local level, as well as briefly introduce the major policy instruments at the federal and state levels, as a basis for discussion.

The United States government structure itself, built on the principles of federalism, is a major factor in local policy. Federalism is defined as ‘a system of government in which the same territory is controlled by two levels of government’. In the United States, the Constitution makes provision for ‘dual sovereignty’, allowing the federal and state governments to share power to make laws while, in some sense, maintaining a level of autonomy from each other (Bednar, 2011).

However, this autonomy at the local level has been regarded by many scholars as demonstrably vulnerable to the whims of state and federal government. The ability of cities to operate as truly sovereign entities is undermined by a lack of authority to exercise the necessary powers to ‘create currency, limit immigration within their city limits' and independently manage

their revenue structures (Sbragia, 1996). In fact, Peterson's city limit theory suggests that cities are often incorrectly analyzed as if they were nation-states, exercising complete authority over their destinies. However, Peterson points out that the most pressing issues cities face–including economic mobility challenges–are generally outside of the purview of local politics (Peterson, 1981). In addition, he asserts that oftentimes cities and states are reacting to the actions of the federal authority, rather than acting as the driver of particular actions (Peterson, 2012). As a local elected official, I can attest to many issues impacting constituents are indeed, outside of local government (national defense, education funding, criminal charges and sentencing, bail bonds, and business practices, to name a few). In fact, Peterson argues that the lack of differentiation at the federal level in response to interstate fiscal inequity actually perpetuates social inequity. Still, at the local level, much can be done in the way of lobbying for federal and state assistance, and employing that aid in innovative ways via economic mobility programs tailored to address the locally-specific challenges within a city.

Every city in the nation, apart from the District of Columbia (which, though unencumbered by state authority, is totally encumbered by Congress), is generally operating under one of two types of decision authority in relation to the state. The first, called the Dillon Rule, is characterized by a more limited legal interpretation of the scope of the city, in which local governments can only exercise the powers that the state expressly (or immediately implicitly) grants them, as well as those required for the function of local government (Sbragia, 1996). Judge John Forest Dillon, for whom the rule is named, took the position that for cities that served as centers of larger regional communities, the power of formal public institutions to influence economic activity and private investment was more limited. However, the state could better exercise authority across city limits and over special-purpose regional investment

authorities (composed of appointed, rather than elected officials), thereby acting as a check to private industry (Sbragia, 1996).

Conversely, some states grant home rule authority to local municipalities, recognizing each level of government as having its own separate authority, under given conditions (Moore, 2020). Home rule cities enjoy a creative license in policy selection that their Dillon rule counterparts cannot claim for fear of the consequences of overreaching their authority. Stepping over the line in exercising their delegated authority invites punishment and, sometimes, retaliation from the state legislature, especially where political ideological differences between the locality and the state are present. These measures to reign in wayward Dillon rule cities can come in the form of reduction in funding for critical expenditures, or in the narrowing of decision authority in key legislative priorities, further handcuffing local officials. Sometimes these political skirmishes can have significant effects on the city and the state.

The City of Charlotte knows this all too well. In 2016, Charlotte passed a non-discrimination ordinance that specifically allowed transgender people to use the bathroom of their choosing. The North Carolina General Assembly quickly acted to pass House Bill 2, infamously dubbed the ‘bathroom bill’, which nullified Charlotte's ordinance, as well as forbade any other NC locality to pass non-discrimination ordinances. After a national public outcry and scores of businesses redirecting their expansions, relocations, and conventions (including the NBA All-Star game) out of North Carolina, the General Assembly relented in 2017, repealing the law. Despite the course correction, North Carolina is estimated to have lost billions of dollars in economic impact (Dalesio and Drew, 2017). Then-mayor Jennifer Roberts, who spearheaded the local ordinance, was defeated in the primary in her bid for reelection later that year.

Apparently, even those most likely to agree with her ideology did not want to sacrifice the city's economic position of the city for social issues.

Years later, the memory of the ordeal still looms large in the minds of elected officials as the city seeks to negotiate support for raising its debt ceiling and to secure permission to raise taxes for transportation. In fact, local authority is a significant political factor that impacts the city's approach to spending on economic mobility, so cities must consider their local authority when setting budget policy. This dynamic can act as both a deterrent from engaging in overtly inequitable policy, but can also be a hindrance to the enactment of innovative redistributive policy within city limits. The most robust decision support tool must reflect this reality.

Local, State, and Federal Government's Impact on Economic Mobility

Federal

The impact of US federal policy at the local level can be seen largely in the streets of every large city in the nation. In particular, the effectiveness of institutional racism, supported by legislation, is immediately present to even the untrained eye.

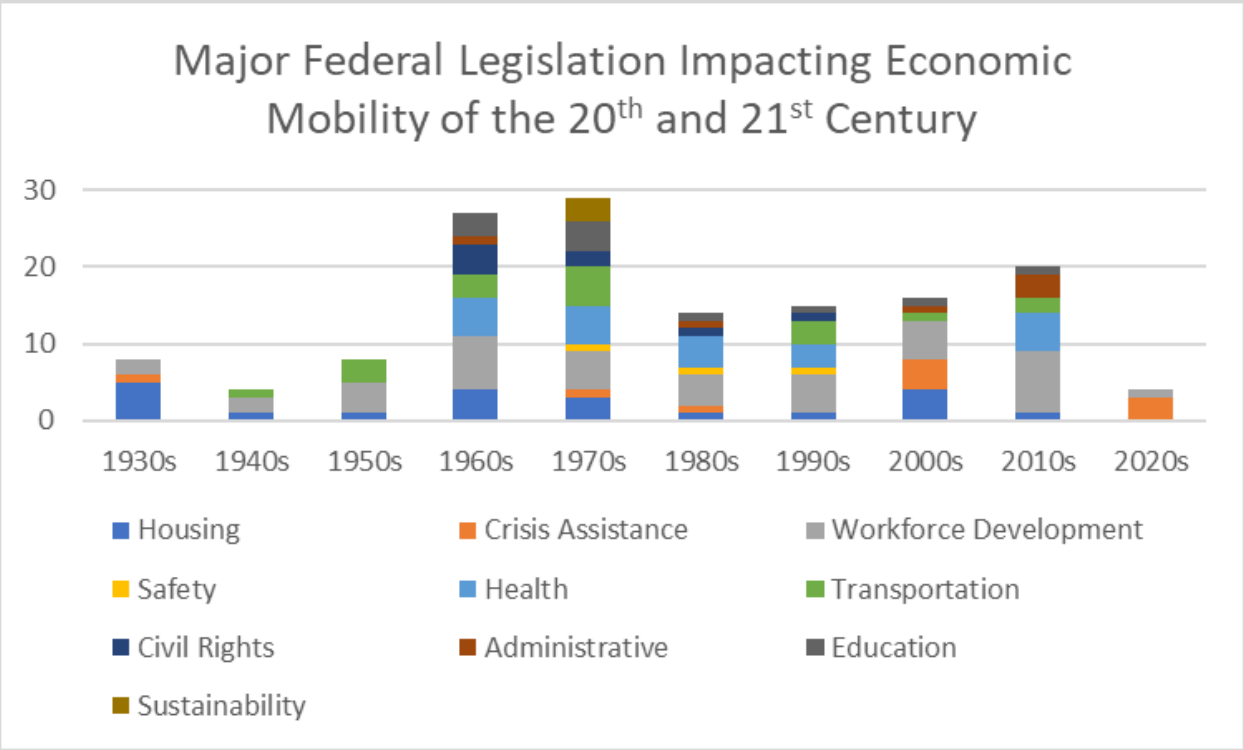
Before 1900, in the wake of Reconstruction, cities in America were characterized by racially diverse neighborhoods around the nation (Rothstein, 2017). In fact, poor Blacks and Whites showed political strength in alliances to overthrow the ruling elites in a number of electoral contests in North Carolina, Alabama, and Virginia (Semuels, 2017). As expected, this created fear in the ruling class, who moved quickly to shift the allegiance of poor Whites through orchestrated campaigns like the White supremacy movement in North Carolina (Hanchett, 2020; Prather, 1977). Part of that strategy was to ensure separation through a race-based housing

policy. As a result, US cities became increasingly racially segregated, and economic outcomes diverged for White and Black citizens.

Federal policy was a driving factor in this shift, particularly in public housing, at times with intention and other times with consequence.

Figure 4

Major Federal Legislation Impacting Economic Mobility of the 20th and 21st Century



Throughout the twentieth century, legislation shaping housing, urban development, education, healthcare, and other factors that impact mobility often dictated cities' ability to provide equal opportunity for their residents. However, in the post-Reconstruction Jim Crow South, even policies that should have been a catalyst for equity were implemented as vehicles to perpetuate economic oppression of Black Americans. In the wake of the Great Depression, segregation and housing discrimination was exacerbated by racist policies like the National

Housing Act of 1934 and the Home Owners Loan Corporation (HOLC) in 1937, which segregated public housing and simultaneously limited more desirable housing to White people (Fishback, et al., 2020). Then, after World War II came to an end, a combination of federal Housing and Urban Development policies and the GI Bill were enacted, which enabled White Americans to flee to the suburbs. The legacy of government-subsidized 'Levittowns' that explicitly excluded Black people as a funding condition endures, as previously purchased affordable homes have ballooned in value, contributing to the net worth of White families. These assets could be used for education, healthcare, and other factors that impact mobility. Furthermore, the 1949 federal Housing Act instituted the urban renewal program, which gave the legal authority to seize land in the target areas, largely inhabited by Black residents, to be redeveloped by private developers in the name of commercial investment (Lang and Sohmer, 2000).

Housing wasn't the only area in which African Americans were left out of prosperity. Another example of the negative impacts of federal policy is the grant of wage bargaining rights to unions that excluded African Americans from membership (Economic Policy Institute, 2017). This inherently disempowered Black people from negotiating for better working conditions, and thereby, a better life. Interestingly, although some unions saw the benefit of including Black workers among their ranks–thereby eliminating the opportunity for employers to hire lower paid non-unionized Black tradesmen–most unions continued to exclude Black, whether explicitly or in practice. According to Cassedy (1997), "In 1930 no more than 50,000 out of 1,500,000 Black workers engaged in transportation, extraction of minerals, or manufacturing were members of any trade union." Apparently, race was a stronger bond than class.

By the mid-1950s, cities were in such declining condition that the federal government was forced to intervene through a series of legislation meant to spur investment in US urban areas. Unfortunately, the Federal-Aid Highway Act of 1956 set the backdrop to enable interstate highways to be routed directly through Black communities, effectively reinforcing segregation as the de facto way of life in American cities for years to come, long after the legal framework had been dismantled. According to Fullilove and Wallace (2011), *"*Approximately one million people were displaced in 2,500 projects carried out in 993 American cities; 75% of those displaced were people of color".

In response, through the 1960s, the federal government made significant investments in American cities. They invested in education, transportation, and workforce development. Landmark legislation included President Johnson's Elementary and Secondary Education Act in 1965, whose Title 1 section focused on high poverty schools (Erickson, 2012), as well as the Urban Mass Transportation Act of 1964 and its subsequent transportation acts (Smerk, 1991), the creation of the Economic Development Administration through the Public Works and Economic Development Act of 1965 (Congress, 1965), and the Economic Opportunity Act of 1964 (Davies, 1992).

Regarding housing, several key policies shaped the construction of urban cities. The Housing and Urban Development Act of 1965, the Demonstration Cities and Metropolitan Development Act of 1966, and the Housing and Urban Development Act of 1968 worked together to take a comprehensive approach to area planning, guiding development, and construction in revitalizing targeted communities (Weiner, 1997).

National leaders took the approach that it was not just about bricks and mortar, but about people in cities (Tach, 2009). In addition to capital investments, many federal legislators

understood that cultural problems needed to be addressed. A series of progressively effective congressional acts–the Civil Rights Acts of 1957, 1960, and 1964, as well as the Voting Rights Act of 1965–formed the foundation for the political empowerment of, and educational and employment protections for Black Americans, among others. Additionally, the Civil Rights Act of 1968 aimed to expand federal enforcement provisions to combat housing discrimination through the Fair Housing Act (Sbragia, 1996).

The tides were turning. According to (Dilger, 2015), 'In concert with President Johnson's Great Society initiatives, Congress nearly tripled the number of federal grants to state and local governments during the 1960s, from 132 in 1960 to 387 in 1968.' However, despite efforts at the federal level, inequity persisted. Why? The answer lies in the composition of the US government grant structure[2].

> The three general types of federal grants to state and local governments are categorical grants, block grants, and general revenue sharing. Categorical grants can be used only for a specifically aided program and are usually limited to narrowly defined activities. Block grants can be used only for a specifically aided set of programs and are usually not limited to narrowly defined activities. General revenue sharing can be used for any purpose not expressly prohibited by federal or state law and is not limited to narrowly defined activities. (Dilger, 2015)

Therefore, although the federal government funded large-scale programs, the implementation of the program often fell to local officials to varying degrees based on grant

[2] which itself was a product of US political structure in which urban development stood at odds with Southern Democrats' desire to maintain segregation

type. In many cases, this led to what amounted to the federal sanction (or, rather, enablement) of resegregation, disinvestment in, and the outright destruction of Black neighborhoods, impacting economic mobility (Fullilove and Wallace, 2011). Many people were forced to relocate in search of better conditions and opportunities, tearing at the communal fabric of previously tight-knit neighborhoods (Fullilove and Wallace, 2011).

Despite the incongruence between federal policy and local-level impacts, growing resentment was brewing among Whites who felt this new, more politically prescriptive agenda threatened their way of life. Much like it would be in the 2016 post-Obama election, this 'White backlash' would open the door for a candidate who would be vaulted to victory in the thinly-veiled politics of race–Richard Nixon (Smith, 2015).

In keeping with his campaign promises, in 1972, then-President Richard Nixon officially declared the War on Drugs (Mayer, 2001). In its own right, this was meant to reduce crime in America's cities. Unfortunately, with the poor urban economic climate and the segregation of people of color into cities, the increase in drug enforcement and the restructure of sentencing for drug crimes disproportionately affected Black and Brown people. In the name of reducing crime, it became much easier to craft seemingly benign policies in such a way that racial oppression could continue (whether intentionally or unintentionally). With the Nixon administration at the helm, state and local officials enjoyed more discretion over how federal grants could be spent. Nixon led a shift further away from project categorical grants, which many saw as having become cumbersome in administration and overly restrictive in their scope, to block grants and general revenue sharing, an approach dubbed 'New Federalism' (Conlan, 2010).

However, before the end of the decade, significant legislation was passed, including the Equal Educational Opportunities Act of 1974, which prohibited discrimination against students

and teachers. (Adams, 1975). Continuing investment was made in transportation and housing through the Urban Mass Transportation Act of 1970 (as well as the Federal Highway Act of 1973, the National Mass Transportation Act of 1974, and the Federal Highway Amendments of 1974) and the Housing and Urban Development Act of 1970, respectively. In housing, despite the truncation of the public housing capital investment program, the Housing and Community Development Act of 1974 created Section 8 housing provisions for the subsidization of private housing, and the Housing and Community Development Act and the Community Reinvestment Act of 1977 sought to mitigate the impacts of previous redline policies (Gotham, 1998).

Workforce development was a key focus area in the 1970s legislative agenda, as well. The Occupational Safety and Health Act (OSHA) of 1970, the Equal Employment Opportunity Act of 1972, the Employee Retirement Income Act of 1974, the Overhaul of Vocational Education Programs in 1976, and the Comprehensive Employment and Training Act of 1973 (Rosenbloom, 1983)—which was later updated in the Job Training Partnership Act of 1982 (Congress, 1982), and eventually repealed by the Workforce Innovation and Opportunity Act of 2014 (Bird and Ganzglass, 2014)—served to increase opportunities for low-come teens and adults, as well as improve workplace conditions for all workers.

The 1980s brought with it the rise of conservatism. Ronald Reagan's 'trickle-down economics" and "tough-on-crime" bills, including the Comprehensive Crime Control Act of 1984 (Kantor, 2021), reflected the growing exacerbation with big government interventions that seemed to do little to stymie the decline of urban cities. Throughout his tenure, Reagan reworked federal block grants and consolidated additional federal assistance programs, resulting in aggregate funding that was 12% less than the previous sum of individual programs (Dilger, 2015). Despite the reduction in spending, when combined with an increase in defense spending

and large-scale tax cuts, the sum total of Reagan-era policies resulted in historic national debt, mass incarceration, and the explosion of the federal penal system, among other things (Heclo, 2008). However, the 1980s also brought about the passage of several economic mobility-related legislative actions, including the Job Training Partnership Act of 1982, the Social Security Amendments of 1983, Food Security Act of 1985, the Age Discrimination in Employment Act of 1986, the Housing and Community Development Act of 1987, the Civil Rights Restoration Act of 1987, and the Worker Adjustment and Retraining Notification Act of 1988 (Congress, 2023).

Reagan's successor, George H. W. Bush signed into law the Housing and Community Development Act of 1992, which introduced a number of programs meant to reform previous public housing initiatives, including funding the Home-ownership and Opportunity for People Everywhere (HOPE) programs (102nd Congress, 1992). Other notable legislation passed during his tenure included the Americans with Disabilities Act of 1990, the Civil Rights Act of 1991, and the Housing and Community Development Act of 1992 (Congress, 2023).

The 1990s-era Clinton administration sought to make crime a bipartisan issue, through the Violent Crime Control and Law Enforcement Act of 1994 (McCullom, 1994), which, among other things, incentivized states to enact harsher penalties for offenses committed, further increasing incarceration numbers, particularly for Black men. Consequently, this increased the number of single-mother households in urban neighborhoods. In his approach to community development, Clinton further pushed Nixon and Reagan's block grant framework by instituting a first-of-its-kind state block grant program called Temporary Assistance to Needy Families (TANF), the first of his major welfare reform initiatives, which also included the Workforce Investment Act of 1998 and the Personal Responsibility and Work Opportunity Act (Welfare Reform Act). Although this move gave states more discretion over welfare spending, its

elimination of programmatic specificity ushered in a waning of political advocacy previously employed by groups who had previously received individual earmarks. Furthermore, it made program evaluation and accountability through performance metrics more difficult to come by (Blank and Ellwood, 2001).

In the early 2000s, the George W. Bush administration oversaw a number of legislative acts impacting economic mobility, including the Economic Growth and Tax Relief Reconciliation Act of 2001, the Job Creation and Worker Assistance Act of 2002, the Small Business Liability Relief and Brownfields Revitalization Act, Jobs and Growth Tax Relief Reconciliation Act of 2003, and the controversial No Child Left Behind Act. Later, faced with navigating a mounting recession, Bush's second term saw the passage of several key economic recovery bills, including the Economic Stimulus Act of 2008, Housing and Economic Recovery Act of 2008, and Emergency Economic Stabilization Act of 2008.

The historic election of Barack Obama, the country's first Black president, ushered in a new optimism in the fight for racial equity. However, the hope for change was tempered by the reality of ongoing economic challenges. In response, Obama focused on turning the tide, shepherding through a suite of legislation including the American Recovery and Reinvestment Act of 2009, the Helping Families Save Their Homes Act of 2009, the Worker, Homeownership, and Business Assistance Act of 2009, the Hiring Incentives to Restore Employment Act, the Health Care and Education Reconciliation Act of 2010, the Patient Protection and Affordable Care Act, the Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010, the Middle Class Tax Relief and Job Creation Act of 2012, the Jumpstart Our Business Startups Act (JOBS Act), and the American Taxpayer Relief Act of 2012, the Workforce

Innovation and Opportunity Act, the Every Student Succeeds Act, and the Global Food Security Act of 2016.

In keeping with the historic trend of White backlash in the wake of civil rights advancement, in 2016, Donald Trump was vaulted to the presidency on a wave of White resentment and hatemongering. During his tenure, Americans saw the passage of the Tax Cuts and Jobs Act of 2017, the Economic Growth, Regulatory Relief and Consumer Protection Act, and (after Trump initially dismissed the global COVID-19 pandemic as a hoax) the CARES Act (Coronavirus Aid, Relief, and Economic Security Act). In 2020, Trump was defeated in his re-election run by Joe Biden, whose first significant bill was the American Rescue Plan Act of 2021.

Today, federal lawmakers seek to rectify the ills of previous generations through a variety of programs and incentives. Carasso (2008) investigated federal investment in economic mobility initiatives in the 2006 budget. Focusing on expenditures and tax subsidies driving mobility in personal income and assets, they outlined ten categories of interest.

- employer-related work subsidies (e.g., 401(k) plans and exclusion of employer contributions for medical insurance premiums and medical care)
- homeownership (e.g., capital gains exclusion on home sales and exclusion of net imputed rental income on owner-occupied homes).
- savings and investment incentives (e.g., dividend exclusion and expensing of certain small investments)
- education and training [e.g., Title I Education for the Disadvantaged, Higher Education including HBCUs (McKinsey Institute, 2021), and Job Corps]

- child health and nutrition (e.g., Medicaid and child nutrition); The ability to order groceries online with SNAP benefits is rapidly expanding across retailers and geographies as a USDA pilot program scales up.
- work supports (e.g., earned income tax credit [EITC] and child care entitlement to states) (Berlin, 2007), (Stewart, 2021)
- other child well-being (e.g., foster care and children's welfare services)
- business incentives and development (e.g., Economic Development Administration and Small Business Administration)
- citizenship services (e.g., refugee and entrant assistance)
- equal opportunity services (e.g., minority business development and Equal Employment Opportunity Commission) [Because much of this comes from employer-related subsidies, this flows mostly to middle- and upper-income people, rather than lower income.]

In his review, Carasso found that 'almost 60% of federal expenditures went to taxpayers in the highest income quintile, in which Black Americans are underrepresented." Therefore, despite significant investment by the federal government, inequality has not only persisted, but increased. Unfortunately, those who might most benefit from assistance are not the target of public spending.

One policy initiative that has received a lot of attention and has been evaluated for effectiveness is the U.S. Moving to Opportunity program. The policy provided housing vouchers to allow low-income families to move to low-poverty neighborhoods, with mixed results. On the one hand, for children under 13, researchers found that children in relocated families earned more than those who remained in high-poverty neighborhoods. However, those earnings were not substantial enough to increase mobility enough for affected children to move to a higher

income rank. Furthermore, for children who moved to new neighborhoods after age 13, the program appeared to have a negative effect on the outcomes.

Chetty noted that low-poverty neighborhoods were not necessarily well suited for upward mobility, as many of the key features, such as less segregation, better schools, and more efficient transit, were not expressly present. He suggests that, with these changes, the MTO program could enable greater mobility (PDEandR Edge, 2022).

Although there are several policies to specifically address economic mobility, a number of federal policies have had indirect impacts on economic mobility in the United States, typically negative. For example, foreign trade policy and the globalization of the US economy have resulted in the elimination of more than five million manufacturing jobs, the exact kind of skilled labor opportunities that enabled workers to rise to the middle class. As a result, Black and Hispanic workers, who are disproportionately non-college educated, have even more limited access to better paying jobs. Researchers have proposed investing in skilled labor jobs and setting clear equity (Scott et al., 2022). Domestically, the No Child Left Behind Act of 2001 aimed to establish high scholastic standards and implement metrics to hold schools accountable for educational outcomes across the nation. However, it also introduced school choice vouchers, which enabled parents to move their children from underperforming schools to better schools in the district. As one can imagine, this migration of high-achieving students (and their involved parents) resulted in dismal circumstances–and reduced federal funding–for those who were indeed “left behind (Sanger, 2001).”

Federal investment in higher education has been shown to be a powerful driver of economic mobility (Chetty et al., 2014). If low-income students can earn college degrees, they

enjoy much greater mobility gains. Unfortunately, the probability of earning a college degree for those who grow up in the lowest quintile is low.

Policy advocates across the country continue to work to influence policy makers on several initiatives. The proposed policies include the following.

- raising the federal minimum wage (Zipperer et al., 2021)
- investment in CDFI capacity (Howell, 2021)
- transit Investment
- canceling student debt (Miao, 2022)
- baby bonds
- Medicare for All (Inequality.org, 2019)

State

At the state level, several policies impact economic mobility, like education and health initiatives, although the literature at the state level is lacking. Education funding, parental education, and within-school disparities are well documented to be key factors in economic mobility and are areas in which states play a key role (Jackson, 2018; Atteberry and McEachin, 2020). In addition, state licensing laws impact the entrepreneurship climate in the state, for better or worse (Klein, 2021).

With regard to education, states invest on multiple levels. In addition to elementary and secondary education, states invest in public universities, and some institutions have added enrichment programs to increase completion rates for first-generation college students (Stewart, 2021). Many states also provide job training programs for adults (Grawe, 2008), as well as invest in early and k-12 education.

One of the cornerstones of American society has been the skilled labor workforce. From tool and die makers to masons, skilled labor workers remain in demand today. Not only does investing in technical training ensure a viable workforce, careers in the trades have proven excellent vehicles for economic mobility. In recent years, higher mobility states like Virginia, Maryland, Michigan, and Connecticut have been particularly focused on enacting legislation to bolster Career and Technical Education programs, as have Louisiana, Mississippi, and Alabama (presumably in an effort to reverse their own historically low economic mobility trends) (Economic Mobility Project, 2012). Initial results are promising. In Virginia, Blowe and Price (2012) found that students who completed CTE training achieved statistically significant scores than their counterparts who did not complete the program.

Unfortunately, the strength of these workforce development initiatives varies from state to state. North Carolina, South Carolina, and Florida boast relatively modest CTE reform agendas in the 21st century, despite having worse mobility than the national average (Education Commission, 2023). Education funding, parental education, and within-school disparities are well documented to be key factors in economic mobility (Jackson, 2018; Atteberry and McEachin, 2020).

Regarding health care and economic mobility, O'Brien and Robertson (2018) investigated the impact of Medicaid expansion across states (which provide health services to vastly varying degrees) on intergenerational mobility for Medicaid recipients. They concluded that expanded eligibility for low-income pregnant women led to better economic outcomes for their children in adulthood. Interestingly, they found no significant correlation for children who received Medicaid benefits later in their childhood.

Local

Despite the power states wield in the policy landscape, at times the needs of cities seem more pressing than and loom larger than the help coming from the state capitol. Much closer to home, local municipalities can significantly affect economic mobility for their residents. Across the country, cities are seeking effective policies in key areas, generally outlined below (Results 4 America, n. d.):

- education and youth development
- health and well-being
- workforce development
- justice and public safety
- housing
- community development and financial security
- transportation
- financial access (Results 4 America, n.d.)

Local government officials must navigate the political environment at both the state and federal levels. In general, the federal government influences state and local policy through restricted spending grants (Khan Academy, 2022). The need for federal funding can drive changes in local policy to access additional resources.

In the District of Columbia, local leaders struggle to find ways to improve education, workforce, and health outcomes for residents, particularly minorities. Interestingly, more than 30% of residents do not have formal education beyond high school, and that number rises to *more than half* when considering Black and Hispanic residents exclusively (Acs, 2015). To combat mobility challenges, policymakers are focusing on areas to improve education and higher-quality job opportunities for residents. Other cities around the country, such as Charlotte,

NC, are also investigating ways to reduce segregation and provide more access to affordable housing in desirable areas (Charlotte Opportunity Initiative, n.d.). Atlanta is investing in food access initiatives in the target communities (Stewart, 2021). However, the path to better outcomes is fraught with implementation pitfalls, often creating unintended consequences as a result of well-intentioned policies (Charlotte Opportunity Initiative, n.d.). Officials must also weigh the pros and cons of addressing immediate needs - with policies like minimum wage increases, reparations (Perry and Barr, 2021), and temporary cash transfers (Murdoch and Schneider, 2021) - with long-term solutions (Chetty et al., 2018). Evidence that additional investment in other efforts such as mentoring Black boys, racial bias education, and criminal justice reform increases intergenerational mobility is also mounting (Chetty et al., 2020).

To achieve greater mobility, public policy alone is not enough. Local governments must work alongside private partners such as affordable housing providers, employers, community development financial institutions, non-profit organizations, and, most importantly, residents themselves, to take a holistic view of social support in communities (Gallagher, 2018).

The purpose of this paper is to examine the impact of political ideological differences between the levels of government on city grant allocations, as well as the impact of local authority on specific types of spending. Substantial research has been conducted on identifying political and socioeconomic determinants, as well as defining theories regarding how and why funding allocation decisions are made. The business of allocating federal funds, some scholars assert, tends to be largely proportionally based. Copeland and Meier (1984) concluded that population is the overwhelming factor in the allocation of federal grant funds, which Stein (1981) had declared, albeit for different reasons (capacity of smaller communities to apply for funding). Several others posited that with population came greater tax bases and, therefore, a

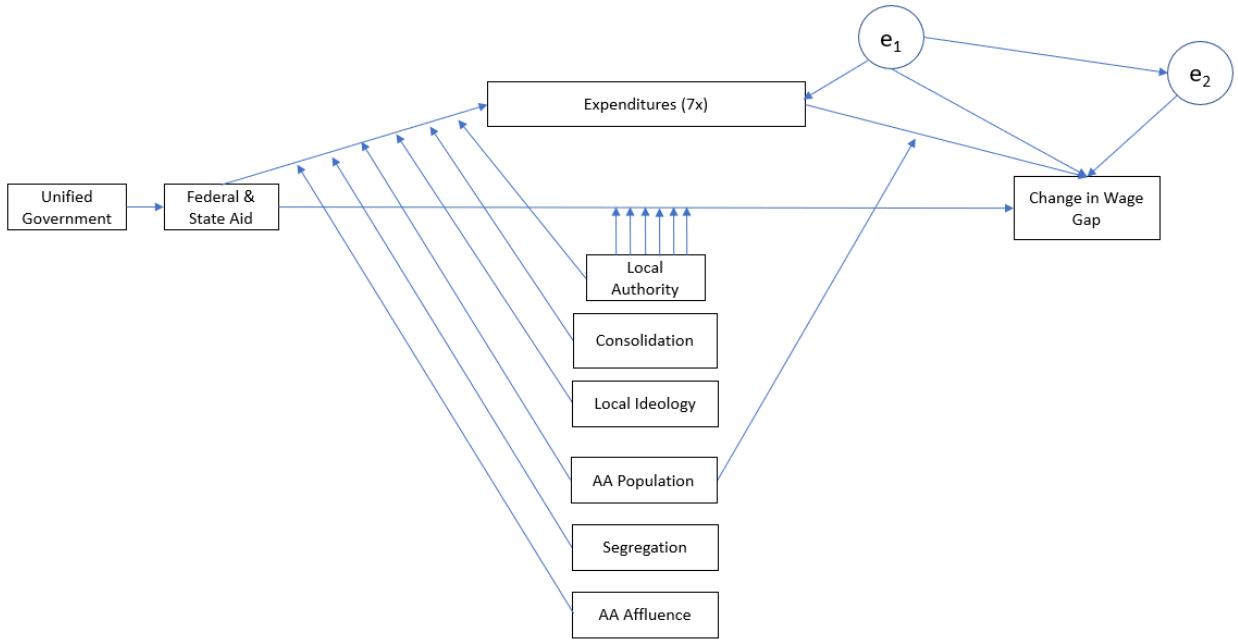
stronger position from which larger cities could meet grant matching requirements (Gist and Hill, 1981). Several other scholars focused on myriad other factors, including those driven by the recipient jurisdictions like community need and intergovernmental collaboration, as well as political-economic cycles, as elected officials look to secure a subsequent term from key voting blocs. Still others explained funding allocations as a function of political preferences between ruling parties (pork belly politics, for instance), and the impact of the ability of influential political actors to curry political preferential treatment in the allocation process (Rich, 1989; Bickers and Stein, 2004; 2000; Bond and Fleisher, 1990; Dye, 1990; Stam and Reid, 1980; Mayhew, 1974).

However, the literature is scarce on the determinants of federal funds in longitudinal studies analyzing the impact of institutional control. Schaal (2009) considered the longitudinal approach for crime control and, but stopped short of any attempt to link allocations to socioeconomic outcomes. I argue that political ideological alignment lends itself to more consensus and, for Democratic majorities, leads to more investment in economic mobility-related policy. This, in turn, will result in a decrease in the racial wealth gap. Furthermore, I expect that Democratic-led home-rule cities will spend more overall and invest in more innovative policies than Dillon-rule cities, resulting in a greater decrease in the racial wealth gap. When benchmarking economic mobility policies and budget allocation, city officials would do well to consider the political climate within which peer cities enacted successful legislation.

Theoretical Framework

Figure 5

Government, Funding, and Economic Mobility Theoretical Framework



Economic Mobility Policy Portfolio Optimization

Part of the reason public policy decisions are more complex is that policy makers have multiple conflicting objectives. The goal is to ensure that policy initiatives work together to deliver an overall improvement in the quality of life of the constituents, which is achieved through optimization of the policy mix.

A policy mix is a set of policy instruments whose interactions collectively impact the desired outcomes (Ghazinoory, 2019). The definition of a policy mix can be extended to include the strategic hierarchy of policy decisions at various levels of government, delegating authority in a way that supports maximum effectiveness in meeting goals. The aim is to optimize trade-offs between policy effects to optimize overarching goals. Understanding the importance of synergy between policies has led to research on the development of policy mix in sustainability

policy (Ring and Schröter-Schlaack, 2011; Lehmann, 2012; Reichardt, 2013), innovation policy (S. Ghazinoory et al., 2013; Flanagan, Uyarra, and Laranja, 2011), energy policy (Boonekamp, 2006; Fischer and Preonas, 2010) and transportation policy (Givoni et al., 2013; Justen et al., 2014). As the need for evaluation of the policy mix increases, scholars have turned their attention to developing a standard framework (Justen et al., 2014; Matt et al., 2013b; Taeihagh, Baares-Alcántara, and Givoni, 2014).

The characteristics of a policy mix can be assessed considering its consistency, coherence, congruence, credibility, stability, and comprehensiveness (Howlett and Rayner, 2013; Rogge and Reichardt, 2013). Howlett and Rayner (2013) define consistency, the crucible characteristic, as 'the ability of instruments to reinforce, rather than weaken, each other to achieve separate policy objectives'. Various methods have been presented to determine the level of complementary interaction between individual instruments in a policy mix (Boonekamp, 2006; Del Rio and Howlett, 2013; Taeihagh, Baares-Alcántara, and Givoni, 2014; Howlett, 2004; Konidari and Mavrakis, 2007; Rey, Anil Markandya, and Drummond, 2013; Boonekamp, 2006).

Researchers in various fields have developed tools and methods to support public policy decision makers. Multi-criteria decision making (MCDM) is an operations research discipline focused on developing strategies that enable decision makers to manage competing interests in real-world decisions. MCDM is further subdivided into two branches: multiattribute decision analysis and multi-objective optimization (Abdulgader et al., 2018). Multiattribute decision analysis deals with the challenge of selecting the best from known alternatives, each of which has associated risk and uncertainty (Karim, 2000). Much of the decision-analysis research in public policy can be classified in this category.

In contrast to multi-attribute decision analysis, multi-objective optimization (MOO) research seeks to establish tools and methods to identify optimal choice sets that meet the decision maker's goals. MOO uses the economic principle of 'Pareto optimality' to define desirable choice sets. Pareto optimal solutions are those in which it is impossible to further improve the position of any one stakeholder without negatively impacting another (Karim, 2000).

The optimization algorithm scholars have used one, multiple, or some combination of MOO methods to identify optimal solutions on various policy topics. Sali (2016) used linear programming methods to structure a multi-objective optimization problem to explore land use for agriculture in Milan, Italy. Using a two-objective model (technically below the four-objective threshold for MOO) as a case study in Switzerland, Schwaab (2018) identified optimal locations for urban development while preserving fertile soil. In addition, the model allowed his team to measure the impact of delayed development on the increase of suboptimal land use for urban development.

In recent years, more sophisticated methods have been developed. There is a growing body of work in the literature on policy design to address uncertainty, as urban planning is inherently a practice based on assumptions about the future. As the urbanization of developed countries continues, so does the complexity of managing diverse populations and their corresponding needs. For example, Hamarat (2014) leveraged the evolutionary algorithm technique, the non-dominated classification genetic algorithm II (NSGA-II), to generate multiple potential solutions simultaneously to support the expansion of renewable energy in the European Union. Citing the limitations in optimizing real-time and exponential growth problems, Guo (2020) used an integrated content analysis and clustering method to develop a quantitative policy

design framework and identify the optimal mix of policy tools and tools for the rental housing market in China. In the area of transportation planning, Armas (2017) combined MOO and simulation to optimize service levels to improve mobility in the urban environment while minimizing operational cost, providing decision makers with solutions based on desired service levels as input in policy design. Urban planning, transportation, energy planning, and urban design are increasingly being seen as a multi-objective optimization problem, as scholars abandon the sequential single objective approach for evolutionary algorithms (Chen et al., 2017; Jiang-Ping, 2019; Ascione, 2016; Matott, 2012; Abdulgader et al., 2018; Wicki, 2020; Pakdel et al., 2020; Nyahora, 2020; Zhong et al., 2018; Bruno, 2011; Jing et al., 2018; Lubida, 2019; Sharmin, 2018; Wang, 2021).

My research is concerned with leveraging (MOO) to generate alternative economic mobility policy options in local urban governments.

Currently, mathematical models for economic mobility have focused on mapping trends in income across generations and demographics (Honner, 2018), rather than optimizing the portfolio mix. Multi-objective optimization has been used to evaluate the housing mix in an urban area. Johnson (2001) used MOO to assess optimal public housing locations in the greater Chicagoland area. However, scarce is the literature for policy portfolio optimization through modeling, and nothing in regards to multi-objective optimization for economic mobility on the whole.

Summary

In this chapter, I covered the policy process and decision-making theoretical framework, provided an overview of the economic mobility problem in America, and explored multi-

objective optimization as a decision support tool solution for improved economic mobility budget policy. The review of the literature included a general overview of the policy process and the theoretical framework for decision making, as well as the political and social factors that influence the allocation of budget related to economic mobility and the selection of policy instruments for local urban governments in the United States over the past century. I also reviewed multi-objective optimization applied to public policy as a basis for understanding the methodological approach. Finally, I presented a case study, detailing a theory of the policy selection and budget allocation process to describe how multi-objective optimization can be used to improve the economic mobility gap via data-based decision making as input into policy selection.

Chapter 3: Research Methodology

This chapter outlines the data and methods that underpin the research analysis. I cover the data used in the analyses, summary statistics, data sources, preliminary analysis, and subsequent chapter research designs. For context, preliminary investigations conducted to explore existing policy instrument options, as well as expected interactions between policy instruments based on the literature, are also included. I conclude with an illustrative example of the formulation and methodology of the multi-objective optimization steps.

Data

To examine the relationships between economic mobility and socio-political factors, and to build the appropriate multi-objective optimization model, I compiled a dataset using a variety of social, political, population, and budget policy data from three main sources: the American Community Survey, the Lincoln Institute of Land Policy, and US Congressional Archives. Additional sources include state legislature archives, individual city websites, Ballotpedia, the 2014 Chetty study, the Legislative Research Office, US Census of Governments, Simply Analytics, and the National Conference of State Legislatures. Table 1 outlines the data variables, while Table 2 offers summary statistics of these variables of interest, which I will discuss in detail below.

Table 1

Data Variables

RQ#	Variable	Type	Nature of Data	Source	Chapter
1,2	White median household income	DV	median White household income by year 2010-2020 in the top 50 US cities (by population as of 2020 US Census)	American Community Survey	4,5
1,2	Black median household income	DV/Mod V	median Black household income by year 2010-2020 in the top 50 US cities (by population as of 2020 US Census)	American Community Survey	4,5

RQ#	Variable	Type	Nature of Data	Source	Chapter
1,2	Median earnings by sex (M/F) and race (AA/W) (including PT workers)	DV	median earnings by year 2010-2020 in the top 50 US cities (by population as of 2020 US Census)	American Community Survey	4,5
1	Mayor's party	IV/Mod V	Mayor's political party every year 2010-2020 for top 50 US cities (by population as of 2020 US Census)	Ballotpedia	4
1	State legislature party majority	IV	partisan majority every year 2010-2020 for states corresponding to top 50 US cities (by population as of 2020 US Census)	Ballotpedia, National Conference of State Legislatures	4
1	US Senate party majority	IV	partisan majority every year 2010-2020	US Senate Website	4
1	US House party majority	IV	partisan majority every year 2010-2020	US House Website	4
1	Federal Aid	Med V	Total federal aid awarded by year 2010-2020 to the top 50 US cities (by population as of 2020 US Census)	Lincoln Institute of Land Policy	4
1	State Aid	Med V	Total state aid awarded by year 2010-2020 to the top 50 US cities (by population as of 2020 US Census)	Lincoln Institute of Land Policy	4
1,2	Higher Education Expenditure	Med V	Fiscally Standardized Cities Total spent on higher education in the city (all local government entities) by year 2010-2020 to the top 50 US cities (by population as of 2020 US Census)	Lincoln Institute of Land Policy	4,5
1,2	Elementary and Secondary Education Expenditure	Med V	Fiscally Standardized Cities Total spent on Elementary and Secondary Education in the city (all local government entities) by year 2010-2020 to the top 50 US cities (by population as of 2020 US Census)	Lincoln Institute of Land Policy	4,5
1,2	Libraries Expenditure	Med V	Fiscally Standardized Cities Total spent on Libraries in the city (all local government entities) by year 2010-2020 to the top 50 US cities (by population as of 2020 US Census)	Lincoln Institute of Land Policy	4,5
1,2	Cash Assistance Expenditure	Med V	Fiscally Standardized Cities Total spent on Cash Assistance in the city (all local government entities) by year 2010-2020 to the top 50 US cities (by population as of 2020 US Census)	Lincoln Institute of Land Policy	4,5
1,2	Vendor Payments Expenditure	Med V	Fiscally Standardized Cities Total spent on Public Welfare Vendor Payments in the city (all local government entities) by year 2010-2020 to the top 50 US cities (by population as of 2020 US Census)	Lincoln Institute of Land Policy	4,5
1,2	Other Public Welfare Expenditure	Med V	Fiscally Standardized Cities Total spent on Other Public Welfare in the city (all local government entities) by year 2010-2020 to the top 50 US cities (by population as of 2020 US Census)	Lincoln Institute of Land Policy	4,5
1,2	Health Expenditure	Med V	Fiscally Standardized Cities Total spent on Health in the city (all local government entities) by year 2010-2020 to the top 50 US cities (by population as of 2020 US Census)	Lincoln Institute of Land Policy	4,5
1,2	Housing and Community Development Expenditure	Med V	Fiscally Standardized Cities Total spent on Housing and Community Development in the city (all local government entities) by year 2010-2020 to the top 50 US cities (by population as of 2020 US Census)	Lincoln Institute of Land Policy	4,5
2	# and % AA pop (total)	Mod V	# and % of the population who identifies as African American by year 2010-2020 in the top 50 US cities (by population as of 2020 US Census)	American Community Survey	5
2	Segregation Index	Mod V	Dissimilarity Index	US Census, ACS	5

RQ#	Variable	Type	Nature of Data	Source	Chapter
1	Local Authority	Mod V	Home or Dillan Rule for the top 50 US cities by population as of 2020 CENSUS	Legislative Research Office	4
1	Consolidated City-County Government	Mod V	Denotes consolidated status for the top 50 US cities by population as of 2020 CENSUS	Lincoln Institute of Land Policy	4
1	Population	CV	City population by year	American Community Survey	4,5
1,2	State	CV	State each city is located in for the top 50 US cities (by population as of 2020 US Census)	US Census of Governments	4,5
1,2	% population under 18	CV	% population under 18 by year 2010-2020 in the top 50 US cities (by population as of 2020 US Census)	American Community Survey	4,5
1,2	% AA Single Mother Homes	CV	% AA female head of household, no spouse by year 2010-2020 in the top 50 US cities (by population as of 2020 US Census)	American Community Survey	4,5
1,2	% White Single Mother Homes	CV	% White female head of household, no spouse by year 2010-2020 in the top 50 US cities (by population as of 2020 US Census)	American Community Survey	4,5
1,2	Employment Status by sex (M/F) and race (AA/W)	CV	% employed by sex (M/F) and race (AA/W) by year 2010-2020 in the top 50 US cities (by population as of 2020 US Census)	Simply Analytics	4,5

Note: RQ = Research Question, IV = Independent Variable, Mod V = Moderate Variable, Med V = Mediator Variable, DV = Dependent Variable

Table 2

Summary Statistics

Summary Statistics

Continuous Variables

Variable	N	Mean	Std. Dev.	Min	Pctl. 25	Pctl. 75	Max
Population	495	680698	308337	295285	457331	798961	1665118
Median White Household Income	495	$60,773.00	$15,829.00	$28,676.00	$51,510.00	$67,646.00	$140,437.00
Median Black Household Income	495	$35,436.00	$8,533.00	$19,500.00	$29,980.00	$40,041.00	$72,325.00
Wage Gap	495	$25,337.00	$14,434.00	-$9,417.00	$18,454.00	$28,844.00	$106,933.00
Change in Wage Gap	450	$898.00	$1,691.00	-$5,218.00	-$9.50	$1,541.00	$10,849.00
Median White Male Household Income	495	$40,420.00	$9,841.00	$22,440.00	$34,805.00	$43,744.00	$95,696.00
Median White Female Household Income	495	$31,282.00	$7,552.00	$16,286.00	$26,744.00	$33,531.00	$71,935.00

Summary Statistics

Median Black Male Household Income	495	$27,454.00	$4,281.00	$18,318.00	$24,582.00	$30,154.00	$41,805.00
Median Black Female Household Income	495	$24,503.00	$3,681.00	$15,826.00	$21,650.00	$27,155.00	$35,395.00
Black Population	495	146224	140481	12340	59451	219666	668573
% Black Population	495	0.22	0.19	0.03	0.07	0.28	1
Degree of Segregation	52	0.054	0.45	-1.1	0.15	0.26	0.47
Federal Aid	360	$268,266,398.00	$219,989,956.00	$24,958,731.00	$123,438,928.00	$351,399,750.00	$1,336,782,592.00
Federal Aid per Person	360	$422.00	$347.00	$35.00	$208.00	$498.00	$2,161.00
State Aid	360	$1,059,722,473.00	$696,796,861.00	$199,539,812.00	$558,067,321.00	$1,334,104,169.00	$4,776,802,119.00
State Aid per Person	360	$1,584.00	$732.00	$493.00	$1,088.00	$2,066.00	$4,686.00
Higher Ed Spending	360	$5,239,626.00	$22,926,900.00	$0.00	$0.00	$0.00	$166,452,169.00
Higher Ed Spending per Person	360	$8.20	$34.00	$0.00	$0.00	$0.00	$198.00
Elementary and Secondary Ed Spending	360	$1,102,388,624.00	$555,635,843.00	$188,591,622.00	$727,861,305.00	$1,306,848,622.00	$3,143,791,620.00
Elementary and Secondary Ed Spending per Person	360	$1,641.00	$371.00	$550.00	$1,393.00	$1,886.00	$2,845.00
Libraries Spending	360	$30,641,268.00	$20,342,858.00	$0.00	$15,956,024.00	$41,216,047.00	$109,963,442.00
Libraries Spending per Person	360	$47.00	$27.00	$0.00	$28.00	$58.00	$159.00
Cash Assistance	360	$28,530,003.00	$85,115,462.00	$0.00	$0.00	$4,727,396.00	$726,909,356.00
Cash Assistance per Person	360	$43.00	$115.00	$0.00	$0.00	$11.00	$895.00
Vendor Payments	360	$18,216,546.00	$48,091,701.00	$0.00	$0.00	$8,356,169.00	$296,064,907.00
Vendor Payments per Person	360	$24.00	$59.00	$0.00	$0.00	$14.00	$305.00
Other Public Welfare Spending	360	$69,283,602.00	$90,367,225.00	$0.00	$9,599,419.00	$78,230,706.00	$485,850,065.00
Other Public Welfare Spending per Person	360	$102.00	$114.00	$0.00	$15.00	$155.00	$582.00
Health Spending	360	$174,544,191.00	$297,502,693.00	$0.00	$35,327,583.00	$177,700,860.00	$1,919,241,293.00
Health Spending per Person	360	$242.00	$322.00	$0.00	$59.00	$285.00	$2,298.00
Housing and Community Development Spending	360	$206,768,696.00	$183,574,447.00	$0.00	$77,698,050.00	$265,291,336.00	$862,964,122.00
Housing and Community Development Spending per Person	360	$335.00	$341.00	$0.00	$129.00	$416.00	$2,078.00
% Black Female Head of Household	495	0.27	0.049	0.09	0.24	0.3	0.38
% White Female Head of Household	495	0.1	0.032	0.03	0.08	0.12	0.2
Full-Time Employed, White Females	495	64226	34029	6493	39613	78601	189275
Full-Time Employed, White Males	495	87200	47134	9967	55070	104864	262830
Full-Time Employed, Black Females	495	21895	20524	1892	7740	30923	105713
Full-Time Employed, Black Males	495	19276	15959	2203	7589	26382	83483

Binary and Indicator Variables

Summary Statistics

Variable	N	Non	Dem	Ind	Rep	Yes	No
Mayor's Party	539		350	36	33	120	
State Legislature Majority Party	495		33	306	36	120	
Local/State Party Alignment	495					299	196
US House Majority Party	495		0	135	0	360	
US Senate Majority Party	495		0	225	0	270	
Local/Congress Party Alignment	495					70	423

Social Variables

My primary dependent variable accounted for African American relative economic mobility in the top 50 American cities by population, as per the 2020 US Census, over the period 2010-2020. My key dependent variable was operationalized as the change in racial wage gap, or more simply put, the change year-over-year in the difference between White median household income and Black median household income. The change in wage gap and economic mobility are inversely related–therefore, a positive change in the wage gap is equal in magnitude and opposite in direction of economic mobility. For example, if the control wage gap in a given city increased by $500 year-over-year, the relative economic mobility for African Americans would be described as -$500. Income data was sourced from the American Community Survey, from which the wage gap was calculated for each city from 2010-2020. The dependent variable ranged from -$5,218 (in El Paso, where African Americans out-earn their White counterparts, likely due to a large armed forces population) to $10,849 (San Francisco, the heart of the technology sector, which has been largely dominated by Whites and Asians). The distribution of the wage gap by city can be seen in Figures B.1-B.5.

One major aspect of my model dealt with social factors specific to African American affluence and population in a given city. I included the African American population and

percentage of the total population, taken from the American Community Survey. I also included the dissimilarity index as a measure of segregation, sourced from the US Census and the American Community Survey. When unavailable, the previous year coefficient was carried forward.

Lastly, control variables included the state, population, percent population under 18, percent single mother households for both Whites and African Americans, and percent full-time employment of African Americans, each sourced from the American Community Survey and US Census data.

The unit of analysis was the 'proper' city, as defined by the US Census.

Political Variables

Another primary aspect of my model was the political alignment across levels of government. As such, I collected data to measure unified government across local, state, and federal institutions by comparing the majority party at three levels of government for each city: Mayor's party, state legislature majority, and congressional majority. Data for the mayor's party were assigned via indicator variables as follows: Non-partisan (1), Democrat (2), Independent (3), Republican (4). Indicator variables describing the state legislature majority were assigned in a similar way: Democrat (1), split (0), Republican (4). Then, state unified government was assigned a binary dummy variable based on status of party match (in which the mayor's party and the state legislature majority party was the same) or split government (1 or 0, respectively). An analogous process was followed at the federal level to determine federal party match as compared to the city. Unified government at all levels was captured as a binary variable, with 1 denoting unified government and 0 otherwise.

I further explored the variation in local authority that is granted to cities as well as the nature of city-county relationships with two additional variables. Local authority was represented by a binary dummy variable indicating local level authority, sourced from the Legislative Research Office and individual city websites (or 311 inquiries, as necessary). Home rule cities have been assigned a 1, while Dillon rule cities were assigned a zero. Furthermore, consolidation was represented by a binary dummy variable representing the status of city-county consolidation, sourced from the Lincoln Institute of Land Policy. Consolidated cities were assigned a 1, while non-consolidated cities were assigned a zero.

Policy Variables

The primary source for revenue and expenditure data was from the Lincoln Institute of Land Policy's Fiscally Standardized Cities (FiSC) Database. Using a methodology (Langley, 2020) developed by Howard Chernick, Adam Langley, and Andrew Reschovsky, "FiSCs are constructed by adding revenues and expenditures of each central city municipal government to a portion of the revenues and expenditures of overlying governments, including counties, independent school districts, and special districts." This enabled apples-to-apples comparison of city investments at the local level. In addition, I normalized the spending per person ($/person) in the broader analysis for clarity of comparison. In addition, financial and state aid, as well as budget expenditures divided into the following investment categories: higher education, elementary and secondary education, libraries, cash assistance, other public welfare, health, and housing and community development. All budgetary data was in 2017-adjusted US dollars. Category spending by year for each city is illustrated in Figures B.18-B.23.

Although the categories represent broad categories of interest, they did not reach a level of granularity such that the individual programs within each bucket are listed. Still, this provided a sufficient basis for developing a foundational multi-objective optimization model.

Supplemental Policy Analysis

As a supplementary exercise, I leveraged the Economic Mobility Catalog (EMC) (Results 4 America), in order to further understand the types of individual policy instruments that made up the larger budget expenditure categories. The EMC combines policies and program evaluations conducted by the nation's top clearinghouses, including, The Pew-MacArthur Results First Clearinghouse**,** The U.S. Department of Education, Institute for Education Sciences' What Works Clearinghouse**,** The US Department of Labor's Clearinghouse for Labor and Evaluation Research (CLEAR), The County Health Rankings and Roadmaps' What Works for Health Clearinghouse, Blueprints for Healthy Youth Development**,** The Department of Justice's Crimesolutions.gov, and Arnold Ventures' Social Programs That Work.

Understanding the policy tool mix began with identifying current policies enacted in local urban governments across the US to increase economic mobility. This policy listing formed the basis for the options in the policy portfolio. Individual policy interventions were limited to those most strongly associated with economic mobility. After deduplication and grouping, the 191 individual policy interventions resulted in a total of 55 policy instruments (see Table 3). The individual policy instruments were reviewed for categorization into the broader budget expenditure categories.

Table 3

Economic Mobility Policy Instruments

i	Economic Mobility Policy Instruments
1	Charter schools
2	Evidence-based math curricula
3	Evidence-based reading curricula
4	School-wide practices
5	Teacher training and professional development
6	Internships and apprenticeships
7	Job placement services
8	Re-entry programs
9	Sector-based skills training
10	Transitional jobs
11	Work readiness training
12	Career and technical education
13	Child wellness programs
14	Community schools
15	Dropout prevention programs
16	Ged/hsed programs
17	Mentoring, counseling, and case management
18	School-based health programs
19	Sexual health programs
20	Substance use prevention programs
21	Summer jobs
22	Early childhood quality rankings systems
23	evidence-based childhood curricula
24	Preschool
25	Accelerated remedial education programs
26	College access programs
27	Dual enrollment/early college programs
28	Financial aid completion support
29	Post-secondary academic support

i	Economic Mobility Policy Instruments
30	Post-secondary student guidance and support
31	Post-secondary tuition support and incentives
32	SAT/ACT preparation programs
33	Diversion programs
34	Eviction, displacement, and homelessness prevention
35	Financial literacy programs
36	Financial navigators
37	Housing quality programs
38	Service-enriched housing
39	Transportation access
40	Unconditional cash supports
41	Health systems navigation assistance
42	High-quality childcare
43	Home visiting programs
44	Job quality
45	Living wage laws
46	Parent training and support
47	After-school, extracurricular, and summer programs
48	Nutrition programs
49	Restorative justice programs
50	Affordable housing creation and preservation
51	Built environment improvements
52	Community health programs
53	Direct health interventions
54	Health-related financial incentives
55	Neighborhood safety strategies

As previously indicated, the best policy mixes demonstrate consistency, coherence, congruence, credibility, stability, and comprehensiveness (Howlett and Rayne, 2013; Rogge and Reichardt, 2013). In optimal policy mixes, interactions between policy instruments lead to better

outcomes—the whole is greater than the sum of its parts. To assess this dynamic, interactions between policies must be quantified. Boonekamp (2006) and Howlett and Del Rio (2013) set forth a framework of four types of interaction: contradiction, weak contradiction, synergy, and perfect complementary. In 2014, Taeihagh, Banares-Alcantara, and Givoni introduced an additional interaction, precondition.

1. Facilitation: occurs when the presence of one instrument increases the effectiveness of another. For example, participating in an internship program increases the effectiveness of job placement services.
2. Synergy: occurs when there exists a mutually beneficial relationship between instruments such that each strengthens the effectiveness of the other. For example, better trained teachers have a positive impact on the effectiveness of the use of evidence-based math curricula, and vice versa.
3. Potential contradiction: occurs when two or more instruments have potentially negative effects on each other's functionality. For example, in planning policy, rezoning a community for higher density because it is near a transit line while also implementing neighborhood character overlay districts in the same areas because they are vulnerable to gentrification may dilute the effectiveness of both policies.
4. Precondition: precondition exists when a particular instrument must be implemented in order to implement another. For example, business creation counseling has a preconditional relationship with capacity-building programs for minority businesses because in order for businesses to grow to a point that warrants capacity-building investment, said businesses must exist.

For context, an initial assessment of policy interactions is captured in Table 4. The individual policy instruments were reviewed for categorization into the eight broader budget expenditure categories, and interaction coefficients assessed for inclusion into the objective function (see Table 5). This analysis proved useful in establishing initial expectations for expenditure interactions. However, the final interaction relationships for the multi-objective optimization were extracted from the regression analysis for use in Chapter 6.

Table 4

Policy Instrument Interactions

i	Instrument	Interaction	i	Instrument	Source
6	internships	facilitates	7	job placement services	Gault, J., Leach, E., and Duey, M. (2010). Effects of business internships on job marketability: the employers' perspective. Education+ *Training*.
9	Sector-based skills training	facilitates	7	job placement services	Lake, J. B. (1975). Specific Training Aids Job Placement. Journal of Rehabilitation, 41(4), 20.
11	Work readiness training	facilitates	7	job placement services	Kapareliotis, I., Voutsina, K., and Patsiotis, A. (2019). Internship and employability prospects: assessing student's work readiness. Higher Education, Skills and Work-Based Learning.
12	Career and technical education	facilitates	7	job placement services	McKinney, F. L. (1982). Factors Relating to the Job Placement of Former Postsecondary Vocational-Technical Education Students.
16	Ged/hsed programs	facilitates	7	job placement services	
17	Mentoring, counseling, and case management	facilitates	15	Dropout prevention programs	Smink, J. (1990). Mentoring programs for at-risk youth: A dropout prevention research report.
21	Summer jobs	facilitates	7	job placement services	Gault, J., Leach, E., and Duey, M. (2010). Effects of business internships on job marketability: the employers' perspective. Education+ *Training*.
25	Accelerated remedial education programs	facilitates	16	Ged/hsed programs	Garvey, J. (2011). From GED to College Degree: Creating Pathways to Postsecondary Success for High School Dropouts. Jobs *for the Future*.
31	Post-secondary tuition support and incentives	facilitates	26	College access programs	Billings, M. (2018). Free *college for all: The impact of promise programs on college access and success* (Doctoral dissertation).
51	Built environment improvements	facilitates	55	Neighborhood safety strategies	Anderson, J. M., MacDonald, J. M., Bluthenthal, R., and Ashwood, J. S. (2013). Reducing crime by shaping the built environment with zoning: An empirical study of Los Angeles. University *of Pennsylvania Law Review*, 699-756.

i	Instrument	Interaction	i	Instrument	Source
54	Health-related financial incentives	facilitates	53	Direct health interventions	Bassani, D. G., Arora, P., Wazny, K., Gaffey, M. F., Lenters, L., and Bhutta, Z. A. (2013). Financial incentives and coverage of child health interventions: a systematic review and meta-analysis. BMC *Public Health*, 13(3), 1-13.
5	Teacher training and professional development	synergy	2	Evidence-based math curricula	Taylor, J. A., Getty, S. R., Kowalski, S. M., Wilson, C. D., Carlson, J., and Van Scotter, P. (2015). An efficacy trial of research-based curriculum materials with curriculum-based professional development. American Educational Research Journal, 52(5), 984-1017.
5	Teacher training and professional development	synergy	3	Evidence-based reading curricula	Taylor, J. A., Getty, S. R., Kowalski, S. M., Wilson, C. D., Carlson, J., and Van Scotter, P. (2015). An efficacy trial of research-based curriculum materials with curriculum-based professional development. American Educational Research Journal, 52(5), 984-1017.
5	Teacher training and professional development	synergy	23	evidence-based childhood curricula	Taylor, J. A., Getty, S. R., Kowalski, S. M., Wilson, C. D., Carlson, J., and Van Scotter, P. (2015). An efficacy trial of research-based curriculum materials with curriculum-based professional development. American Educational Research Journal, 52(5), 984-1017.
13	Child wellness programs	synergy	52	Community health programs	Mason, J. B., Sanders, D., Musgrove, P., and Galloway, R. (2011). Community health and nutrition programs.
17	Mentoring, counseling, and case management	synergy	26	College access programs	Coles, A. (2011). The Role of Mentoring in College Access and Success. Research to Practice Brief. Institute *for Higher Education Policy*.
27	Dual enrollment/early college programs	synergy	26	College access programs	Pretlow, J., and Wathington, H. D. (2014). Expanding dual enrollment: Increasing postsecondary access for all?. Community *College Review*, 42(1), 41-54.
28	Financial aid completion support	synergy	26	College access programs	Tierney, W. G., and Venegas, K. M. (2009). Finding money on the table: Information, financial aid, and access to college. The *Journal of Higher Education*, 80(4), 363-388.
38	Service-enriched housing	synergy	46	Parent training and support	Bassuk, E. L., and Geller, S. (2006). The role of housing and services in ending family homelessness. Housing *Policy Debate*, 17(4), 781-806.
45	Living wage laws	synergy	44	job quality	Osterman, P. (2008). Improving the quality of low-wage work: The current American experience. International Labour Review, 147(2-3), 115-134.
47	After-school, extracurricular, and summer programs	synergy	14	Community schools	Anderson, J. M., MacDonald, J. M., Bluthenthal, R., and Ashwood, J. S. (2013). Reducing crime by shaping the built environment with zoning: An empirical study of Los Angeles. University *of Pennsylvania Law Review*, 699-756.
48	Nutrition programs	synergy	52	Community health programs	Mason, J. B., Sanders, D., Musgrove, P., and Galloway, R. (2011). Community health and nutrition programs.

Table 5

Budget Expenditure Interactions

Expenditure	Interaction	Expenditure
Higher Education	facilitation	Other Public Welfare
Elementary and Secondary Education	facilitation	Other Public Welfare

Health	synergy	Elementary and Secondary Education
Higher Education	synergy	Elementary and Secondary Education
Health	synergy	Higher Education

Preliminary Bivariate Analysis

Major variables for the study were preliminarily analyzed (see summary statistics in Table 2 and Appendix Figures B.1-B.28). Cities data points have been labeled with appropriate abbreviations for ease of interpretation. All dollars for budgetary variables were 2017-adjusted. In Figures B.1-B.5, along the x axis are years, along the y axis is wage gap. It was immediately apparent that the wage gap has increased during the 2010-2020 period in all cities in the study, with the exception of Albuquerque, NM, whose wage gap remained relatively flat when comparing 2010 to 2020.

In Figures B.6-B.10, along the x axis are years, along the y axis is federal aid. Disbursements in each city trended largely flat or decreasing, with spikes in particular years, likely due to competitive grants awarded.

In Figures B.12-B.16, along the x axis are years, along the y axis is state aid. Similar to federal aid, state aid was mostly flat or decreasing in each city. Upon closer inspection, as per the methodology, Washington, DC cannot be compared to the other FISCs, as their local government is responsible for what would normally come from state governments in other cities. Therefore, DC was removed from the analysis.

In Figure B.24, Home rule and Dillon rule cities seemed to display similar median wage gaps as well as similar median change in wage gap, despite there being much more variation across the distribution in home rule cities.

In Figure B.25, consolidated and non-consolidated cities displayed similar median wage gaps as well as similar median change in wage gap; however, the consolidated cities distribution reached significantly higher than Dillon Rule cities. There seems to exist an opportunity for benchmarking in higher performing consolidated cities.

In Figure B.28, along the x axis is total population, along the y axis is federal aid. Consistent with the literature review, there is an apparent positive correlation of federal aid with population–that is, the larger a city's population, the more federal aid it is likely to receive.

Theoretical Framework Revisited

Figure 6

Government, Funding, and Economic Mobility Theoretical Framework Revisited

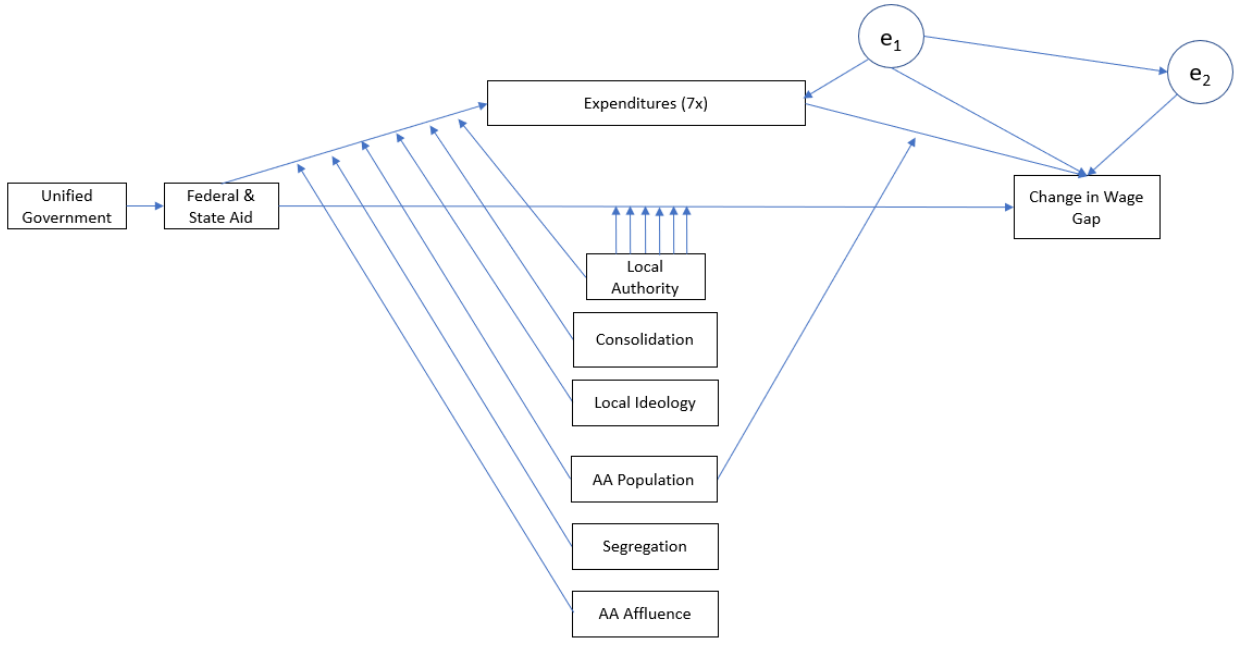


Figure 6 presents the theoretical framework that describes the relationships between social, political and policy factors. The relationships between the variables are complex, beyond what ordinary least squares regression would enable. A number of variables are endogenous to the model and are therefore both independent and dependent at various points in the model. Not only am I interested in the correlations but in the mechanisms that drive economic mobility through budget policy, which can be used to make causal inferences based upon the theory design. Therefore, in addition to stepwise regression analysis, I employed structural equation modeling (Gunzler et al, 2013), including mediation and moderated mediation analysis to determine direct and indirect effects of political factors on economic mobility.

Testing Federal and State Political Institutions, Party Control and Ideological Influences on Economic Mobility Policy

I argue that political factors influence both aid allocation and budget policy priorities in future years as the effect of said policy is reflected in programming. To test this in Chapter 4, I conducted four studies. First, I ran a cross-sectional and time-series regression analysis (accomplished by using one year lag data for all independent and control variables) of the annual federal and state budget allocations to the top 50 US cities (as of 2020) for fiscal years 2010-2020. The dependent variables were state and federal aid per person. The independent variable was split/unified government, determined by comparing the political majority at the federal (US Congress), state (legislature), and local level (mayor's party).

Second, I ran a cross-sectional and time-series stepwise regression analysis (accomplished by using one year lag data for all independent and control variables) exploring the effect of political, population, and budget policy variables on the change in wage gap. The

dependent variable was the year-over-year change in wage gap between Black and White Americans. The independent variables were federal aid per person and state aid per person, as well as, local authority, consolidation, local partisanship, and economic mobility expenditures per person by category (see Table 1 for details) by year by city.

Third, I ran two moderated mediation analyses to understand the effect of institutional control on expenditures and the change in wage gap. The dependent variable was the year-over-year change in wage gap between Black and White Americans. The mediator variables were economic mobility expenditures per person by category by year by city. The independent variable was total federal and state aid per person. The moderator variables were local authority and city-county consolidation.

Fourth, I ran a moderated mediation analysis to understand the effect of local ideology on expenditures and the change in wage gap. The dependent variable was the year-over-year change in wage gap between Black and White Americans. The mediator variables were economic mobility expenditures per person by category by year by city. The independent variable was total federal and state aid per person. The moderator variable was local ideology, operationalized as the mayor's party.

Control variables for each analysis included the population, percent population under 18, percent African American single mother households, and percent full-time employment of African Americans. The unit of analysis was the 'proper' city, as defined by the US Census.

Testing Urban Contextual Influences on Economic Mobility Expenditures

In Chapter 5, I investigated the relationship between African American population, segregation, affluence, and local economic mobility investment. I anticipated as African

American populations increase, cities would spend more on economic mobility policies. I also hypothesized that, in accordance with social contact theory (Pettigrew, 2018) the more people live and work around each other, the better appreciation they have for each other's needs, which is then reflected in policy. I expected that less segregated cities would spend more on economic mobility policy, resulting in a greater decrease in the racial wealth gap. I expected that cities in which African Americans have higher starting median incomes (using 2010 as the baseline) would spend more on economic mobility policy, resulting in a greater decrease in the racial wealth gap.

To investigate these hypotheses, I conducted three studies. Building on Chapter 4, I ran a cross-sectional and time-series stepwise regression analysis (accomplished by using one year lag data for all independent and control variables) exploring the effect of social, political, population, and budget policy variables on the change in wage gap. The dependent variable was the year-over-year change in wage gap between Black and White Americans. The independent variables were federal aid per person and state aid per person, as well as local authority, consolidation, local partisanship, and economic mobility expenditures per person by category (see Table 1 for details) by year by city.

I conducted a moderated mediation analysis to understand the effect of African American population, segregation, affluence on the change in wage gap via expenditures. The dependent variable was the year-over-year change in wage gap between Black and White Americans. The mediator variables were economic mobility expenditures per person by category by year by city. The independent variables were total federal and state aid per person. The moderator variables were African American population, degree of segregation, and African American affluence. The control variables for each analysis included population, population under 18, percent African

American single mother household, and percent full-time employment of African Americans. The unit of analysis was the city 'proper' as defined by the US Census.

Improving the Policymaking Process through Modeling: MOO Model Formulation

In Chapter 1, I identified system gaps in the policy selection and resource allocation process for a case study local urban government, the City of Charlotte. Multi-objective optimization (MOO) is a data-based approach which can be used to improve the quality of the budget allocation process output, as well as improve the efficiency with which selections are made. The general structure of a multi-objective optimization consists of one or more objective functions and additional criteria.

$$minF(x) = (f_1x, f_2x, \dots, f_kx) \quad (1)$$

$$\text{subject to } x \in X, x = x^1, x^2, \dots, x^n$$

where *k* are objective functions, *n* are the optimization parameters, and X. R^n is the solution space (Xiujuan and Zhongke, 2004).

Optimization problems are most often conceptualized as linear relationships between unknown variables. They can also be non-linear (Knowles and Hillier, 2008; Hillier, 2008). Constrained and unconstrained problems make up nonlinear programming. Optimization problems can be deterministic (Chen et al, 2012). They can also be stochastic, in which uncertainties are considered (Shmoys et al, 2004). For the initial development, this study will use a linear deterministic model.

In Chapter 6, I developed an MOO model. The methodology adapted elements from Guo's 2020 framework for multi-objective optimization for China's rental housing public policy mix, as well as Ghazinoory's (2019) optimization of RandD public policy in Iran. Decision making was emphasized in this MOO, as the goal was to identify the optimal budget allocation to minimize the change in wage gap, while minimizing the annual wage gap. Therefore, I employed a hybrid approach of deterministic compromise programming and epsilon constraint technique using the GRG Nonlinear method in Excel software.

Objectives

Leveraging the multiple regression analyses in Chapters 4 and 5, I constructed the objective function made up of two sub-functions to achieve both objectives: minimize the change in wage gap and minimize the wage gap.

Table 6

Multi-Objective Optimization Variables

Variable	Symbol	Description	Objective
Change in Wage Gap	$f_1(x)$	The change in African American relative mobility year-over-year	Minimize
Wage Gap	$f_2(x)$	Difference in White vs African American median household income	Minimize

To reflect relative importance of objectives, the weighted-sum method was employed (Marler et al, 2010):

$$F(x) = \sum_{1}^{i} w_i * f_i(x) \quad (2)$$

where *i* is the number of objective sub-functions

Each of the two objectives was assigned equal weight of 0.5 in initialization.

Constraints

To better reflect real-world conditions, I imposed four constraints on the optimization model. Because cities cannot allocate negative money, I constrained the model such that all real dollar amounts must be non-negative values. Second, as the goal is to close the wealth gap, I set the lower bound of $f_2(x)$ to \$0.00, preventing a reversal of the wealth gap, in which White Americans were outearned by their African American counterparts. In addition, I required each city to spend an amount equal to their total spending in the economic mobility-related categories [footnote: some cities did use other sources of revenue towards economic mobility related items]. Finally, to ensure portfolio diversity, I restricted spending in each category to no more than 20% of the budget. As mentioned previously, though economic mobility-focused revenue can come from sources other than federal and state aid, I assumed the majority of economic mobility-focused funding to come from these two sources, with the vast majority of local revenue directed towards operating expenses.

Decision Variables

The model included both binary and continuous variables, as indicated earlier in this chapter. Party alignment, consolidation, and home rule were included or excluded based on city characteristics as input into the optimization. Variables representing the budget in US dollars for each category allocation were represented as continuous variables.

Formulation

Using input from the explorations of political and socioeconomic factors and their relationship with economic mobility, I formulated a multi-objective function to select optimal budget mixes for cities based on their political and socioeconomic profiles. I took a hybrid approach of deterministic compromise programming and epsilon constraint technique using the G2G Nonlinear method in Excel software.

The following simulation was conducted to illustrate the formulation of a model to forecast mobility for a given city. Again, for this example, I used the city of Charlotte, NC. First, I set up the equation:

Change in Wage Gap = Percent African American Population + Local/Federal Alignment + Local/State Alignment + Federal Aid $/pp + State Aid $/pp + Higher Education Expenditure $/pp + Elementary and Secondary Education Expenditure $/pp + Libraries Expenditure $/pp + Cash Assistance Expenditure $/pp + Other Public Welfare Expenditure $/pp + Health Expenditure $/pp + Housing and Community Development Expenditure $/pp + Intercept *(3)*

In the study, I conducted a series of linear regressions to find the variables that have the greatest impact on reducing the wage gap. The resulting best fit model (for both change in wage gap and wage gap, respectively) served as the basis for the objective function used in the optimization algorithm. For this example, I used the full dataset as-is, which returned the following model:

```
Call:
lm(formula = wage_gap_diff ~ pct_AA + Fed_Gov_Party_Match + State_Gov_Party_Match +
    Federal_Aid_pp + State_Aid_pp + Higher_Education_Expenditure_pp +
    Elementary_Secondary_Education_Expenditure_pp + Libraries_Expenditure_pp +
    Cash_Assistance_Expenditure_pp + Other_Public_Welfare_Expenditure_pp +
    Health_Expenditure_pp + Housing_Community_Development_Expenditure_pp,
    data = primary_data_new)

Residuals:
    Min      1Q  Median      3Q     Max
-5029.9  -801.2   -77.4   629.3  9732.6

Coefficients:
                                            Estimate Std. Error t value Pr(>|t|)
(Intercept)                                 687.2723   169.9500   4.044 6.21e-05 ***
pct_AA                                      823.0014   422.4607   1.948  0.05204 .
Fed_Gov_Party_Match                        -481.3967   266.9273  -1.803  0.07200 .
State_Gov_Party_Match                       387.9551   158.3468   2.450  0.01467 *
Federal_Aid_pp                               -1.3692     0.6943  -1.972  0.04924 *
State_Aid_pp                                 -0.4016     0.1723  -2.331  0.02018 *
Higher_Education_Expenditure_pp               2.1635     2.1765   0.994  0.32076
Elementary_Secondary_Education_Expenditure_pp -0.2179     0.1839  -1.184  0.23690
Libraries_Expenditure_pp                      8.3982     3.5716   2.351  0.01915 *
Cash_Assistance_Expenditure_pp                2.3424     1.1228   2.086  0.03755 *
Other_Public_Welfare_Expenditure_pp           0.6218     0.8050   0.772  0.44026
Health_Expenditure_pp                         0.7493     0.4250   1.763  0.07859 .
Housing_Community_Development_Expenditure_pp  2.0037     0.7033   2.849  0.00459 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 1481 on 438 degrees of freedom
  (99 observations deleted due to missingness)
Multiple R-squared:  0.1694,    Adjusted R-squared:  0.1467
F-statistic: 7.445 on 12 and 438 DF,  p-value: 1.559e-12
```

Using the above equation, I input Charlotte’s 2017 data to predict the change in wage gap in 2018 based on the model.

*CLT Change in Wage Gap = $687.2723 + (823.0014 * 0.34) - (481.3967 * 0) + (387.9551 * 0) - (1.3692 * $457.85) - (0.4016 * $1278.90) + (2.1635 * $173.92) - (0.2179 * $1426.07) + (8.3982 * $32.96) + (2.3424 * $121.93) + (0.6218 * $18.79) + (0.7493 * $150.35) + (2.0037 * $229.62) = $1038.98*

(4)

This indicates a widening of the wage gap by $1,038.98. Seeking to improve this result, I considered adjusting the factors negatively correlated with a positive change in wage gap:

local/federal alignment, federal aid, state aid, and elementary and secondary education. Therefore, I simulated a circumstance in which Charlotte enjoyed federal party alignment, which corresponds to an arbitrarily adjusted 2x increase in federal aid, all of which was spent on elementary and secondary education.

$$\begin{aligned} \textit{CLT Change in Wage Gap (Adj)} &= \$687.2723 + (823.0014 * 0.34) - (481.3967 * \underline{1}) + (387.9551 * 0) - (1.3692 * \underline{\$915.7}) - (0.4016 * \$1278.90) + (2.1635 * \$173.92) - (0.2179 * \underline{\$1883.92}) + (8.3982 * \$32.96) + (2.3424 * \$121.93) + (0.6218 * \$18.79) + (0.7493 * \$150.35) + (2.0037 * \$229.62) \\ &= \underline{-\$169.07} \end{aligned} \tag{5}$$

These adjustments were reflected in the model output as a $169.07 decrease in the wage gap year-over-year. That is, the median African American household income would be anticipated to increase by $169.07, *relative to their White counterparts*.

The optimization algorithm proceeded in such a fashion, searching for optimal budget policy mixes for a given city that meet the aforementioned goals: minimize the change in wage gap and minimize the wage gap within a given budget.

Summary

This chapter outlined the data and methods that underpin the research analysis. I covered summary statistics, data sources, preliminary analysis, and subsequent chapter research designs. For context, I also included preliminary investigations conducted to explore existing policy instrument options, as well as expected interactions between policy instruments based on the literature. I concluded with an illustrative example of the formulation and methodology of the multi-objective optimization steps.

Chapter 4: Political Factors

Charlotte, NC, has experienced tremendous growth since the turn of the century, increasing in size by more than 64,400 people since 2010 (US Census). Ask any long-time resident, and she will agree she has met her fair share of newcomers, migrating south from larger northern cities like New York, Chicago, and Philadelphia. The seasoned Charlottean can recite these introductory conversations. After a while, they become remarkably familiar. While our new coworkers and neighbors love the weather, the amenities, and the southern charm, there are always one or two things they wish Charlotte did like the cities "back home" --homelessness prevention, policing, business regulation, etc. As we politely listen to how great the cities which they left behind run things, we gently remind them: 'That might work up there, but this is not (insert city here)."

Sure, some of our rebuttal can be chalked up to stubborn Southern pride. However, there is merit to the argument that all cities are not created equal. The fabric of each city is made up of several types of characteristics, each of which influences the environment within which policy is shaped, informs the way in which policy is implemented, and impacts the level of success each policy ultimately achieves. For example, one key difference between New York and Charlotte is the nature of its local authority. Although New York enjoys home rule, Charlotte's authority is limited to that explicitly given by the North Carolina General Assembly. For these so-called Dillon-rule cities, limited authority is exacerbated by partisan differences at the state level (as is the case in Democrat-led Charlotte, whose officials serve at the pleasure of a current Republican-led legislature). My aim is to identify and operationalize the major variables at play, and to build a budget forecasting tool based on the unique characteristics of each city to direct tax dollars for highest economic mobility.

To do so, in Chapter 4, I analyzed the population, political and budget policy variables outlined in Chapter 3 in the top 50 cities in the US from 2010-2017. From this information, I identified the relationship between these components and the economic mobility of each city, measured as the year-over-year change in the racial wage gap between White and African Americans. These relationships form the basis of the multi-objective optimization model formalized in Chapter 6.

I began with a regression analysis investigating partisanship impacts on aid. Second, I conducted a stepwise regression analysis exploring partisanship, local authority, institutional structure, aid, and expenditures on economic mobility. As a public policy engineering exercise, I presented and compared two models: the first taking a social science perspective, reflecting theoretically significant variables, and the second adhering to a traditional engineering approach, reflecting only the statistically significant variables.

If public investment is of any value at all, mobility is a function of spending. I contend that relationships matter when it comes to budget allocation and expenditure, and so do institutional factors. Not only am I interested in the correlations but in the mechanisms that drive economic mobility through budget policy, which can be used to make causal inferences based upon the theory design. The relationships between the variables are complex, beyond what ordinary least squares regression would enable. A number of variables are endogenous to the model and are both independent and dependent at various points in the model. Therefore, to analyze this, I employed structural equation modeling (Gunzler et al, 2013), including mediation and moderated mediation analysis, to determine direct and indirect effects of political factors and expenditures on economic mobility.

Table 7

Chapter 4 Research Question: Political Factors

Chapter 4 Research Questions: Political Factors			
Research Question	**Hypothesis**	**Analysis**	**Variables**
How does partisanship of state, local, and federal elected officials impact state and federal budget aid?	Cities in which local, state, and federal political ideologies are aligned will receive more aid.	Regression Analysis	Unified Government on State and Federal Aid
How do population contextual factors of a city impact aid?	As African American employment rates increase, federal and state aid decreases.	Regression Analysis	Population Factors on State and Federal Aid
How does aid impact economic mobility?	As aid increases, economic mobility increases.	Stepwise Regression Analysis	Aid on Change in Wage Gap
How do city institutional designs influence economic mobility?	The presence of home rule is positively correlated with an increase in economic mobility.	Stepwise Regression Analysis	Local Authority on Change in Wage Gap
	The presence of consolidation is positively correlated with an increase in economic mobility.	Stepwise Regression Analysis	Consolidation on Change in Wage Gap
How does city partisanship influence economic mobility?	The presence of local Democratic partisanship is positively correlated with an increase in economic mobility. The presence of local Republican partisanship is negatively (or to a lesser positive degree versus Democratic partisanship) correlated with an increase in economic mobility.	Stepwise Regression Analysis	Partisanship on Change in Wage Gap
How do aid, partisanship, and institutional design impact economic mobility expenditure?	In a comparison of cities, those with legislative autonomy (or home rule) spend more on economic mobility-related expenditures with a given level of aid than those without legislative autonomy.	Moderated Mediation Analysis	Aid, Population, Institutional and Political Factors, and Expenditures on Change in Wage Gap
	In a comparison of cities, consolidated cities spend more on economic mobility-related expenditures with a given level of aid than non-consolidated cities.	Moderated Mediation Analysis	Aid, Population, Institutional and Political Factors, and Expenditures on Change in Wage Gap
	In a comparison of cities, Democrat-led cities spend more on economic mobility-related expenditures with a given level of aid than Republican-led cities	Moderated Mediation Analysis	Aid, Population, Institutional and Political Factors, and Expenditures on Change in Wage Gap

Results and Analysis

Regression Analysis: Unified Government on Federal Aid and State Aid

My investigation into the research question proceeded as described in Table 7. As discussed in Chapter 2, I am interested in the structure of our government and the role federalism plays in the outcomes of economic mobility. I argue that co-partisanship matter when it comes to funding, and that partisan alignment yields increased aid to localities from federal and state

governments. To test this, I regressed three political variables (local-state party match, local-federal party match, and unified government) on federal, state, and total aid per person, controlling for population, youth population, percent African American single female heads of household, and percent African American employment. The results of the regression analysis are summarized in Table 8 below. The results showed that, when it comes to federal, state, and total funding, it *does* matter if a city's elected officials share a party with the majority party in a higher level of government–specifically at the state level. Surprisingly, this does not hold for the federal level. On the basis of this model, there exists no statistically significant relationship between local-federal alignment and funding.

As evident in Figure 7, shared partisanship at the local and state level was a statistically significant predictor of per person aid. The left-hand side of this plot shows different parties controlling local and state government, while the right-hand side shows unified local and federal or state government (respectively). When there was divided control, state aid per person was roughly $1300, while the presence of unified government increased this total to nearly $1900. Although this may not seem like a large figure, if we extrapolate this effect to Charlotte, NC, this would be an increase in state investment of over $500,000,000. With federal funding, aid per person when there was divided control was approximately $400, compared to $500 with the presence of unified government. For Charlotte, that equates to about $90,000,000. Given the amount of engagement each state's congressional delegation has with its legislature, as well as the structure of some federal grants that require a state match, it follows that cities whose state legislatures are advocating for the same priorities would perform better during the budget season at the federal level. In forecasting aid, policymakers must take into account the partisan climate in their state, and would do well to build relationships across the aisle at the state level.

Next, I turned my attention to population factors. As shown in Figure 8, population was a statistically significant predictor of per person aid. Figure 8 shows the relationship between population and federal and state aid per person. It indicates that federal funding per person increased by $100 for every 100,000 people living in a city, while state aid per person decreased by $200 for every 100,000 people living in a city. For a growing Charlotte, that means an estimated federal aid of $700,000,000 when the city reaches 1,000,000 people, while reducing to about $800,000,000 in state aid per person ($90,000,000 in lost revenue).

In addition to total population, youth population was a statistically significant predictor of aid at the state and federal levels. Figure 9 shows the relationship between youth population and state and federal aid per person. It indicates that federal aid per person was reduced by $375 for every 100,000 children in a city. Conversely, state aid per person increased by $850 for every 100,000 children. federal $375 reduction for every 100,000 minors. That population drives funding to cities is no surprise. This model confirmed previous explorations in the literature, as previously discussed. The relationship between youth population and aid at the federal and state level is also to be expected. Considering that states fund education and generate the bulk of their revenue from income tax, legislatures are making investments in areas with larger youth populations and in cities where people need jobs[3]. Oftentimes, large cities (employment centers in which the bulk of state income taxes are raised) see those dollars reallocated across the state, to offset costs in more rural or seasonal tourist areas (take for instance, towns along the Outer Banks, who see dips in their economy during the winter, yet still require year-round services to function). This dynamic only increases the tension between larger cities and their state legislatures–not only are their political interests in opposition, but also their financial interests.

[3] Though outside of the scope of this study, economic development and business recruitment spending certainly play a role toward this end as well.

Finally, I expected that public investment would be reduced as African American employment increased (as those who may have previously been eligible for aid matriculate into higher income levels). A statistically significant relationship was confirmed in Figure 10, where I plotted African American employment versus aid per person. Results showed that a 10% increase in African American employment resulted in a $150 decrease in federal aid per person and a $730 decrease in state aid per person. For Charlotte, that translates to a reduction of $135,000,000 and an astounding $675,000,000, respectively.

In general, with adjusted R^2 values of 0.238, 0.321, and 0.359, the political and population factors explain a significant portion of the movement of federal, state and total aid (respectively). Additional variables could include economic conditions overall, the initiation and sunsetting of various legislation and corresponding funding programs, and executive administration priorities.

Table 8

Unified Government on Aid

Unified Government on Aid			
	Federal	State	Total
Population $_{t-1}$	0.0010***	-0.0020*	0.0002
	-0.0002	-0.0004	-0.0004
Local-Federal Party Alignment	10.608	80.668	97.307
	-68.3560	-136.0230	-157.7420
Local-State Party Alignment	83.7740*	357.9610***	475.1110***
	-35.7170	-75.3620	-84.7380
Unified Government	-90.3700	-248.8720	-368.2370
	-90.1260	-179.1920	-207.4400
State Aid $_{t-1}$	0.0430		

	Unified Government on Aid		
	-0.0270		
Under 18 Population	-0.0040***	0.0080***	0.0004
	-0.0010	-0.0010	-0.0020
% African American Single Female Heads of House	471.9860	-872.1690	-359.6520
	-375.6100	-748.0120	-865.8380
African American Employment	-1,636.7520***	-6,557.0590***	-8,823.5960***
	-365.0290	-660.2060	-727.8870
Federal Aid $_{t-1}$		0.1710	
		-0.1060	
Constant	833.8260***	3,982.0700***	5,169.4960***
	-220.1700	-393.4480	-438.9990
Observations	360	360	360
Adjusted R^2	0.238	0.321	0.359
Note:			‘p<0.1;*p<0.05; **p<0.01; ***p<0.001

Figure 7

Effect Plots for State-Local Party Alignment on Federal and State Aid

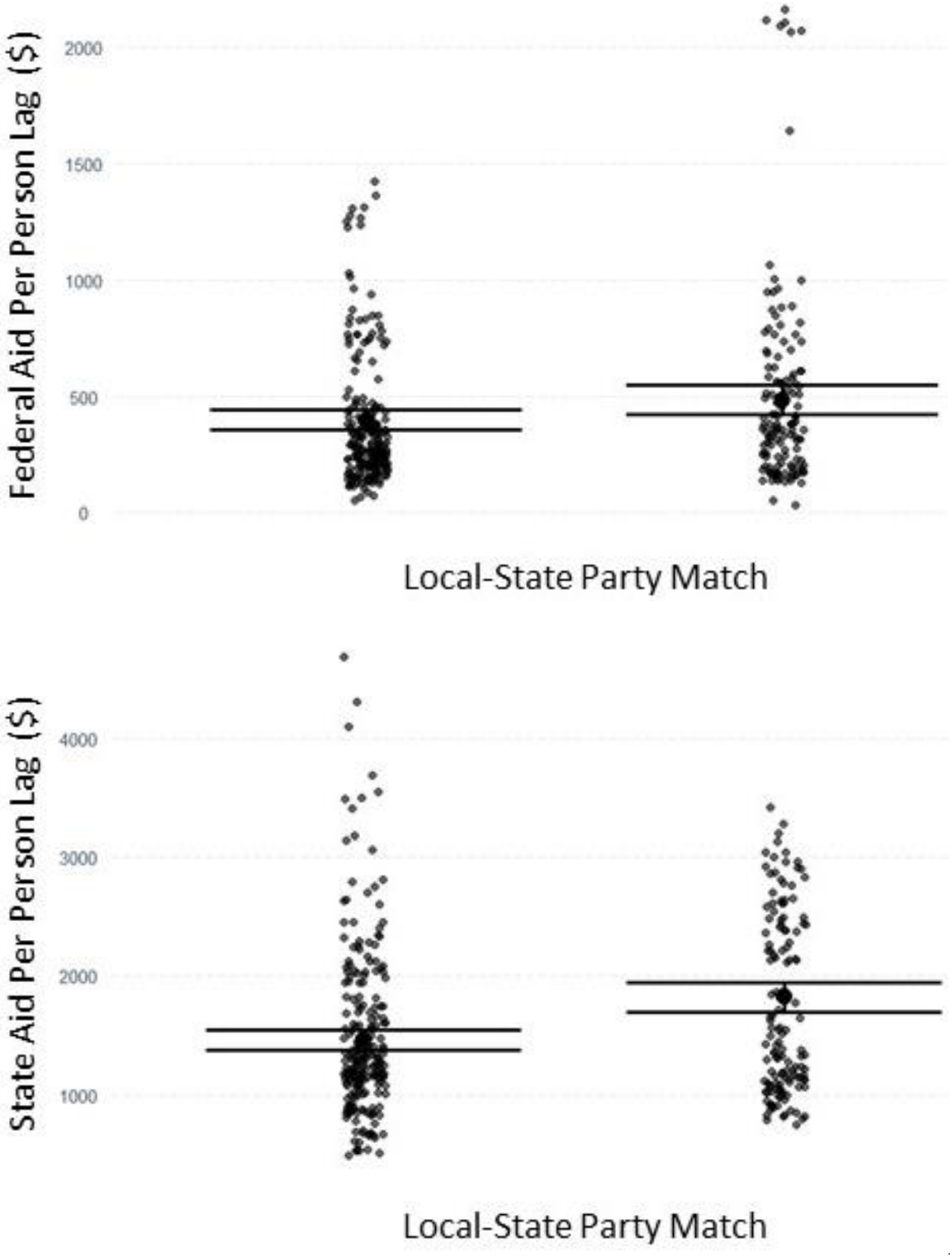


Figure 8

Effect Plots for Population on Federal and State Aid

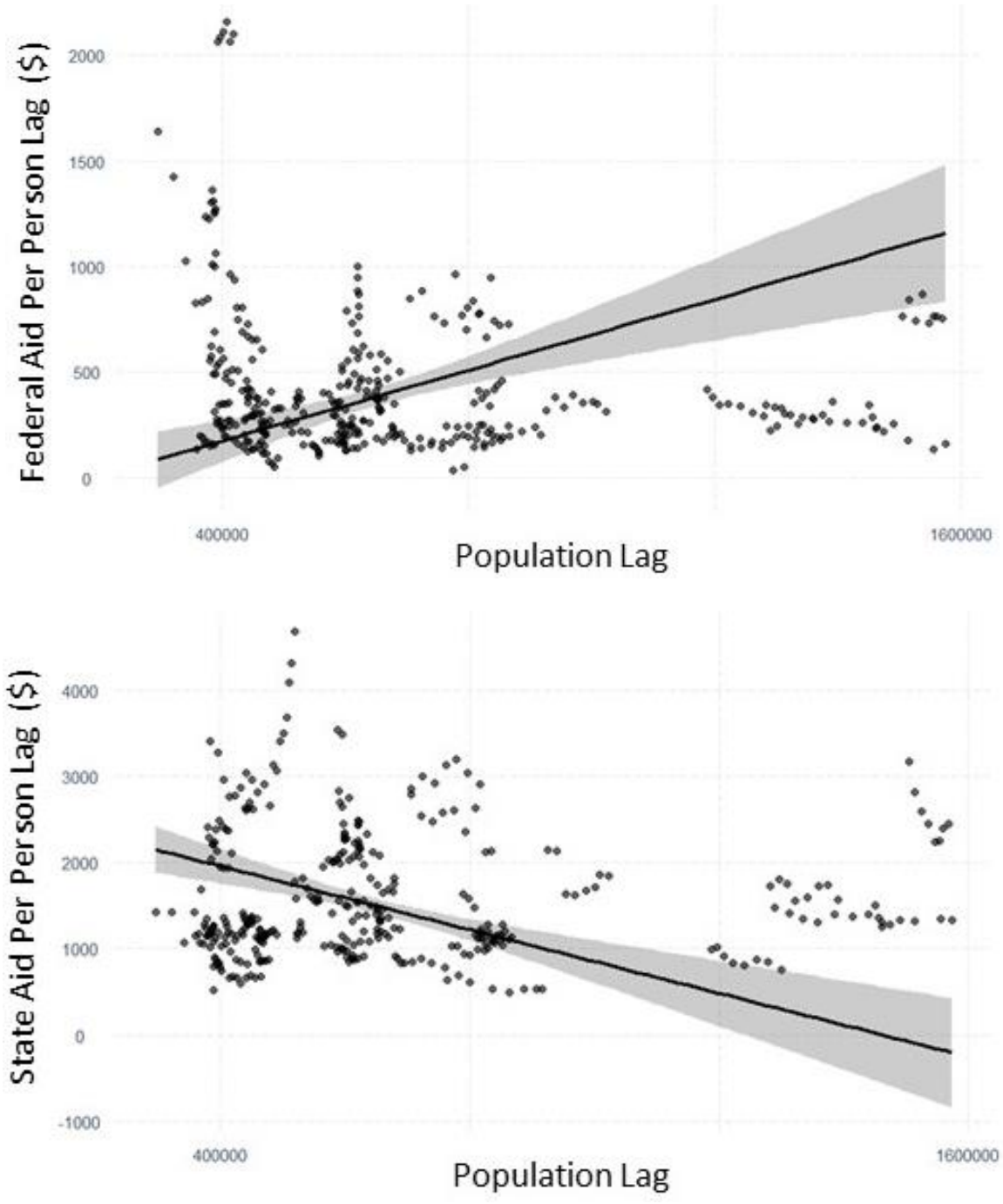


Figure 9

Effect Plots for Youth Population on Federal and State Aid

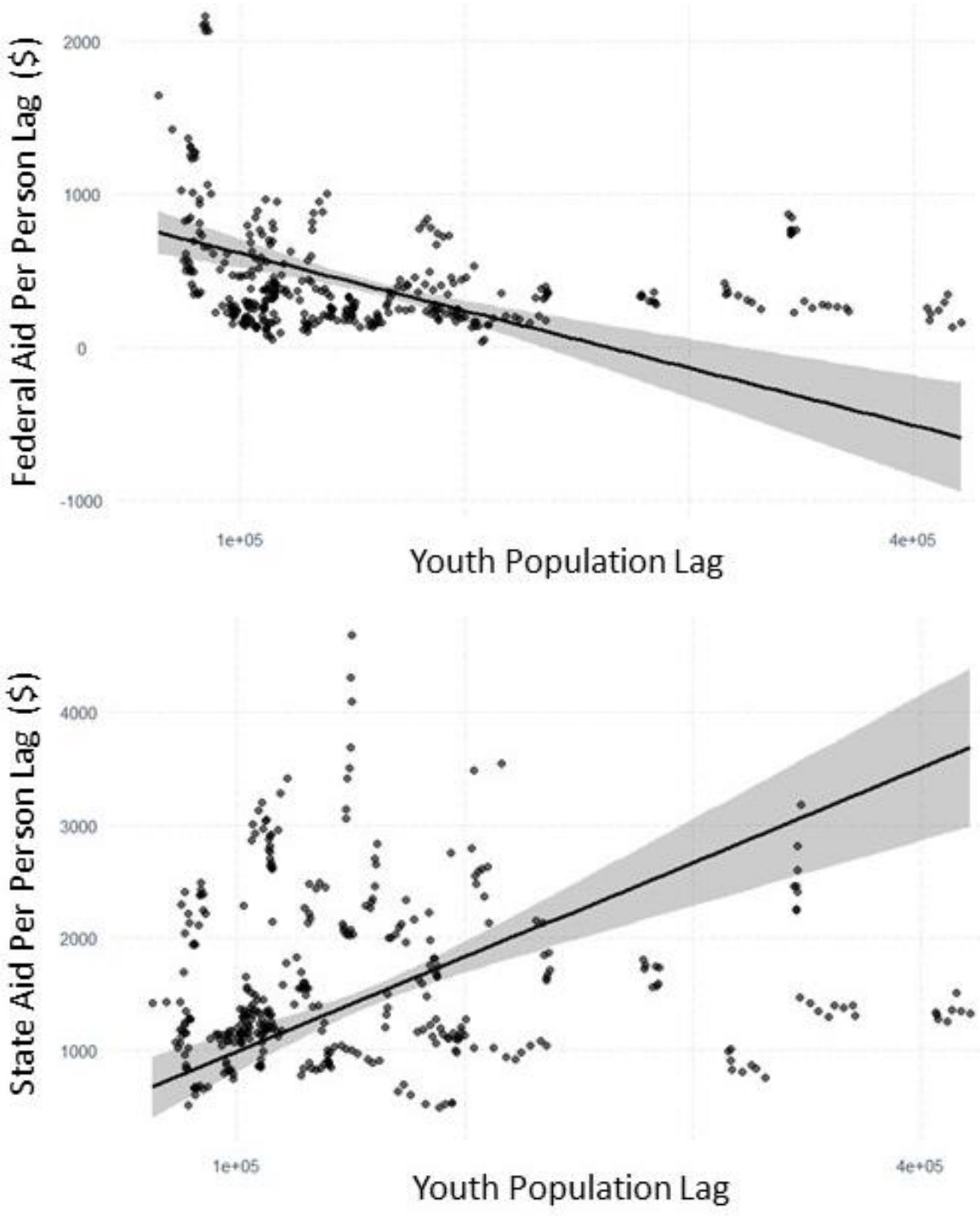
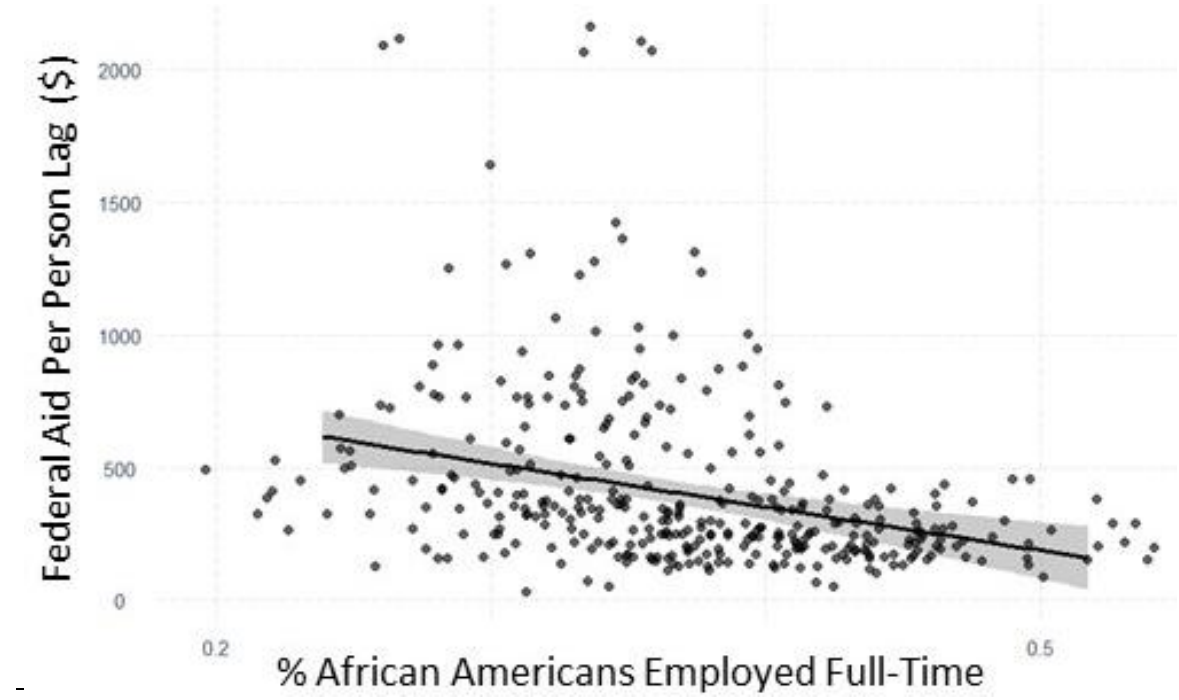


Figure 10

Effect Plots for African American Employment on Federal and State Aid



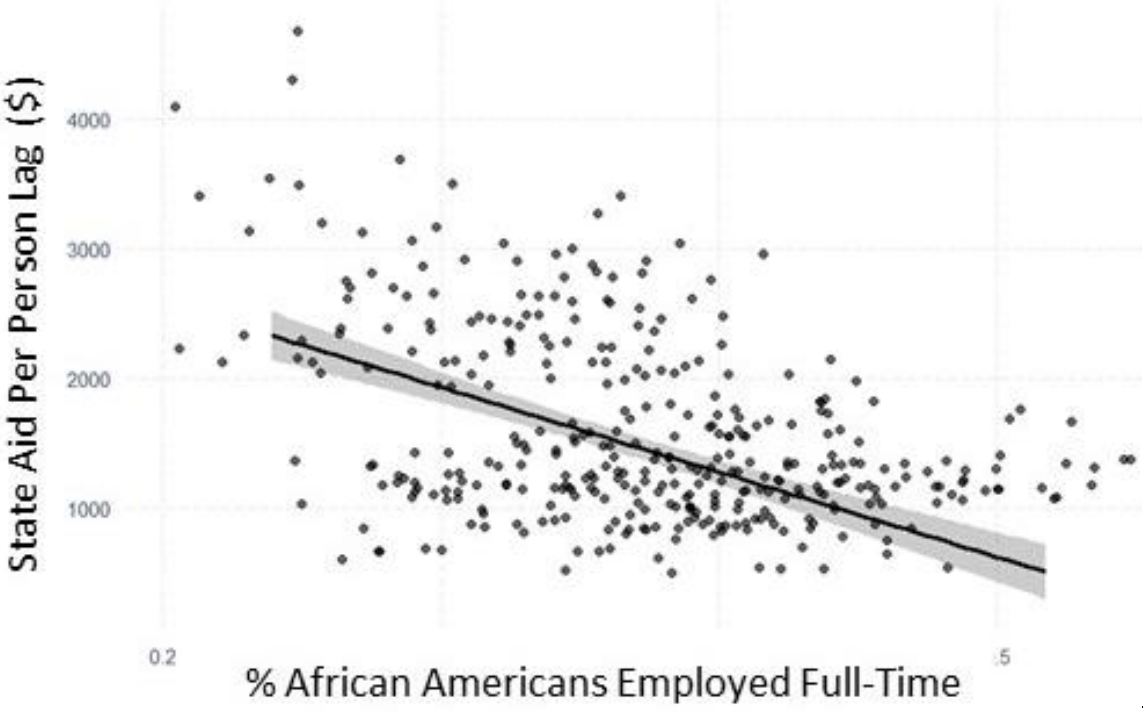


Table 9

Chapter 4 Research Questions Results (Partisanship on Aid)

Chapter 4 Research Questions: Political and Institutional Factors			
Research Question	**Hypothesis**	**Accept/Reject**	**Table**
How does partisanship of state, local, and federal elected officials impact state and federal budget aid?	Cities in which local, state, and federal political ideologies are aligned will receive more aid.	**Partially Accept**	Table 8
How do population contextual factors of a city impact aid?	As African American employment rates increase, federal and state aid decreases.	**Accept**	Table 8

Stepwise Regression Analysis: Population, Political, and Budget Policy Factors on Economic Mobility

The previous section explored the impact of unified government on state and federal aid to cities. Securing federal and state aid is the first–and very important part of the puzzle, because, as general sound accounting practices dictate, sustainable cities do not operate at a deficit. The second step, then, is spending said aid in a manner that yields the highest mobility. I argue that the way city officials allocate federal and state funding significantly impacts economic mobility. Though cities generate local revenue through property and sales taxes, I argue that a city's economic mobility rises and falls with federal and state aid. This is because federal and state dollars are directed towards public welfare, while the bulk of local revenue is spent on operating expenses to keep the city's lights on (staff, buildings, vehicle fleets, etc.).

Again, economic mobility budget policy decisions do not happen in a vacuum. They are impacted by political factors like institutional control and partisanship, as well as each city's unique population factors. I submit that local authority, institutional structure, and partisanship each impact expenditure choices, and ultimately economic mobility. I argue that cities with broader authority and scope experience different levels of mobility than more limited cities. I

also submit that mobility varies with partisanship, as a function of budget priorities (explored further in the moderated mediation analysis). I explored this by conducting a stepwise regression, the results of which are documented in Tables 10-13 below.

In Step 1, I considered each set of variables individually, then in pairs. As expected, individual variable factors tell very little of the economic mobility story on their own (see Table 10). When variable sets are paired, the models' explanatory value increased, particularly the population and expenditures pairing with an adjusted R^2 of 0.31; aid and expenditures, with an adjusted R^2 of 0.30; and political and expenditures, with an adjusted R^2 of 0.26. The population and expenditures model explained the most variation in the dependent variable compared to the other two sets.

In Step 2, I built upon the best fit model in the first step by combining aid, population, and expenditure factors (Table 11). This increased adjusted R^2 up to 0.322, with eight of twelve variables as significant factors. Moving on to Step 3, I added political factors to the best-fitting model pairs for comparison. Recalling the theoretical model, I argue that political factors influence how total aid is spent. Table 12 shows the results of the model when testing political factors with aid, population and expenditures, and aid and expenditures. With an adjusted R^2 of 0.334, combining political, aid, and expenditures yielded the highest explanatory significance.

Finally, I added political factors to the model from Step 2. Table 13 shows the full theoretical model, which boasted an adjusted R^2 value of 0.343, an improvement over the previous step by including population factors. Statistically significant variables included local authority, total aid, local partisanship, population, youth population, and expenditures in libraries, cash assistance, health, housing and community, and the interactions of aid with local authority and local partisanship.

Figure 11 plots the local authority versus the change in wage gap. The left-hand side shows Dillon rule authority, while the right-hand side shows home rule. For Dillon-rule cities, the median change in wage gap was $649, with a range of -$2,858 to $2,962. For home rule cities, the median change in wage gap was $698, with a range of -$5218 to $10,849. The total effect of local authority on the change in wage gap was conditional upon total aid per person, as illustrated in Figure 17. At higher levels of spending (about $2000 per person), economic mobility was higher for a given level of aid for home rule cities than for Dillon rule cities. However, consolidation was not statistically significant, indicating that differences in consolidated government have no impact on economic mobility. As for institutional power and structure, I expected that home rule and consolidation would facilitate economic mobility. Instead, home rule was positively correlated (with statistical significance) with a widening wealth gap.

I argued that economic mobility increases with aid. Table 13 shows that aid has a statistically significant relationship with economic mobility, albeit in the opposite direction compared to my hypothesis. Plotting total aid versus change in wage gap, Figure 12 indicates that a $1000 increase in aid per person results in $1,214 increase in the change in wage gap. I suspect this is because budget policy is reactionary, responding in time to the economic indicators as they are known. It is plausible that, despite not achieving a full reversal, public investment may be tempering the trajectory of downward mobility in the short term. To assess the impact over the long term, additional historical data could be added to the analysis. Additionally, because expenditures appear in the model with aid, it is possible that indirect effects of aid may be attributed to expenditures[4].

[4] I explore this in the mediation analysis later in the chapter.

I argued that Democratic leadership facilitated economic mobility, while Republican leadership hindered economic mobility. Figure 13 shows the impact of local partisanship on economic mobility. From left to right, results indicate median change in wage gap for nonpartisan-led cities was $578 (range -$2,183 to $3,216), Democrat-led cities was $833 (range -$2,858 to $10,849), independent-led cities was $271 (range -$2,517 to $2,665), and Republican-led was cities $383 (range -$5,218 to $4,688). In keeping with the observations regarding aid, neither party was associated with positive mobility outright. However, the magnitude of the correlation with a widening wealth gap was slightly lower in Democrat-led cities (1,721) versus Republican-led cities (2,053). Interestingly, unaffiliated cities are more strongly associated with widening wealth gaps (2,837), although, only two are included in the analysis (Fresno, CA, and Mesa, AZ). Also, as with local authority, the effect of local partisanship was conditional on aid. Figure 16 shows that, at higher levels of spending (about $2,000 per person), partisanship impacts the change in wage gap. The wealth gap in non-partisan cities widens at the highest rate for a given level of aid, followed by Democrat-led cities, Independent-led cities, and Republican-led cities. Therefore, I reject Hypothesis #6.

As shown in Figure 15, population was a statistically significant predictor of economic mobility. Figure 15 plots the relationship between population and the change in wage gap. It indicates that for every 100,000 person-increase living in a city, the change in wage gap increased $200. This seems intuitive, as the larger a city grows, the more likely it is that residents experience a variety of economic outcomes. In addition to total population, youth population was a statistically significant predictor of the change in wage gap. Figure 14 shows the relationship between youth population and the change in wage gap. It indicates that the change in wage gap was reduced by $1,000 for every 100,000 children in a city. Perhaps a larger youth population is

also indicative of a younger median age of working adults (those most likely to be parents). Earlier in their careers, those in early adulthood have not yet reached the higher earnings those later in their careers enjoy.

In addition to the above factors, several expenditure categories are statistically significant predictors of economic mobility. Figure 18 shows the impact of library expenditures on the change in wage gap. For every $100 spent in this category, the change in wage gap increased $889. As shown in Figure 19, every $100 increase in cash assistance expenditures resulted in a $211 increase in the change in wage gap. Furthermore, Figure 20 illustrates the relationship between health expenditures and the change in wage gap, reflecting that an $100 expenditure increase corresponded with a $209 increase in the change in wage gap. Finally, Figure 21 shows the impact of housing and community expenditures on the change in wage gap, indicating that a $100 increase in housing and community expenditures resulted in a $147 increase in the change in wage gap. Again, as with aid, no expenditure category demonstrated a statistically significant association with a decrease (or reversal) in the change in wage gap. Based on the complete model, policy makers should direct funding (in priority order) to cash assistance, libraries, health, and housing expenditures to curb the widening of the wealth gap among residents.

Circling back to overall best model fit, for comparison, the engineering model was also presented, with statistically significant variables only. The adjusted R^2 value in the engineering model was slightly higher, at 0.346. However, while this yielded a more mathematically desirable result, it lacks practical feasibility of implementation. Why? For one, several expenditure categories have been eliminated from the model, which would translate to an exclusion from the budget. Given political, institutional, and administrative factors (grant

restrictions on the use of awards, for instance), completely defunding major categories of expenditures is impossible.

Table 10

Predicting Change in Wage Gap: Step 1 (Political, Aid, Population, and Expenditures)

Predicting Change in Wage Gap: Step 1 (Political, Aid, Population, and Expenditures)

	Political	Aid	Population	Expenditures	Population and Aid	Population and Expenditure	Political and Population	Aid and Expenditure	Political and Expenditure
Home Rule	323.639						384.739		114.026
	-233.882						-237.458		-239.192
Consolidated	593.114**						234.073		222.541
	-205.187						-207.489		-196.388
Mayor Party Dem	460.609						242.065		208.623
	-347.596						-322.32		-335.862
Mayor Party UNA	-176.228						-50.606		-20.946
	-274.427						-183.135		62.72
Mayor Party Rep	-276.956						-177.371		38.896
	-370.932						-348.133		-343.764
Total Aid $_{t-1}$		0.401***			0.372*			-0.593***	
		-0.097			-0.106			-0.143	
Population $_{t-1}$			0.006***		0.007***	0.004***	0.006***		
			-0.001		-0.001	-0.001	-0.001		
Under 18 Population $_{t-1}$			-0.026***		-0.027***	-0.016***	-0.024***		
			-0.003		-0.003	-0.004	-0.004		
% African American Single Female Heads of House $_{t-1}$			-1,768.75		-1,730.28	-2,287.03	-2,216.79		
			-1,807.26		-1,779.26	-1,839.54	-1,902.61		
African American Employment$_{t-1}$			-4,719.932***		-1,429.49	158.524	-2,976.71		

Predicting Change in Wage Gap: Step 1 (Political, Aid, Population, and Expenditures)

			-1,502.52		-1,752.13	-1,675.05	-1,758.56		
Higher Education Expenditure $_{t-1}$				0		0		0	0
				0		0		0	0
Elementary Secondary Education Expenditure $_{t-1}$				-0.279		0.2		0.126	-0.323
				-0.209		-0.234		-0.226	-0.216
Libraries Expenditure $_{t-1}$				13.652***		9.342**		12.203***	12.770***
				-3.26		-3.395		-3.207	-3.423
Cash Assistance Expenditure $_{t-1}$				1.871		2.130*		2.567*	1.898
				-0.983		-0.98		-0.976	-0.993
Other Public Welfare Expenditure $_{t-1}$				-1.958*		-2.512*		-1.723*	-1.712
				-0.848		-0.844		-0.831	-0.907
Health Expenditure $_{t-1}$				1.083*		0.922*		1.756*	0.993*
				-0.36		-0.38		-0.388	-0.376
Housing Community Development Expenditure $_{t-1}$				1.166*		1.004*		1.810*	1.030*
				-0.234		-0.249		-0.276	-0.255
Constant	293.944	109.209	2,903.684*	189.498	922.908	147.673	2,083.26	354.122	47.388
	-399.633	-212.734	-914.517	-380.569	-1,063.10	-986.738	-1,102.93	-374.247	-490.518
Observations	360	360	360	360	360	360	360	360	360
Adjusted R^2	0.069	0.043	0.201	0.272	0.225	0.31	0.21	0.304	0.268

Note: ‘p<0.1;*p<0.05; **p<0.01; ***p<0.001

Table 11

Predicting Change in Wage Gap: Step 2 (Aid, Population, and Expenditures)

	Predicting Change in Wage Gap: Step 2 (Aid, Population, and Expenditures)
Total Aid $_{t-1}$	-0.4230*
	-0.1740
Population $_{t-1}$	0.0030**
	-0.0010
Under 18 Population $_{t-1}$	-0.0110**
	-0.0040
% African American Single Female Heads of House $_{t-1}$	-2824.2620
	-1839.8840
African American Employment $_{t-1}$	-1620.1550
	-1816.3870
Higher Education Expenditure $_{t-1}$	0.0000
	0.0000
Elementary Secondary Education Expenditure $_{t-1}$	0.4170`
	-0.2480
Libraries Expenditure $_{t-1}$	8.8660**
	-3.3760
Cash Assistance Expenditure $_{t-1}$	2.5240*
	-0.9860
Other Public Welfare Expenditure $_{t-1}$	-2.3100**
	-0.8420
Health Expenditure $_{t-1}$	1.4070**
	-0.4260
Housing Community Development Expenditure $_{t-1}$	1.4590***
	-0.3100
Intercept	1227.8260
	-1075.4030
Observations	392

Predicting Change in Wage Gap: Step 2 (Aid, Population, and Expenditures)	
Adjusted R^2	0.322
Note:	‘p<0.1;*p<0.05; **p<0.01; ***p<0.001

Table 12

Predicting Change in Wage Gap: Step 3 (Political, Aid, and Expenditure Interactions)

Predicting Change in Wage Gap: Step 3 (Political, Aid, and Expenditure Interactions)			
	Political and Aid	Political, Aid, and Population	Political, Aid, and Expenditure
Home Rule	-186.6580	668.3190	2,073.2310**
	-608.9370	-592.3240	-650.5080
Total Aid $_{t-1}$	-0.3160	0.7920	1.0020*
	-0.4450	-0.4890	-0.4540
Consolidated	-881.0660	-612.6200	77.5230
	-539.3760	-536.6840	-533.8010
Mayor Party Dem	-296.2420	767.7300	1,479.9660*
	-699.9210	-725.8370	-662.6130
Mayor Party Unaffiliated	814.6610	1544.8900`	2,736.3660**
	-986.7260	-929.6020	-954.8800
Mayor Party Rep	677.6640	1,891.2220*	1,665.2810*
	-898.7600	-882.1020	-803.3770
Population $_{t-1}$		0.0060***	
		-0.0010	
Under 18 Population $_{t-1}$		-0.0250***	
		-0.0040	
% African American Single Female Heads of House $_{t-1}$		-2252.5860	
		-1892.9240	
African American Employment $_{t-1}$		276.6730	

Predicting Change in Wage Gap: Step 3
(Political, Aid, and Expenditure Interactions)

		-2211.4730	
Higher Education Expenditure $_{t-1}$			0.0000
			0.0000
Elementary Secondary Education Expenditure $_{t-1}$			0.0310
			-0.2380
Libraries Expenditure $_{t-1}$			11.1280**
			-3.4840
Cash Assistance Expenditure $_{t-1}$			2.4490*
			-0.9860
Other Public Welfare Expenditure $_{t-1}$			-0.7190
			-0.9090
Health Expenditure $_{t-1}$			2.2300***
			-0.4890
Housing Community Development Expenditure $_{t-1}$			1.7820***
			-0.3190
Total Aid Per Person $_{t-1}$* Home Rule	0.2780	-0.1030	-1.0840**
	-0.3210	-0.3070	-0.3380
Total Aid Per Person $_{t-1}$* Consolidation	0.6930**	0.3910	0.0650
	-0.2370	-0.2420	-0.2500
Total Aid Per Person $_{t-1}$* Mayor Party DEM $_{t-1}$	0.3410	-0.3860	-0.8360*
	-0.3430	-0.3710	-0.3410
Total Aid Per Person $_{t-1}$* Mayor Party Unaffiliated $_{t-1}$	-0.3900	-0.8350*	-1.3370**
	-0.4130	-0.3940	-0.4220
Total Aid Per Person $_{t-1}$* Mayor Party REP $_{t-1}$	-0.6270	-1.3520*	-1.0640*
	-0.5200	-0.5220	-0.4640
Constant	869.1000	-517.5110	-2,526.6250**
	-863.3330	-1716.0510	-883.8550
Observations	360	360	360
Adjusted R^2	0.138	0.253	0.334

Predicting Change in Wage Gap: Step 3 (Political, Aid, and Expenditure Interactions)	
Note:	‘p<0.1;*p<0.05; **p<0.01; ***p<0.001

Table 13

Predicting Change in Wage Gap: Step 4 and 5 (Full Model and Significant Variables Only)

Predicting Change in Wage Gap: Stepwise Regression (Full Model and Significant Variables)		
	Full Model	Significant
Home Rule	1,983.7080**	2,115.4810***
	-670.3480	-550.8090
Total Aid $_{t-1}$	1.2140*	1.2790**
	-0.5170	-0.4030
Consolidated	28.5260	
	-550.2840	
Mayor Party Dem	1,721.8020*	1,666.6210*
	-743.2390	-650.6490
Mayor Party Unaffiliated	2,837.6610**	2,985.9690**
	-973.5100	-945.1700
Mayor Party Rep	2,053.6060*	1,762.1830*
	-834.6080	-802.9860
Population $_{t-1}$	0.0020`	0.0020*
	-0.0010	-0.0010
Under 18 Population $_{t-1}$	-0.0100*	-0.0090*
	-0.0050	-0.0040
% African American Single Female Heads of House $_{t-1}$	-2329.2950	
	-2006.5130	
African American Employment $_{t-1}$	744.9240	
	-2382.6650	
Higher Education Expenditure $_{t-1}$	0.0000	
	0.0000	

Predicting Change in Wage Gap: Stepwise Regression (Full Model and Significant Variables)		
Elementary Secondary Education Expenditure $_{t-1}$	0.2370	
	-0.2710	
Libraries Expenditure $_{t-1}$	8.8970*	8.2470*
	-3.7050	-3.4510
Cash Assistance Expenditure $_{t-1}$	2.1080*	1.9440*
	-0.9980	-0.9440
Other Public Welfare Expenditure $_{t-1}$	-1.3960	
	-0.9550	
Health Expenditure $_{t-1}$	2.0910*	2.0670***
	-0.5160	-0.4800
Housing Community Development Expenditure $_{t-1}$	1.4660*	1.4080***
	-0.3530	-0.3390
Total Aid Per Person $_{t-1}$* Home Rule	-0.9550**	-1.1010***
	-0.3450	-0.2930
Total Aid Per Person $_{t-1}$* Consolidation	0.0480	
	-0.2570	
Total Aid Per Person $_{t-1}$* Mayor Party DEM $_{t-1}$	-0.9760*	-0.9430**
	-0.3790	-0.3360
Total Aid Per Person $_{t-1}$* Mayor Party Unaffiliated $_{t-1}$	-1.4110**	-1.5200***
	-0.4300	-0.4120
Total Aid Per Person $_{t-1}$* Mayor Party REP $_{t-1}$	-1.3500**	-1.1330*
	-0.4910	-0.4620
Constant	-2551.3780	-2,609.0020*
	-1793.2290	-800.4320
Observations	360	360
Adjusted R^2	0.343	0.346
Note:	‘p<0.1;*p<0.05; **p<0.01; ***p<0.001	

Figure 11

Effect Plot for Local Authority on Change in Wage Gap

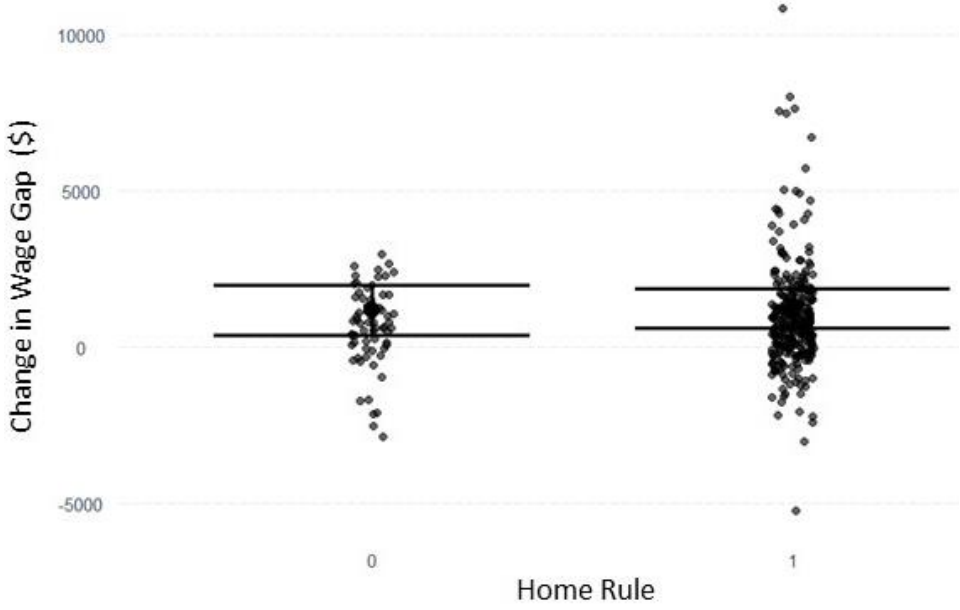


Figure 12

Effect Plot for Total Aid on Change in Wage Gap

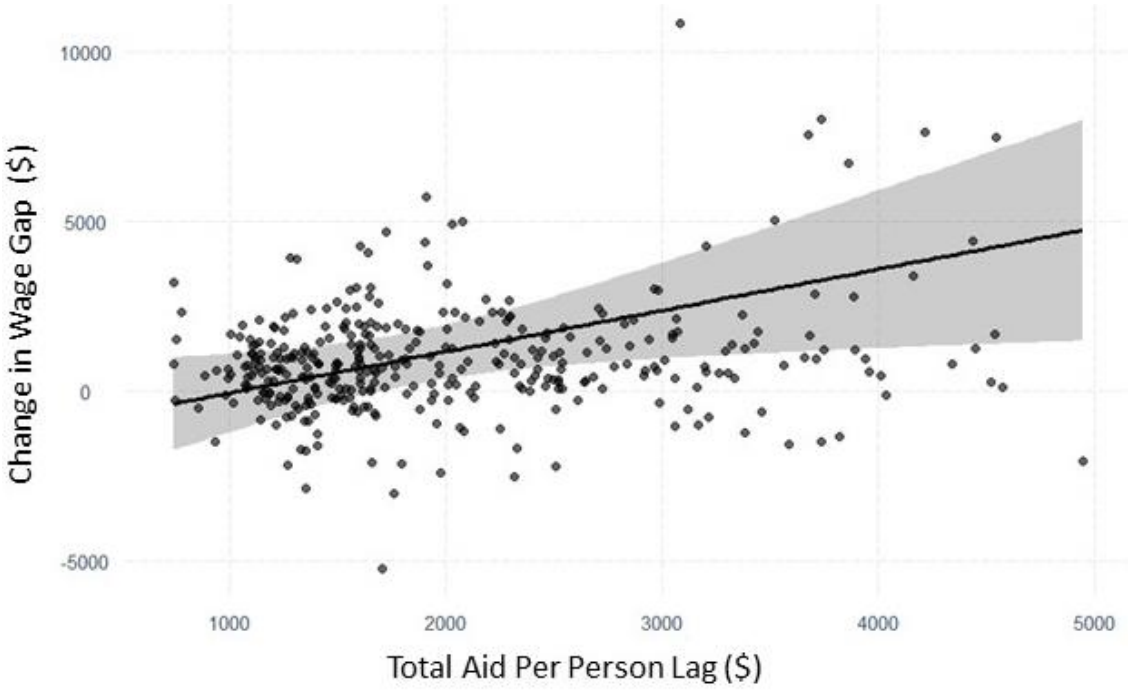


Figure 13

Effect Plot for Local Partisanship on Change in Wage Gap

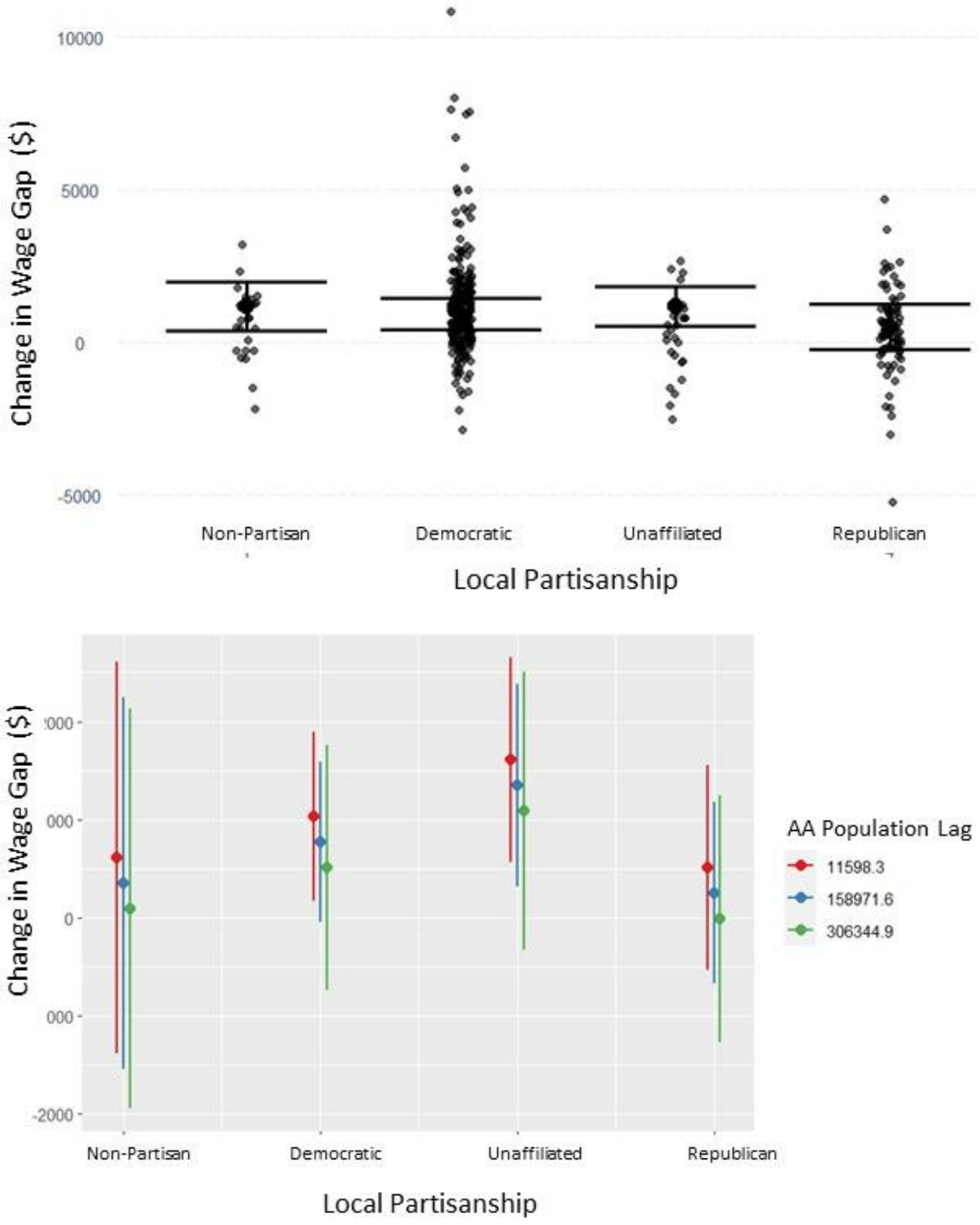


Figure 14

Effect Plot for Youth Population on Change in Wage Gap

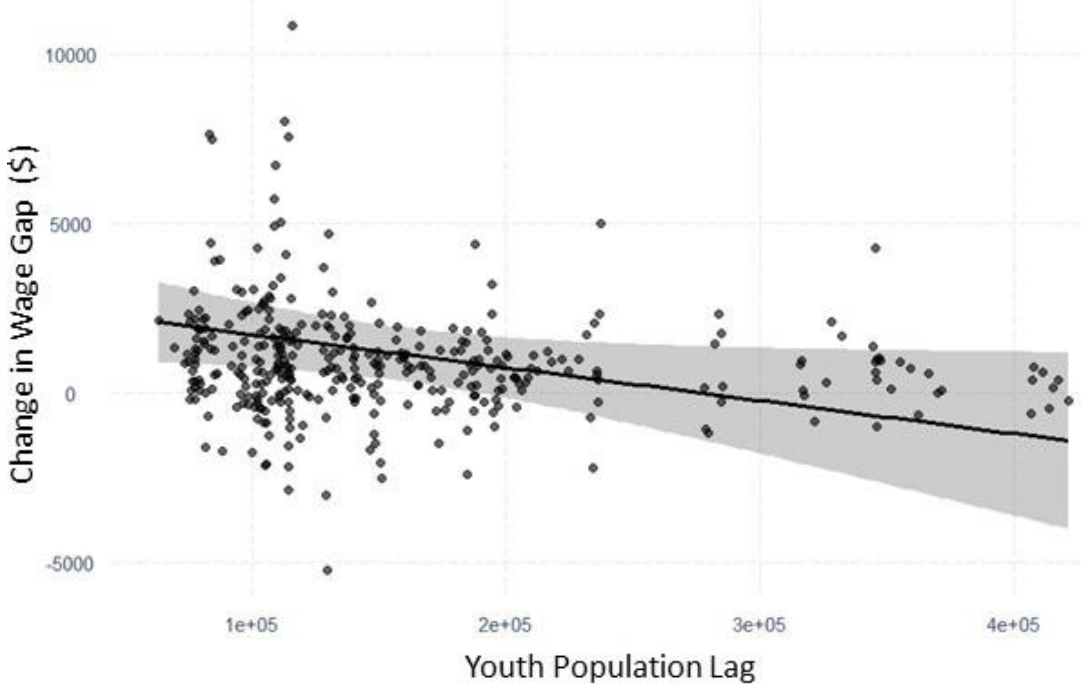


Figure 15

Effect Plot for Population on Change in Wage Gap

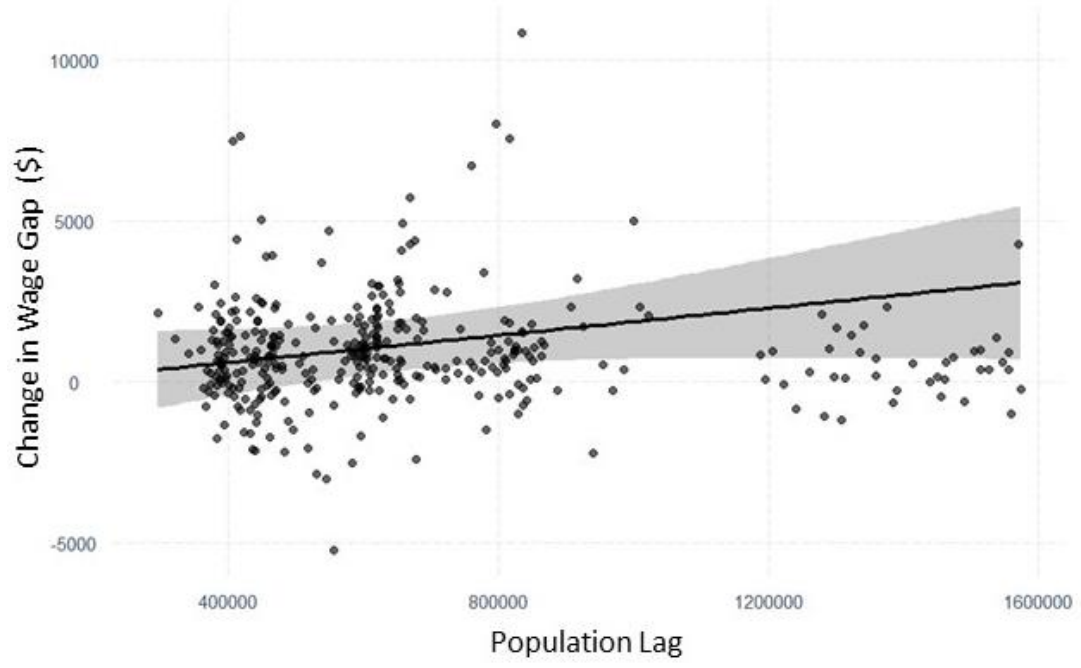


Figure 16

Effect Plot for Interaction of Local Partisanship and Aid Per Person on Change in Wage Gap

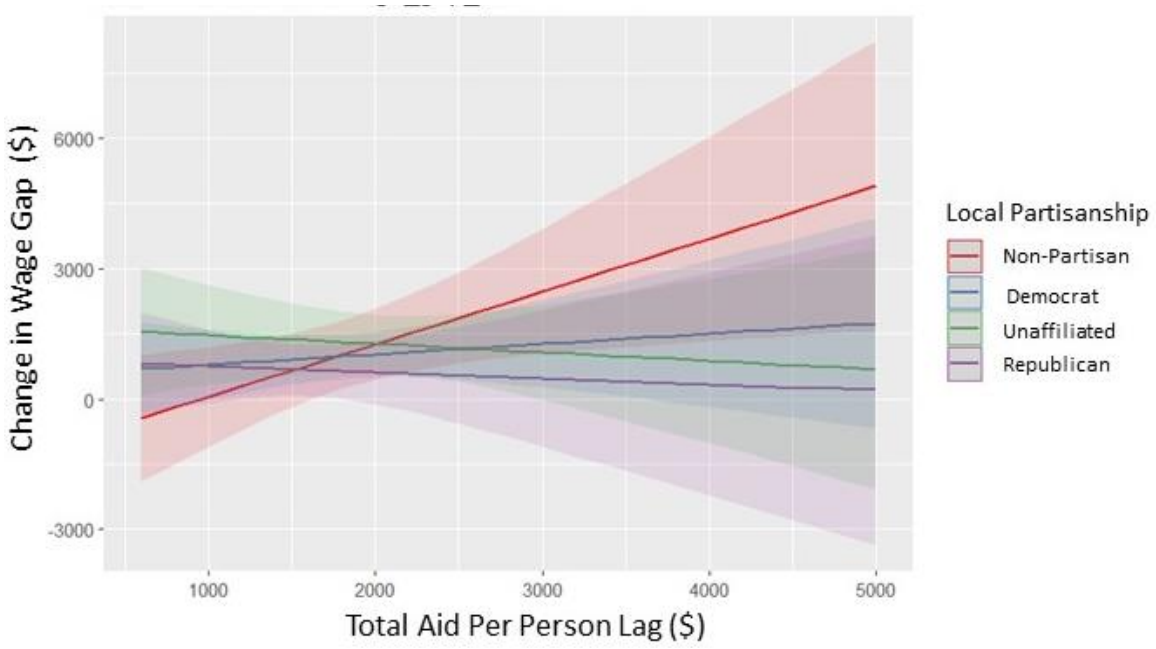


Figure 17

Effect Plot for Interaction of Local Authority and Aid Per Person on Change in Wage Gap

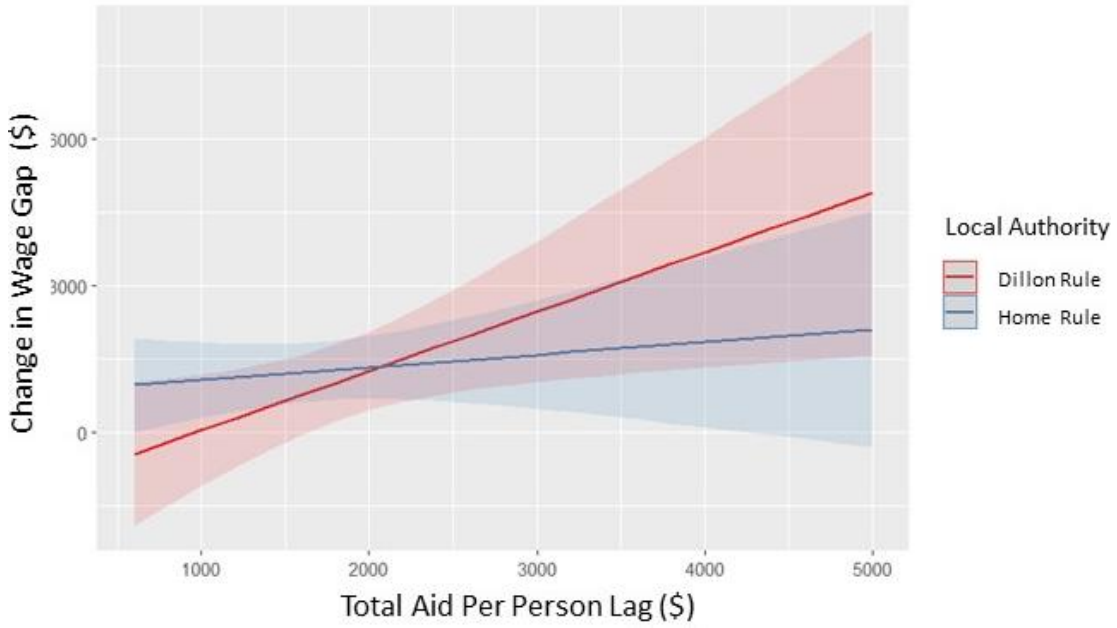


Figure 18

Effect Plot for Library Expenditures on Change in Wage Gap

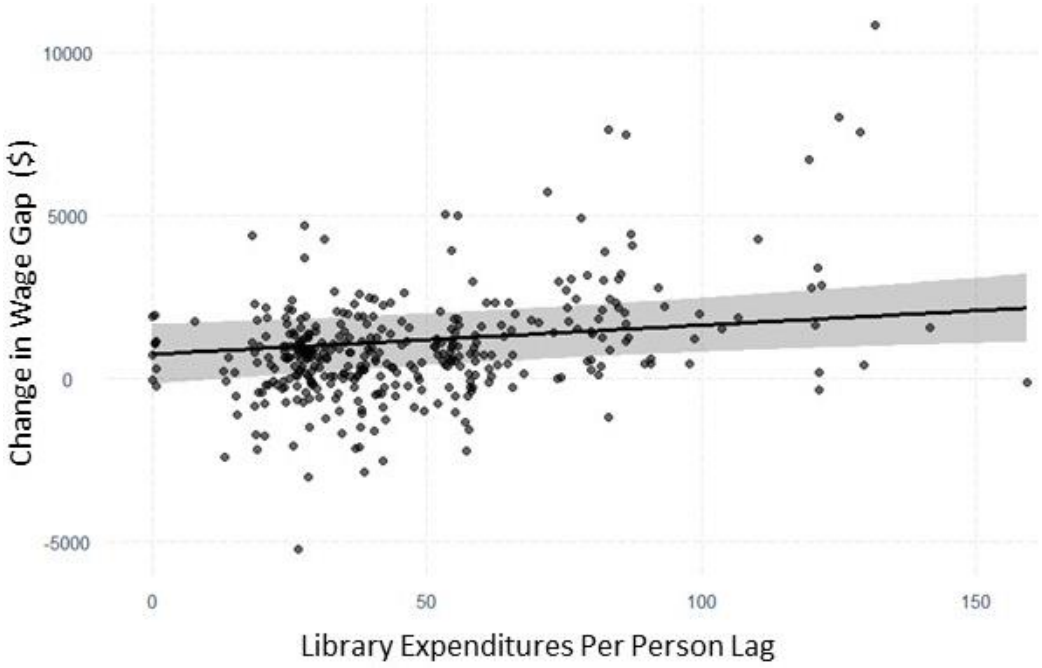


Figure 19

Effect Plot for Cash Assistance Expenditures on Change in Wage Gap

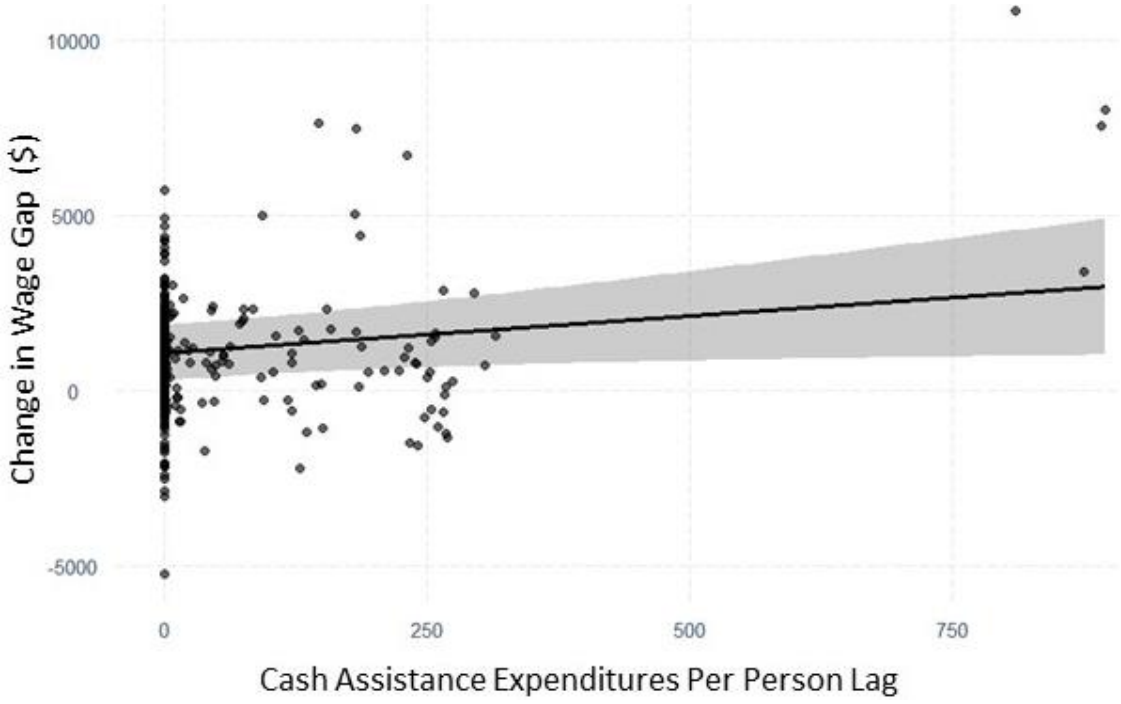


Figure 20

Effect Plot for Health Expenditures on Change in Wage Gap

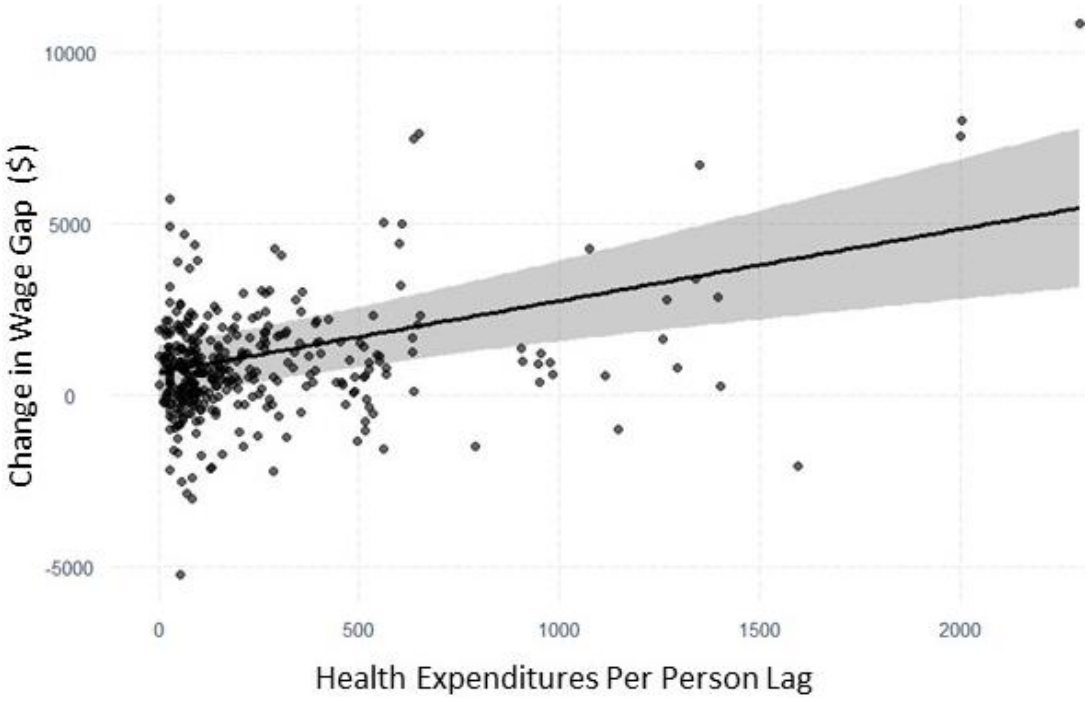
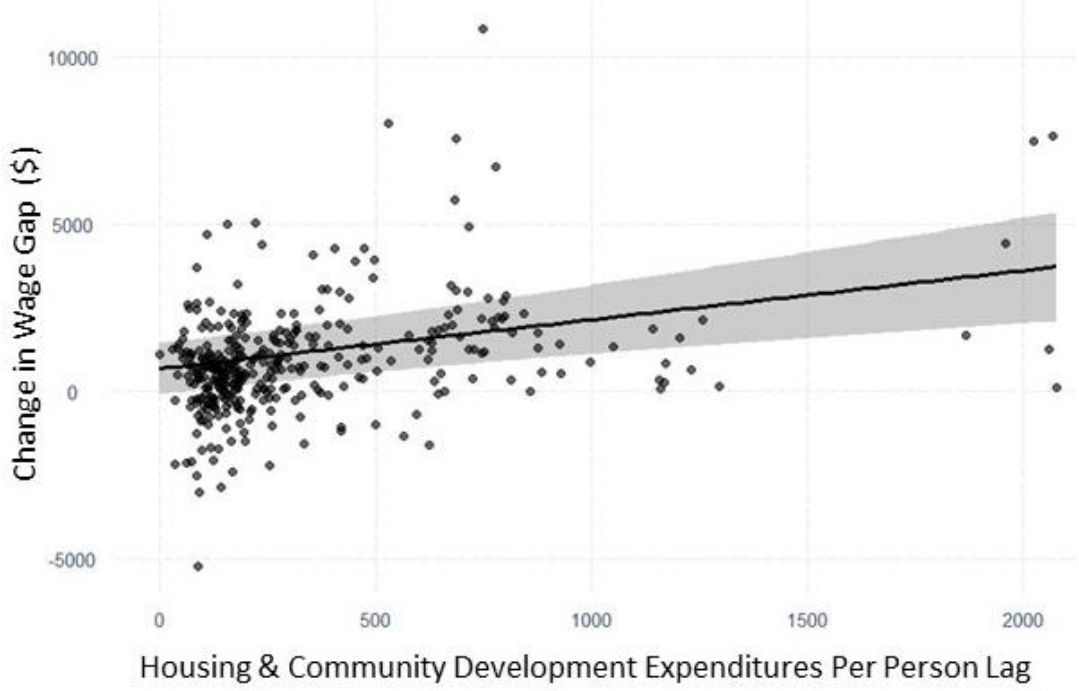


Figure 21

Effect Plot for Housing and Community Expenditures on Change in Wage Gap



Mediation Analysis: Aid and Expenditures on the Change in Wage Gap

Above, I included all the political, population, aid, and expenditure factors in the regression analysis. As discussed previously, I am interested in not only the effects of each variable on economic mobility, but also in establishing causal relationships between them. I expected that the effect of aid on the change in wage gap was mediated by expenditures–that is, the effectiveness of total aid on the change in wage gap was impacted by how the aid was spent. Therefore, as previously discussed, I conducted a mediation analysis to determine the mediating effect of expenditures on economic mobility. Having already confirmed the significance of the effect of total aid per person on the change in wage gap, I proceed to the mediation analysis. Results are captured in Table 14 below.

Table 14

Mediation Effect of Expenditures by Category on Economic Mobility

Mediation Effect of Expenditures by Category on Economic Mobility														
	Mediators													
	Higher Education Expenditure/pp		Elementary Education Expenditure/pp		Libraries Expenditure/pp		Cash Assistance Expenditure/pp		Other Public Welfare Expenditure/pp		Health Expenditure/pp		Housing and Community Expenditure/pp	
Path analysis	***ß***	***SE***	***ß***	***SE***	***ß***	***SE***	***ß***	***SE***	***ß***	***SE***	***ß***	***SE***	***ß***	***SE***
IV-M	945.2	1614	0.1697***	0.023	0.0074***	0.001643	0.078***	0.006743	0.0703***	0.00696	0.02455***	0.01584	0.1892***	0.01903
M-DV	-0.00000049	-0.00000035	0.03645	0.245	12.82***	3.369	2.762***	0.8247	-0.7063	0.8102	1.799***	0.351	0.8428**	2.93E-01
Bootstrapping														
Indirect effect through M	-0.000463		0.00618		0.0948***		0.2169		-0.0496		0.2895		0.1595*	
BC 95% CIa Lower	-0.005641		-0.06460		0.0366		-0.0989		-0.2094		-0.0512		0.00823	
BC 95% CIa Upper	0.01		0.07397		0.18		0.43		0.08		0.59		0.35	

Note: N=360

*p<.05; **p<.01.

IV = aid/pp; DV = change in wage gap

aBC = bias-corrected; CI = confidence interval (10 Bootstrap samples).

In the first step, I tested the impact of total aid on each expenditure, controlling for population factors. In order for there to be a mediating effect, it would stand to reason that aid has a significant impact on economic mobility expenditures. As expected, with the exception of higher education, total state and federal aid to localities has a significant positive effect on all expenditures (states fund higher education institutions directly, so any local funding to higher education would come from other sources).

In the second step, I considered the isolated impact of each expenditure on economic mobility, while controlling for aid population factors. As indicated in Table 14, expenditures on libraries, cash assistance, health, and housing and community development display significant effects on the change in wage gap. However, results indicate a widening of the wealth gap with additional funding. As previously discussed with regard to aid, this pattern seems to mimic a dynamic in which funding is serving to temper the widening rather than reversing it.

Based on the above analyses, I calculated the indirect effect of each expenditure category on economic mobility. Libraries and housing and community appear to significantly mediate the effects of aid on the change in wage gap, again with coefficients in the opposite direction than expected.

Moderated Mediation Analysis: Local Authority, Consolidation, and Partisanship on Expenditures on Change in Wage Gap

I hypothesize that local authority, consolidation, and local partisanship moderate the mediation effect via expenditures of aid on the change in wage gap. Therefore, I conducted moderated mediation analysis for each variable. Results are captured in Table 15 below.

Table 15

Moderated Mediation: Political and Institutional Factors on Mediation Effect of Expenditures

Moderated Mediation: Political and Institutional Factors on Mediation Effect of Expenditures

		Mediators													
Moderator Variable		Higher Education Expenditure/pp		Elementary Education Expenditure/pp		Libraries Expenditure/pp		Cash Assistance Expenditure/pp		Other Public Welfare Expenditure/pp		Health Expenditure/pp		Housing and Community Expenditure/pp	
		Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect
Local Authority	Home Rule	0.346***	0.00528***	0.3599***	-0.00888	0.21855	0.1324***	0.0875	0.2635	0.40547***	-0.05447	-0.0158	0.3668***	0.20928***	0.142***
Consolidation	Dillon Rule	0.6454***	-0.0309***	0.6317***	-0.0236	0.755***	-0.140***	0.6011***	0.01332	0.61168 ***	0.00282	0.5787***	0.03582	0.4287***	0.1858***
	Consolidated	0.660507***	-0.0004	0.6518***	0.00828	0.5929***	0.06719	0.4192***	0.2409	0.66338***	0.00327	0.31	0.350***	0.512***	0.1481***
	Separate	0.2323	-0.00035	0.2146***	0.0173	0.1358	0.096***	0.0071	2.25E-01	0.2464	-0.0145	-0.0131	0.245***	0.04	0.1919***
Local Party	Non-Partisan	0.6103***	-0.011	0.5387***	0.0607	0.4135	0.1858***	0.47116	0.12818	0.60742	-0.00808	0.4923***	0.1070***	0.5799***	0.0194***
	Democratic	0.49172***	0.00133	0.4659***	0.02708	0.3926***	0.1005***	0.2531***	0.2400***	0.5062***	-0.0132	0.0574	0.4356***	0.36702***	0.1260***
	Unaffiliated	-0.07826	0.00482	-0.15578	0.08234	-0.07868	0.00524	-0.3306	0.2571	-0.0447	-0.0288	-0.8316	0.7582	-0.0643	-0.00914
	Republican	-0.47006	-0.00303	-0.574	0.101	-0.6679	0.1948	-0.5139***	0.04079	-0.4673	-0.0058	-0.5114	0.0383	-0.5142***	0.0411

Note: N=360. Adjusted for population, youth population, African American single female heads of household, and African American full-time employment. Bootstraps were constructed using 10 samples and 95% confidence intervals.

Results indicate that home rule cities spend more on libraries, health, and housing and community development expenditures at a given level of aid (above about $1500/pp for libraries and health, up to about $3500/pp for housing and community development). In contrast, Dillon rule cities spend more on higher education expenditures at a given level of aid (up to about $3500/pp) then home rule cities (see Figures 22-25).

Consolidation status significantly moderates expenditures on libraries, health, and housing and community development (see Figures 26-28). Results indicate that consolidated cities spend more at a given level of aid on libraries (up to about $4500/pp), health (above about $1500/pp), and housing and community development (virtually all levels).

Local Partisanship has significant moderating effects on libraries, cash assistance, health, and housing and community development expenditures (see Figures 29-32). Non-partisan and Democratic-led cities are positively correlated with an increase in library, health, and housing and community expenditures. Finally, Democratic-led cities are positively correlated with an increase in cash assistance expenditures.

Figure 22

Effect Plot for Interaction of Local Authority and Aid Per Person on Higher Ed Expenditures

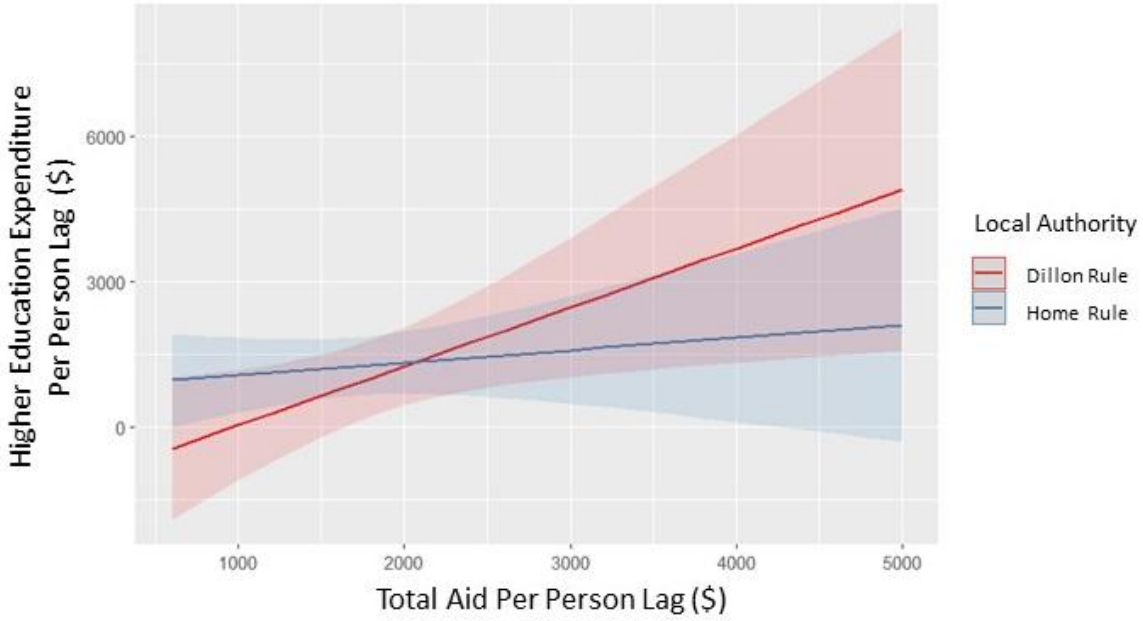


Figure 23

Effect Plot for Interaction of Local Authority and Aid Per Person on Library Expenditures

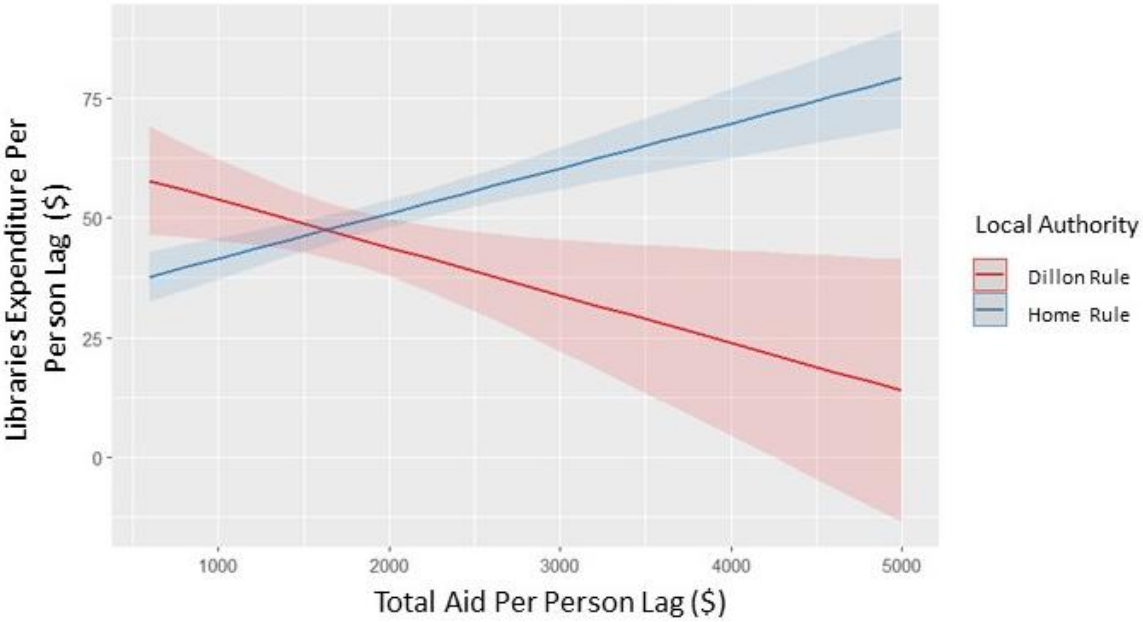


Figure 24

Effect Plot for Interaction of Local Authority and Aid Per Person on Health Expenditure

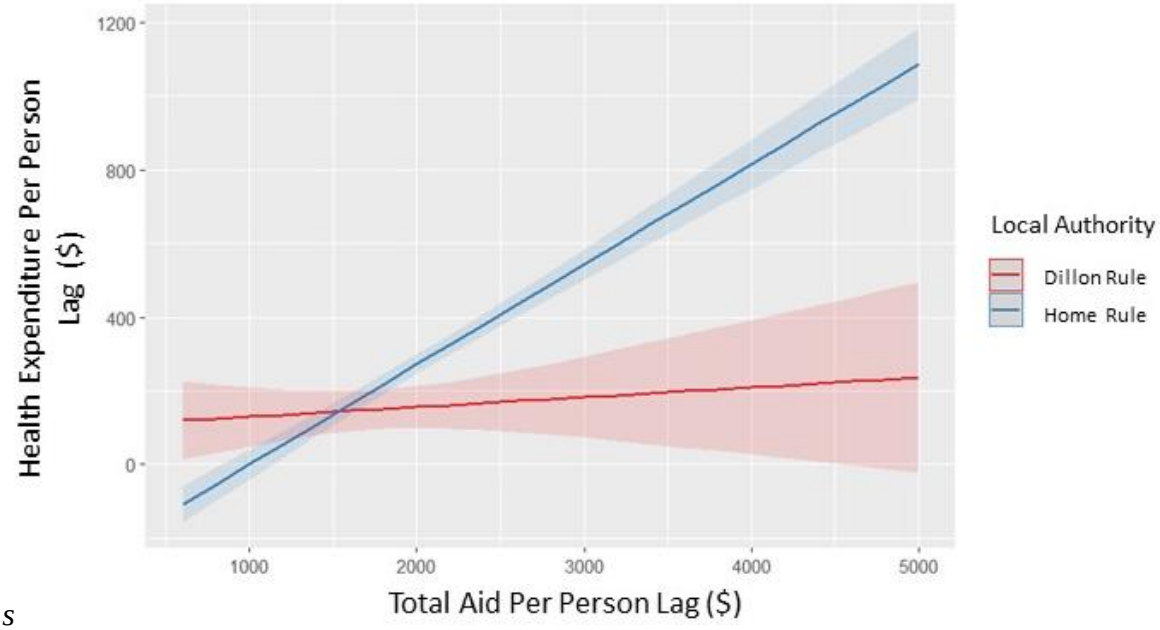


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Figure 25

Effect Plot for Interaction of Local Authority and Aid Per Person on Housing Expenditures

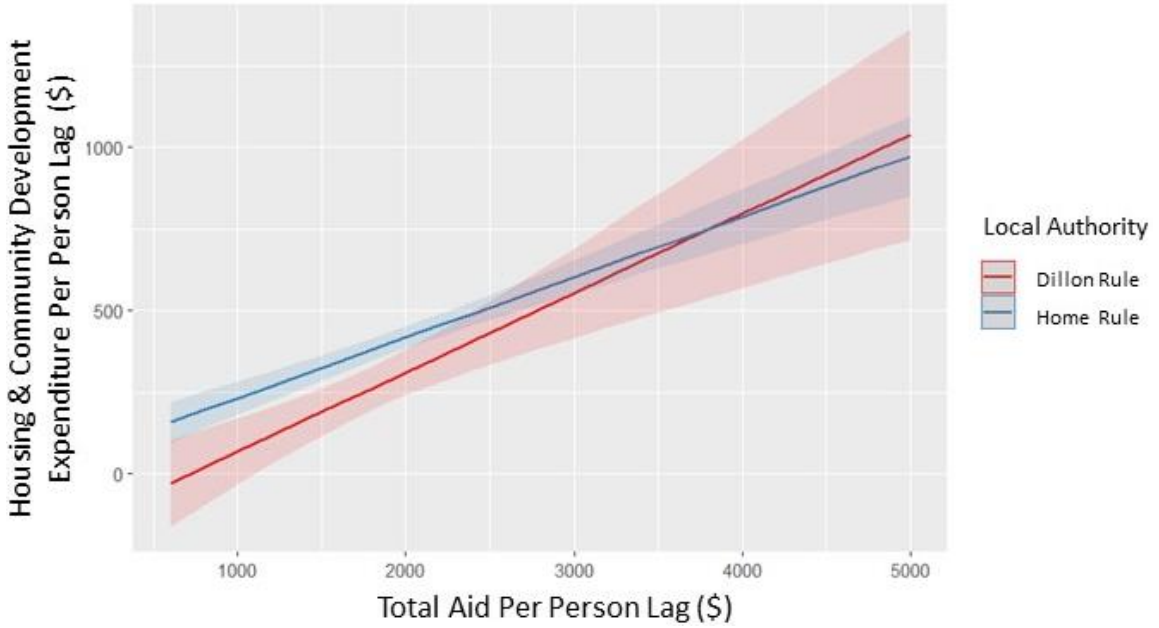


Figure 26

Effect Plot for Interaction of Consolidation and Aid Per Person on Library Expenditures

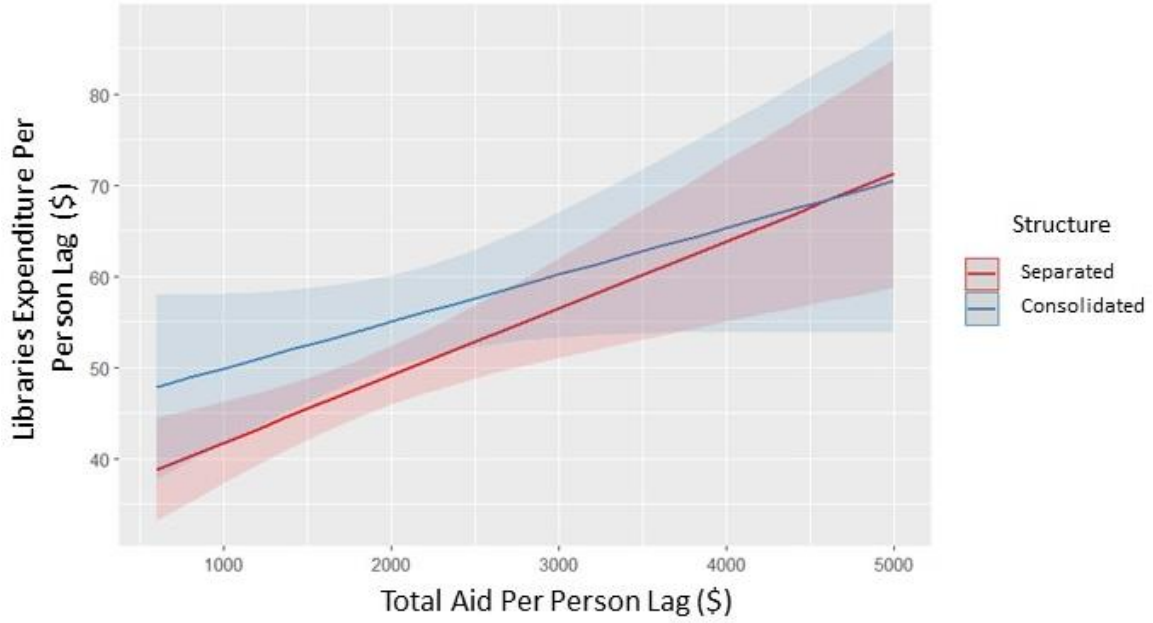


Figure 27

Effect Plot for Interaction of Consolidation and Aid Per Person on Health Expenditures

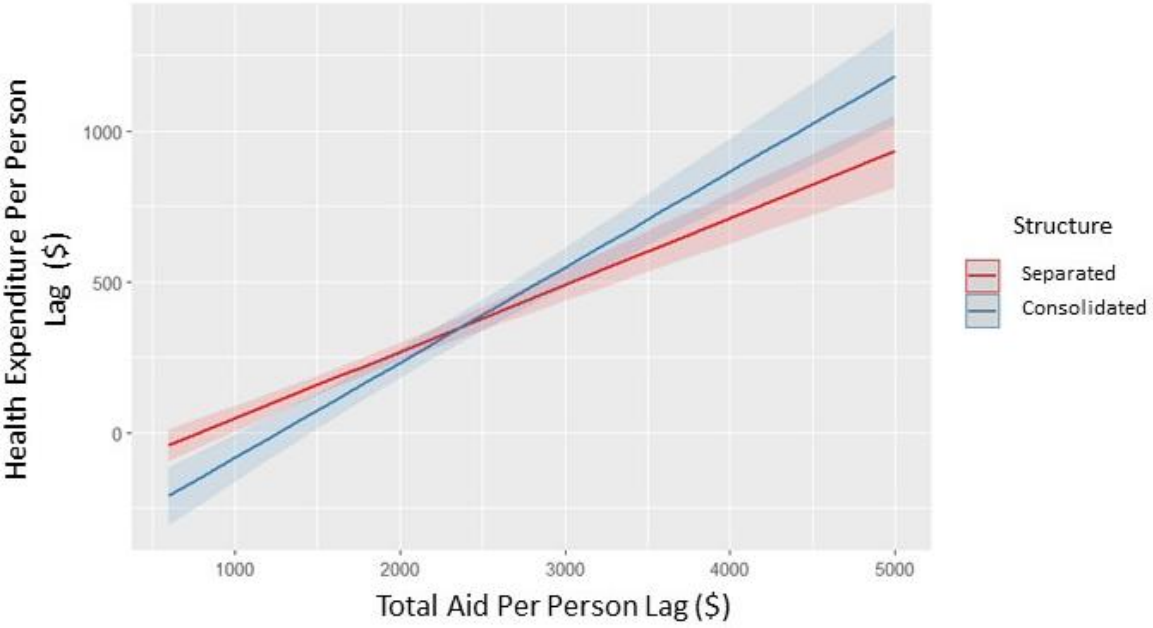


Figure 28

Effect Plot for Interaction of Consolidation and Aid Per Person on Housing Expenditures

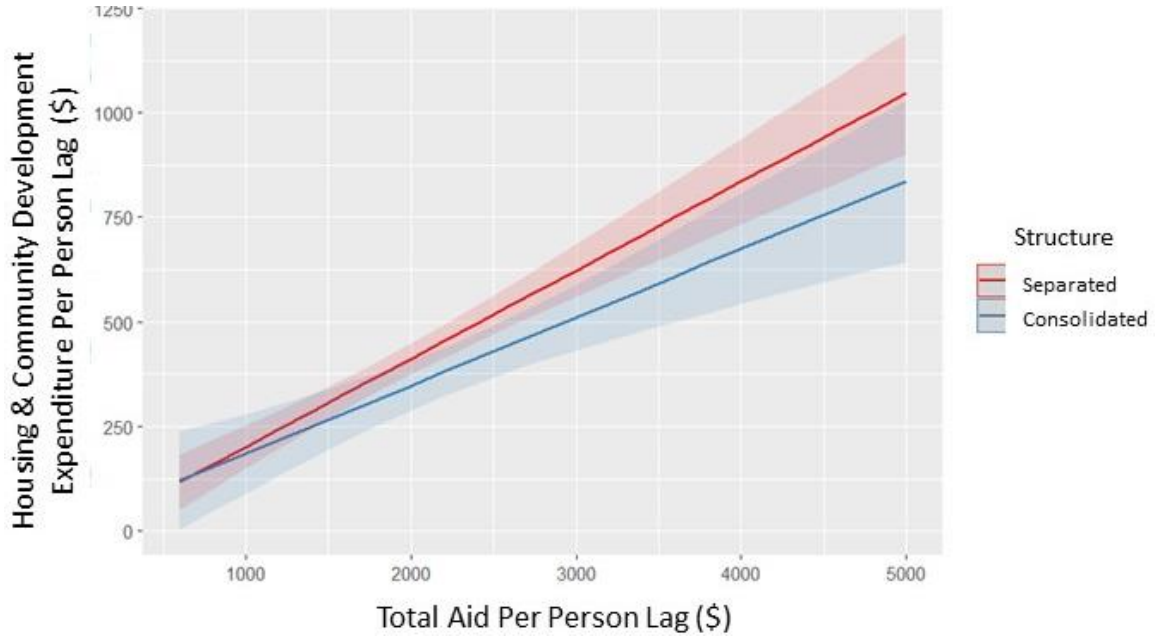


Figure 29

Effect Plot for Interaction of Local Partisanship and Aid Per Person on Library Expenditures

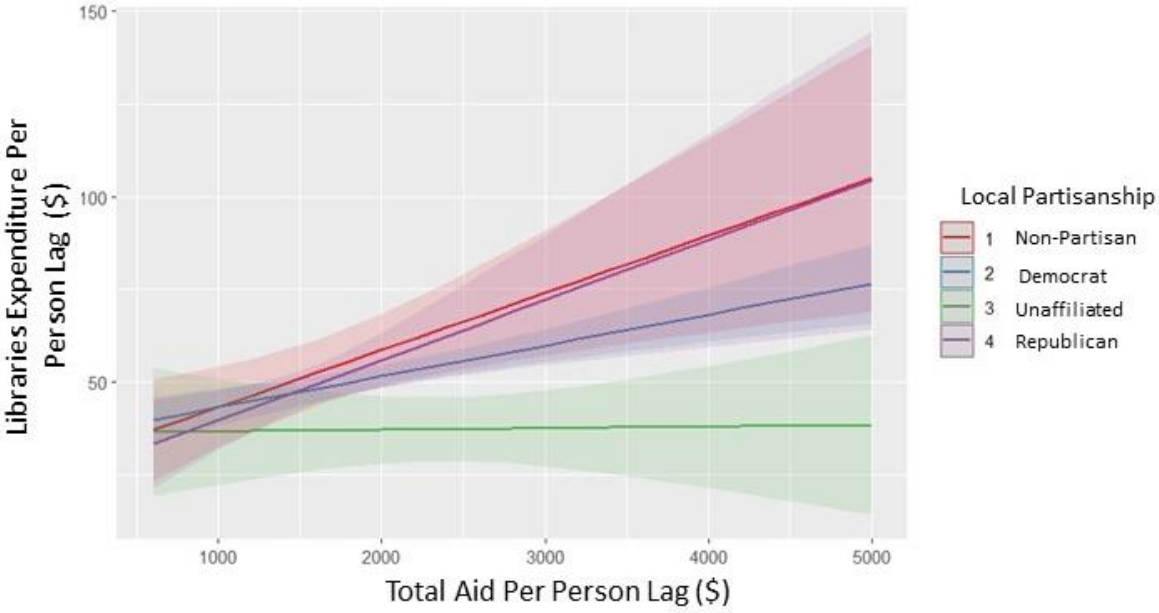


Figure 30

Effect Plot for Interaction of Local Partisanship and Aid Per Person on Cash Expenditures

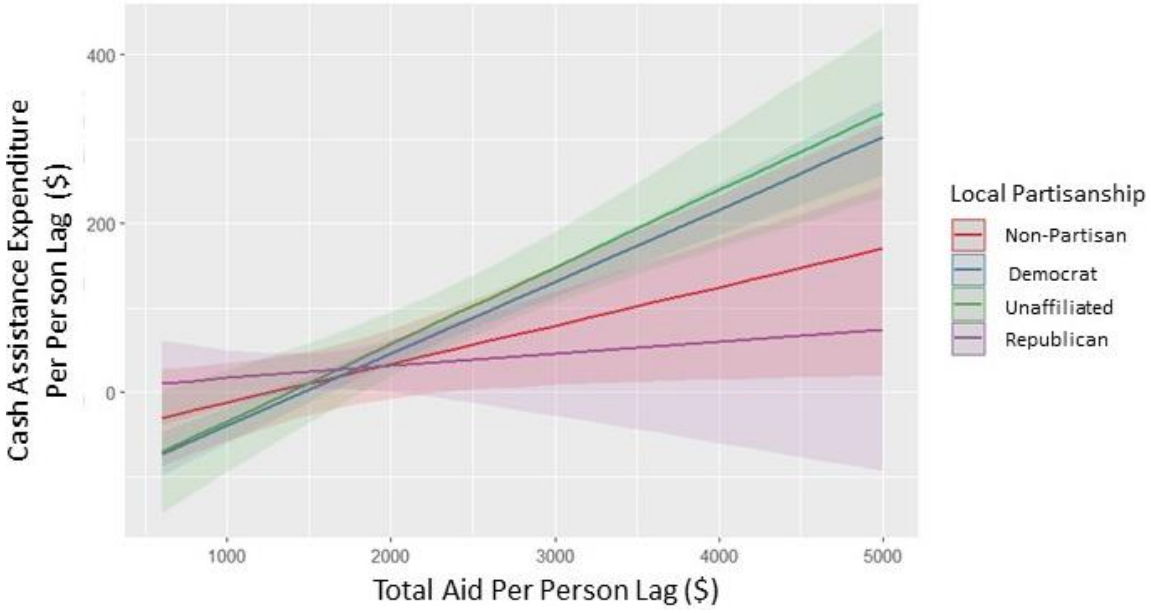


Figure 31

Effect Plot for Interaction of Local Partisanship and Aid Per Person on Health Expenditures

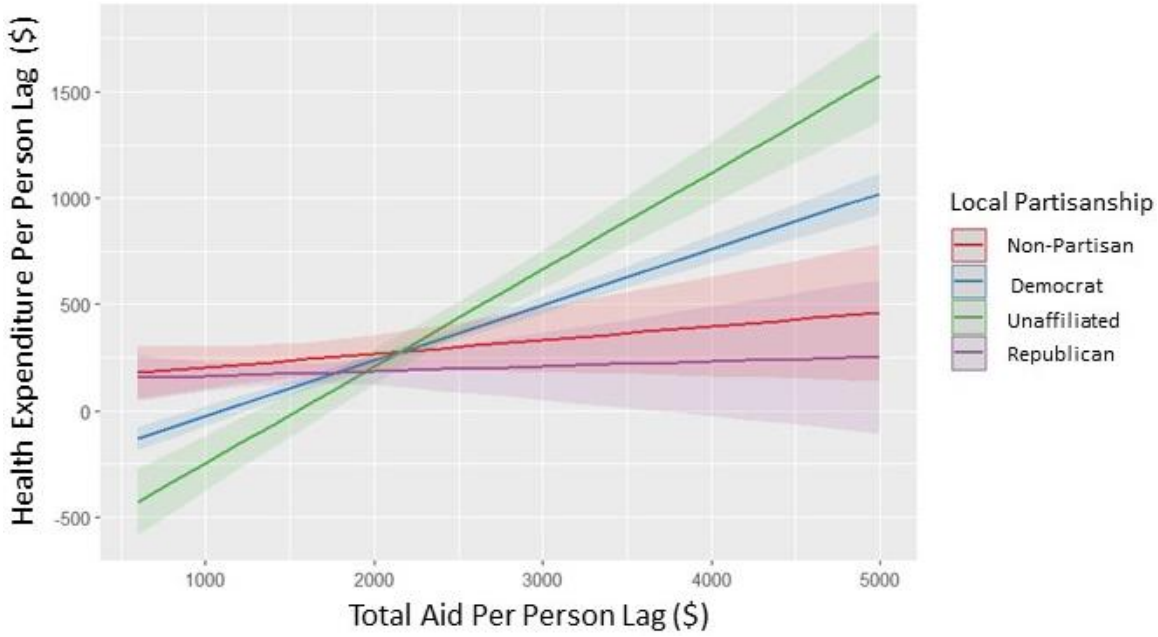


Figure 32

Effect Plot for Interaction of Local Partisanship and Aid Per Person on Housing Expenditures

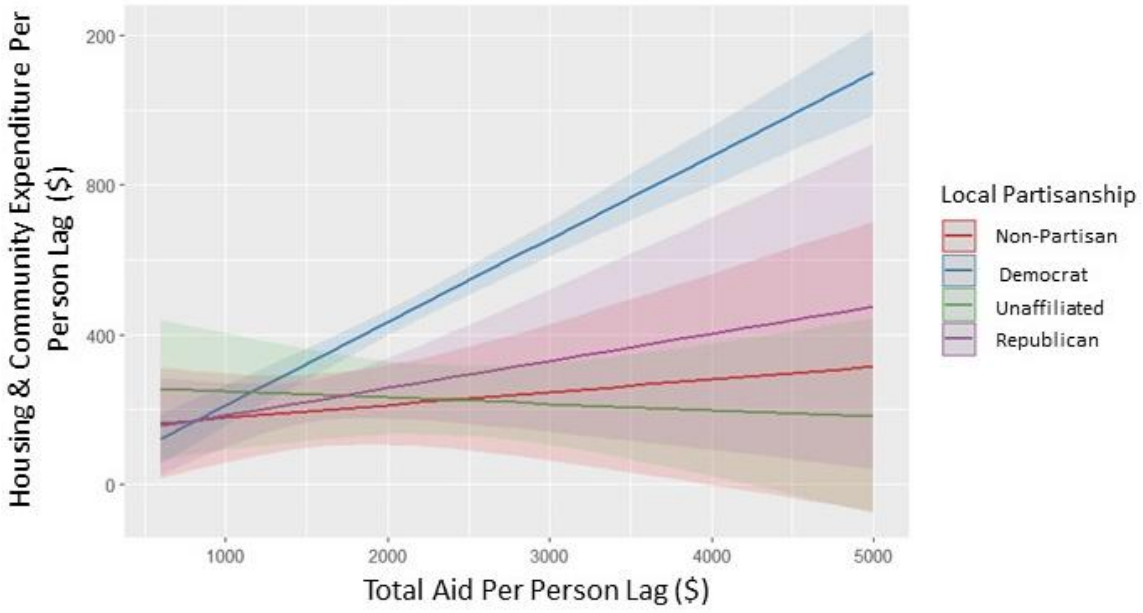


Table 16

Chapter 4 Research Question Results (Stepwise Regression and Mediation Analysis)

Chapter 4 Research Questions: Political and Institutional Factors

Research Question	Hypothesis	Accept/Reject	Table
How does partisanship of state, local, and federal elected officials impact state and federal budget aid?	Cities in which local, state, and federal political ideologies are aligned will receive more aid.	**Partially Accept**	Table 8
How do population contextual factors of a city impact aid?	As African American employment rates increase, federal and state aid decreases.	**Accept**	Table 8
How does aid impact economic mobility?	As aid increases, economic mobility increases.	**Reject**	Table 13
How do city institutional designs influence economic mobility?	The presence of home rule is positively correlated with an increase in economic mobility.	**Reject**	Table 13
	The presence of consolidation is positively correlated with an increase in economic mobility.	**Reject**	Table 13
How does city partisanship influence economic mobility?	The presence of local Democratic partisanship is positively correlated with an increase in economic mobility. The presence of local Republican partisanship is negatively (or to a lesser positive degree versus Democratic partisanship) correlated with an increase in economic mobility.	**Reject**	Table 13

Chapter 4 Research Questions: Political and Institutional Factors			
How do aid, partisanship, and institutional design impact economic mobility expenditure?	In a comparison of cities, those with legislative autonomy (or home rule) spend more on economic mobility-related expenditures with a given level of aid than those without legislative autonomy.	**Partially Accept**	Table 15
	In a comparison of cities, consolidated cities spend more on economic mobility-related expenditures with a given level of aid than non-consolidated cities.	**Partially Accept**	Table 15
	In a comparison of cities, Democrat-led cities spend more on economic mobility-related expenditures with a given level of aid than Republican-led cities	**Partially Accept**	Table 15
How does budget policy impact economic mobility?	As expenditures related to economic mobility increase, economic mobility increases.	**Reject**	Table 14

Summary

In this chapter, I presented results investigating the political, population, aid, and expenditure factors that impact economic mobility. The results of these analyses are summarized in Table 17 below.

To varying degrees, I confirmed that political, population, and budget policy factors matter when it comes to economic mobility. However, perhaps the biggest takeaway is that we are, at best, only tempering the steady widening of the wealth gap in this country.

I also presented two models as a basis for building a predictive model for directing budget policy. Due to the theoretical considerations retained in the full model, I will proceed with using the full model as the basis for the optimization model in Chapter 6. Overall, both models indicate there remains much more to predicting mobility than the political, population, and budget policy variables analyzed to this point. Given the impact of institutional racism in America, I am particularly interested in exploring how social characteristics of cities may play a role in economic mobility outcomes, which I cover in Chapter 5. In addition, given the time-

series nature of the data, additional historical data would enable additional exploration of linkages between aid, expenditures, and economic mobility over time[5].

Table 17

Chapter 4 Research Question: Political Factors Hypotheses Testing Summary

Chapter 4 Research Questions: Political and Institutional Factors

Research Question	Hypothesis	Accept/Reject	Table
How does partisanship of state, local, and federal elected officials impact state and federal budget aid?	Cities in which local, state, and federal political ideologies are aligned will receive more aid.	**Partially Accept**	Table 8
How do population contextual factors of a city impact aid?	As African American employment rates increase, federal and state aid decreases.	**Accept**	Table 8
How does aid impact economic mobility?	As aid increases, economic mobility increases.	**Reject**	Table 13
How do city institutional designs influence economic mobility?	The presence of home rule is positively correlated with an increase in economic mobility.	**Reject**	Table 13
	The presence of consolidation is positively correlated with an increase in economic mobility.	**Reject**	Table 13
How does city partisanship influence economic mobility?	The presence of local Democratic partisanship is positively correlated with an increase in economic mobility. The presence of local Republican partisanship is negatively (or to a lesser positive degree versus Democratic partisanship) correlated with an increase in economic mobility.	**Reject**	Table 13
How do aid, partisanship, and institutional design impact economic mobility expenditure?	In a comparison of cities, those with legislative autonomy (or home rule) spend more on economic mobility-related expenditures with a given level of aid than those without legislative autonomy.	**Partially Accept**	Table 15
	In a comparison of cities, consolidated cities spend more on economic mobility-related expenditures with a given level of aid than non-consolidated cities.	**Partially Accept**	Table 15
	In a comparison of cities, Democrat-led cities spend more on economic mobility-related expenditures with a given level of aid than Republican-led cities	**Partially Accept**	Table 15
How does budget policy impact economic mobility?	As economic mobility-related expenditures increase, economic mobility increases.	**Reject**	Table 14

[5] I completed an analogous analysis for the annual wage gap, the second dependent variable in the multi-objective optimization. Given the adjusted R^2 was so high (.7544), I concluded this model maintained theoretical merit.

Chapter 5: Social Factors

Atlanta. Houston. Dallas. Washington, DC. Each of these cities, among others, is becoming increasingly recognized as havens for the up and coming Black professional. The legendary Maynard Jackson, Atlanta's first Black mayor, is remembered as a prolific leader and trailblazer in the growth of minority business participation in major public projects, credited for creating more Black millionaires in Atlanta than in any other city. Beyond one man's bold vision, what made Atlanta ripe for this kind of wealth generation? Would any other city have been just as attractive a backdrop? Why not Charlotte, whose residents elected Harvey Gantt, the city's first Black mayor in the same year Jackson's second term ended?

In Chapter 4, I investigated the impact of population, political, and budget policy factors on economic mobility. I argue that these variables alone do not fully explain the economic mobility patterns in cities. While each of these factors tend to be more associated with formal institutions, informal institutions–influenced by social factors–have a role to play in economic mobility outcomes. In this case, political capital is the chief currency and a major factor in policy development for local government. I seek to explore how social factors might function as a proxy for political capital, and its impact on economic mobility when wielded in growing numbers by the ones most affected.

This chapter presents results investigating the social factors that impact economic mobility. I argue that economic mobility rises with African American population and affluence: when Black people can influence the political process through voting, financial contributions, and policy advocacy, outcomes for Black people on the whole improve. Why? Because elected officials act in ways to preserve their power. In order to get re-elected, representatives must

maintain positive relationships with those who have an outsized influence on the political landscape.

Consistent with social contact theory outlined in Chapter 2 (Pettigrew, 2018), I also argue that the impact of segregation is decreased economic mobility for Black people, as would-be allies are removed from proximity to the issues affecting lower income (disproportionately Black) earners, so they no longer share common goals.

Following the approach in Chapter 4, I conducted two analyses: stepwise regression to establish correlations between social factors and economic mobility, and moderated mediation analysis to investigate causality of social factors on economic mobility outcomes. Again, I present and compare two models: the first taking a social science perspective, reflecting theoretically motivated variables, and the second adhering to a traditional engineering approach, reflecting only the statistically significant variables.

In this chapter, I analyzed African American population, segregation, and African American affluence across the top 50 cities in the US from 2010-2017. From this information, I identified the relationship between these components and each city's economic mobility, measured as the year-over-year change in the racial wage gap between White and African Americans. Building on the models developed in Chapter 4, these relationships form the basis of the multi-objective optimization model formalized in Chapter 6. My research continues as outlined in Table 18 below.

Table 18

Chapter 5 Research Questions (Social Factors)

Chapter 5 Research Question: Social Factors			
Research Question	**Hypothesis**	**Analysis**	**DV: Change in Wage Gap**
How do local social factors influence economic mobility differently for White and Black populations?	As AA population increases, economic mobility increases	Stepwise Regression Analysis	Aid, Population, Institutional and Political Factors, and Expenditures on Change in Wage Gap
	As segregation increases, economic mobility decreases	Stepwise Regression Analysis	Aid, Population, Institutional and Political Factors, and Expenditures on Change in Wage Gap
	As AA affluence increases, economic mobility increases	Stepwise Regression Analysis	Aid, Population, Institutional and Political Factors, and Expenditures on Change in Wage Gap
	In a comparison of cities, those with higher AA populations spend more on economic mobility-related expenditures with a given level of aid than those with lower AA populations.	Moderated Mediation Analysis	AA Population and Expenditures on Change in Wage Gap
	In a comparison of cities, those with less segregation spend more on economic mobility-related expenditures with a given level of aid than those with greater segregation.	Moderated Mediation Analysis	Segregation and Expenditures on Change in Wage Gap
	In a comparison of cities, those with greater AA affluence spend more on economic mobility-related expenditures with a given level of aid than those with less AA affluence.	Moderated Mediation Analysis	AA Affluence and Expenditures on Change in Wage Gap

Results and Analysis

Stepwise Regression Analysis: African American Population, Segregation, and African American Affluence on Economic Mobility

I argue that African American political capital yields economic mobility dividends. To test this, I regressed three social variables (African American population, segregation, and African American affluence) on the change in wage gap, controlling for population, youth population, percent African American single female heads of household, percent African American employment, and expenditures. The results of the regression analysis are summarized in Table 18 below. The results indicate that when accounting for these social, expenditure, and

population variables, the model delivers an R^2 value of 0.374, 0.31 points higher than the full model in Chapter 4, which accounted for political, population, aid, and expenditure data. Taking a closer look at the individual variables, I found that none of the social factors, in and of themselves, rose to statistical significance. However, the interactions of the African American population with elementary and secondary education, cash assistance, and health expenditures are statistically significant (reflecting the impact of spending being proportional to the number of African Americans in a given city as per the theoretical model presented in Chapter 2).

Table 19

Predicting Change in Wage Gap: Steps 1-4 (Social, Expenditures, and Population)

Predicting Change in Wage Gap: Steps 1-4 (Social, Expenditures, and Population)				
	Social	Social and Population	Social and Expenditures	Social, Expenditures, Population
AA Population $_{t-1}$	-0.0001	0.0001	-0.0030	-0.0005
	-0.0010	-0.0010	-0.0030	-0.0030
Dissimilarity Index $_{t-1}$	-1.3960	0.8210	3.5110	8.3330
	-9.7260	-9.0020	-8.9800	-9.2110
AA Median HHI $_{t-1}$	0.0010	0.0490**	0.0390**	0.0310
	-0.0140	-0.0170	-0.0130	-0.0210
Population $_{t-1}$		0.0060***		0.0040**
		-0.0010		-0.0010
Under 18 Population $_{t-1}$		-0.0260***		-0.0160***
		-0.0040		-0.0040
% African American Single Female Heads of House $_{t-1}$		-513.5840		-3174.0110
		-2641.0360		-2523.0440
African American Employment $_{t-1}$		-9,313.0150***		30.1990
		-2305.8030		-3085.9960

Predicting Change in Wage Gap: Steps 1-4 (Social, Expenditures, and Population)				
Higher Education Expenditure $_{t-1}$			0.0000	0.0000
			0.0000	0.0000
Elementary Secondary Education Expenditure $_{t-1}$			-1.0840**	-0.5640
			-0.3820	-0.4000
Libraries Expenditure $_{t-1}$			19.2890***	9.5900`
			-5.0870	-5.7690
Cash Assistance Expenditure $_{t-1}$			7.0500*	5.3010`
			-2.7480	-2.7440
Other Public Welfare Expenditure $_{t-1}$			-1.1990	-1.7080
			-1.5960	-1.8050
Health Expenditure $_{t-1}$			1.7090**	2.1130**
			-0.6410	-0.6400
Housing Community Development Expenditure $_{t-1}$			1.8200***	1.8550***
			-0.5440	-0.5400
AA Population $_{t-1}$* Higher Education Expenditure $_{t-1}$			0.0000	0.0000
			0.0000	0.0000
AA Population $_{t-1}$* Elementary Secondary Education Expenditure $_{t-1}$			0.00000**	0.00000*
			0.0000	0.0000
AA Population $_{t-1}$* Libraries Expenditure $_{t-1}$			-0.0001	0.0000
			0.0000	0.0000
AA Population $_{t-1}$* Cash Assistance Expenditure $_{t-1}$			-0.0001*	-0.0001*
			0.0000	0.0000
AA Population $_{t-1}$* Other Public Welfare Expenditure $_{t-1}$			0.0000	0.0000
			0.0000	0.0000
AA Population $_{t-1}$* Health Expenditure $_{t-1}$			0.0000	-0.00000*
			0.0000	0.0000
AA Population $_{t-1}$* Housing Community Development Expenditure $_{t-1}$			0.0000	0.0000
			0.0000	0.0000
Constant	1,090.4080	2,750.5260*	-586.9820	-230.4860
	-742.7910	-1,118.4030	-864.5270	-1,232.3520
Observations	295	295	295	295

Predicting Change in Wage Gap: Steps 1-4 (Social, Expenditures, and Population)				
Adjusted R^2	-0.01	0.222	0.349	0.374

Note: ‘p<0.1;*p<0.05; **p<0.01; ***p<0.001

Building on Chapter 4, I incorporated the political, aid, with the population, social, and expenditure factors for a fully specified model, outlined in Table 19. This new fully specified model achieves an adjusted R^2 of 0.407. This suggests that social factors do indeed add explanatory power to the variation in economic mobility across cities.

The statistical results indicate support for Hypothesis #2; as segregation increases, economic mobility decreases. In Figure 33, I plotted degree of segregation versus the change in wage gap. A 20-point increase in the segregation index resulted in a $0.36 increase in the change in wage gap. Degree of segregation was a statistically significant predictor of economic mobility; however, its impact on change in wage gap is minimal in practice. Interestingly, as shown in Figure 34, cities with a higher degree of segregation experienced a greater decrease in the change in wage gap for a given level of aid (above about $2500 per person in funding) versus their more integrated counterparts. This seems to confirm the importance of providing aid to highly segregated cities in reducing the wealth gap.

In contrast, African American population and African American affluence, taken individually, did not rise to statistical significance. However, the interactions of African American population with health and housing and community expenditures (see Figures 35 and 36) were both associated with an increase in economic mobility. Figure 35 plots the impact of health expenditures on the change in wage gap at varying levels of cities’ African American populations. As evident in the figure, one can see that cities with larger African American populations experienced lower changes in wage gap ($1600 for every additional $1000 spent) for

a given level of health expenditure versus cities with smaller African American populations (about $3200 for every additional $1000 spent), at all levels of expenditure. Figure 36 shows the same comparison for housing and community development expenditure. It tells a similar story; cities with larger African American populations experienced lower changes in wage gap for a given level of housing and community expenditure (-$500 for every additional $1500 spent) versus cities with smaller African American populations (about $2000 for every additional $1000 spent), above about $200 per person. It should be noted that when considered separately, health expenditures and housing and community development expenditures (see Figures 37 and 38) are positively associated with an increase in the wealth gap. For every $100 increase in health expenditures, the change in wage gap increased $372, while, for every $100 increase in housing and community expenditures, the change in wage gap increased $231.

Consistent with my interpretation in Chapter 4, I conclude that this is illustrative of a reactionary policy making dynamic, in which officials are responding to wage information at a lag, as it becomes available. This could have the effect of stemming further widening of the wage gap, that would increase at a faster degree but for stop-gap investment. By leveraging forecasting tools like the model I present in Chapter 6, policy makers can proactively direct spending to increase the efficiency of investment and reverse wage gap trends.

As in the full model in Chapter 4, population and youth population were statistically significant (see Figures 39 and 40). As population increased, so did the widening of the wealth gap, to the tune of $300 for every 100,000-person increase. As in Chapter 4, this seems intuitive, as the larger a city grows, the more likely it is that people are from different walks of life. In contrast, the change in wage gap actually decreased $1200 for every 100,000-youth increase.

Again, as concluded in Chapter 4, this may be an indication of a younger workforce (new families) who have not yet reached their peak earning potential.

As in Chapter 4, I present the engineering model for comparison, considering only the statistically significant variables from the fully specified model, which yielded an adjusted R^2 higher than the full theoretical model. However, in this case, the adjusted R^2 was markedly lower than the full model, at 0.352.

It was particularly interesting to note how, when including social factors in the model, the impacts attributed to political factors changed versus the previous model in Chapter 4. Though no longer statistically significant, Democratic-led cities reflected positive correlations with economic mobility, while unaffiliated and Republican-led cities continued to be positively correlated with a widening wealth gap. Furthermore, local authority was no longer a statistically significant predictor of change in wage gap in the new theoretical model.

In addition, effects of aid appear to have been mediated by expenditures, particularly when their interaction with African American population was considered. Spending categories themselves have fallen out of statistical significance (in the case of library and cash assistance expenditures). I further investigated this in the moderated mediation analysis below.

Table 20

Predicting Change in Wage Gap: Step 5 (Ch 5 Full Model and Significant Variables)

Predicting Change in Wage Gap: Stepwise Regression (Full Model and Significant Variables)		
	Full Model	Significant
Home Rule	1,308.299	
	-892.343	
Total Aid $_{t-1}$	0.105	-0.450

Predicting Change in Wage Gap: Stepwise Regression (Full Model and Significant Variables)		
	-1.483	-0.534
Consolidated	88.819	
	-818.638	
Mayor Party Dem	-228.193	
	-1,168.102	
Mayor Party Unaffiliated	2,329.766	
	-1,566.600	
Mayor Party Rep	1,817.017	
	-1,181.189	
AA Population $_{t-1}$	-0.002	0.003**
	-0.004	-0.001
Dissimilarity Index $_{t-1}$	55.698`	-10.108
	-31.078	-20.650
AA Median HHI $_{t-1}$	-0.013	
	-0.052	
Population $_{t-1}$	0.003`	0.004***
	-0.002	-0.001
Under 18 Population $_{t-1}$	-0.012*	-0.018***
	-0.006	-0.004
% African American Single Female Heads of House $_{t-1}$	-2,671.524	
	-2,797.273	
African American Employment $_{t-1}$	-2,243.475	
	-4,336.891	
Higher Education Expenditure $_{t-1}$	-0.00002	
	0.000	
Elementary Secondary Education Expenditure $_{t-1}$	-0.270	
	-0.491	
Libraries Expenditure $_{t-1}$	1.679	
	-7.598	
Cash Assistance Expenditure $_{t-1}$	0.568	
	-3.449	

Predicting Change in Wage Gap: Stepwise Regression (Full Model and Significant Variables)		
Other Public Welfare Expenditure $_{t-1}$	-0.846	
	-2.149	
Health Expenditure $_{t-1}$	3.723***	2.749***
	-0.862	-0.463
Housing Community Development Expenditure $_{t-1}$	2.308**	1.637***
	-0.792	-0.490
Total Aid Per Person $_{t-1}$* Home Rule	-0.611	
	-0.493	
Total Aid Per Person $_{t-1}$* Consolidation	0.226	
	-0.432	
Total Aid Per Person $_{t-1}$* Mayor Party DEM $_{t-1}$	0.320	
	-0.855	
Total Aid Per Person $_{t-1}$* Mayor Party Unaffiliated $_{t-1}$	-0.662	
	-0.961	
Total Aid Per Person $_{t-1}$* Mayor Party REP $_{t-1}$	-0.951	
	-0.870	
Total Aid Per Person $_{t-1}$* AA Population $_{t-1}$	0.000	
	0.000	
Total Aid Per Person $_{t-1}$* Dissimilarity Index $_{t-1}$	-0.025`	0.003
	-0.015	-0.010
Total Aid Per Person $_{t-1}$* AA Median HHI $_{t-1}$	0.000	
	0.000	
AA Population $_{t-1}$* Higher Education Expenditure $_{t-1}$	0.000	
	0.000	
AA Population $_{t-1}$* Elementary Secondary Education Expenditure $_{t-1}$	0.000	
	0.000	
AA Population $_{t-1}$* Libraries Expenditure $_{t-1}$	0.000	
	0.000	
AA Population $_{t-1}$* Cash Assistance Expenditure $_{t-1}$	0.000	
	0.000	
AA Population $_{t-1}$* Other Public Welfare Expenditure $_{t-1}$	0.000	

Predicting Change in Wage Gap: Stepwise Regression (Full Model and Significant Variables)		
	0.000	
AA Population $_{t-1}$* Health Expenditure $_{t-1}$	-0.00001*	-0.00001***
	0.000	0.000
AA Population $_{t-1}$* Housing Community Development Expenditure $_{t-1}$	-0.00001`	0.000
	0.000	0.000
Constant	-1,005.983	444.949
	-3,267.158	-1,019.632
Observations	360	360
Adjusted R^2	0.407	0.352
Note:		‘p<0.1;*p<0.05; **p<0.01; ***p<0.001

Figure 33

Effect Plot for Degree of Segregation on Change in Wage Gap

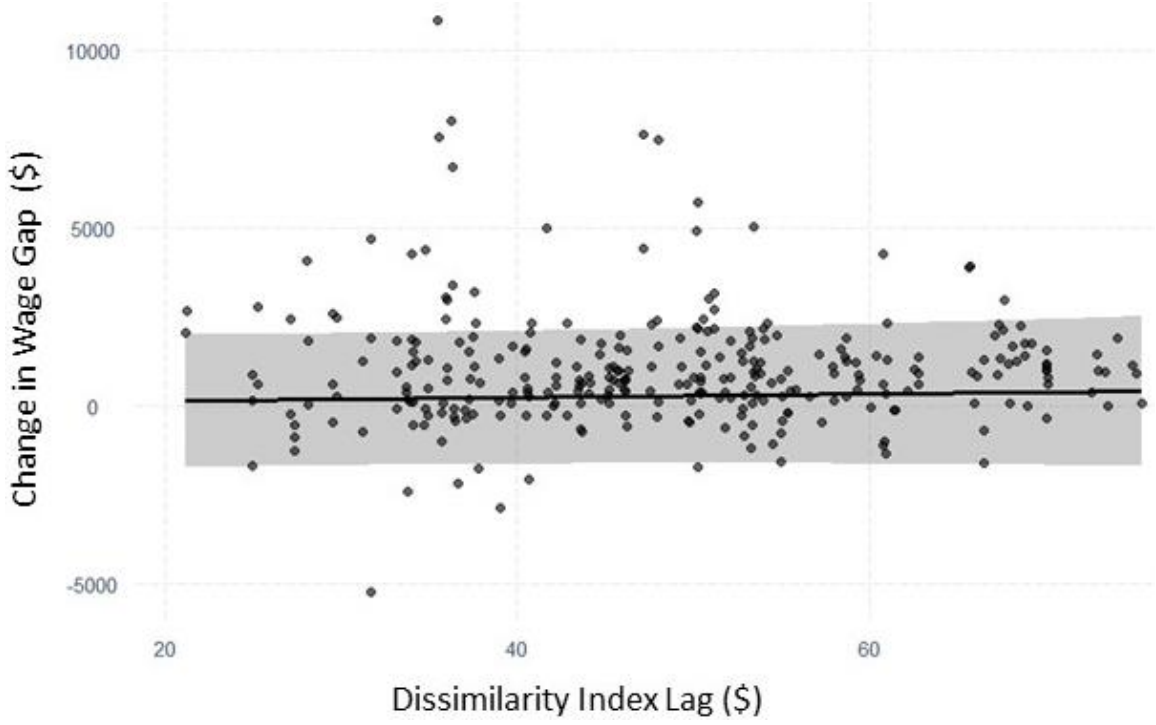


Figure 34

Effect Plot for Interaction of Segregation and Aid Per Person on Change in Wage Gap

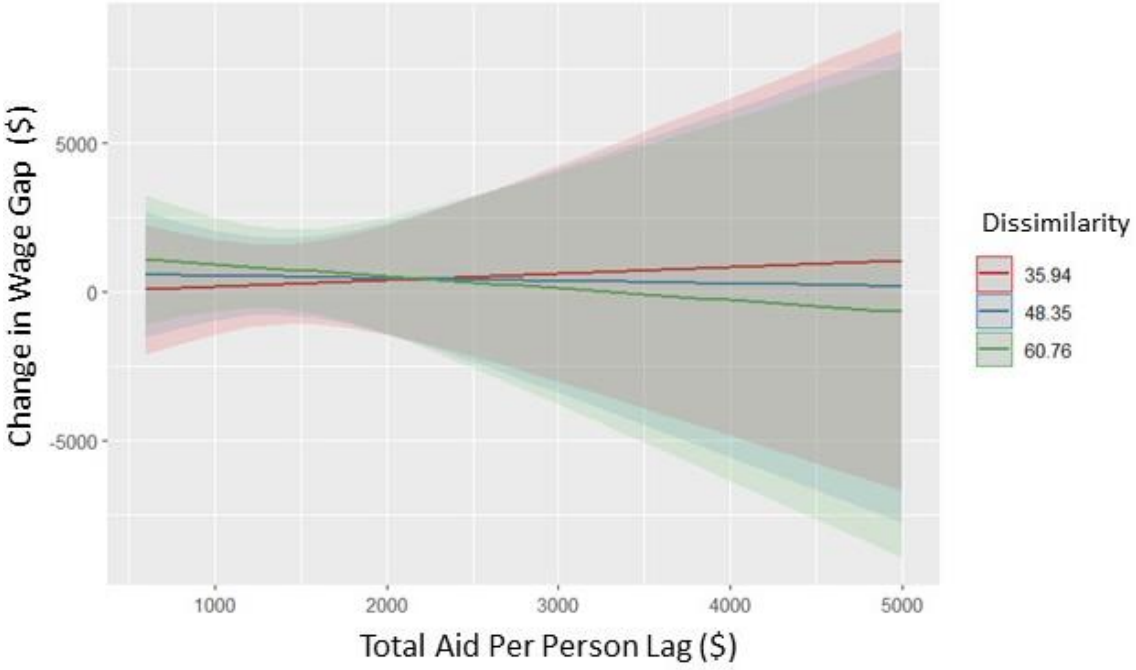


Figure 35

Effect Plot for Interaction of AA Population and Health Expenditure on Change in Wage Gap

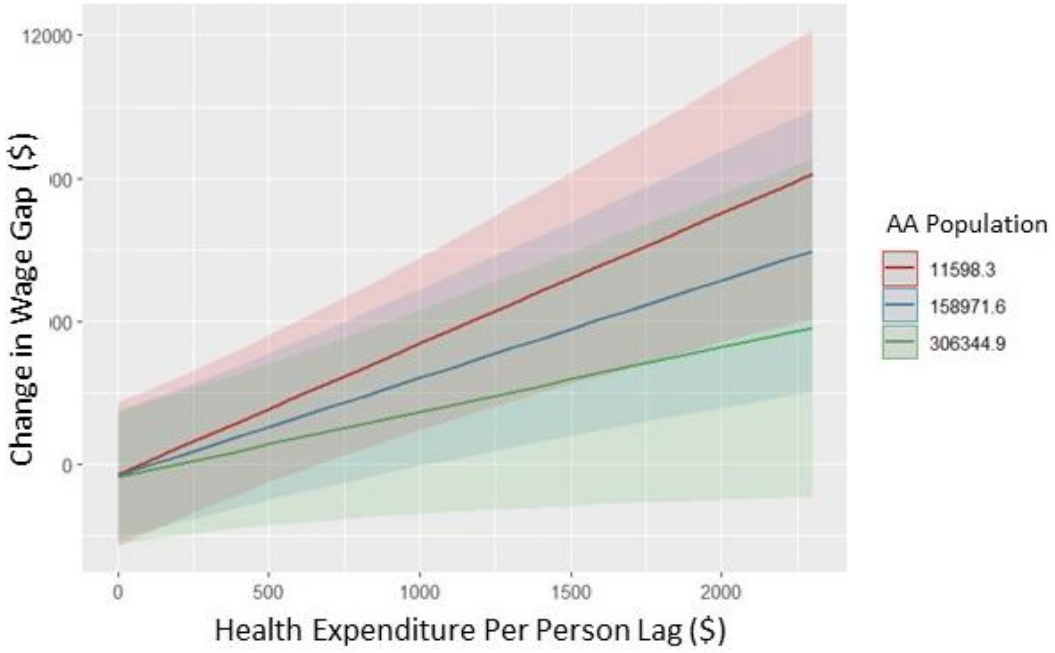


Figure 36

Effect Plot for Interaction of AA Population and Housing and Community Development Expenditure on Change in Wage Gap

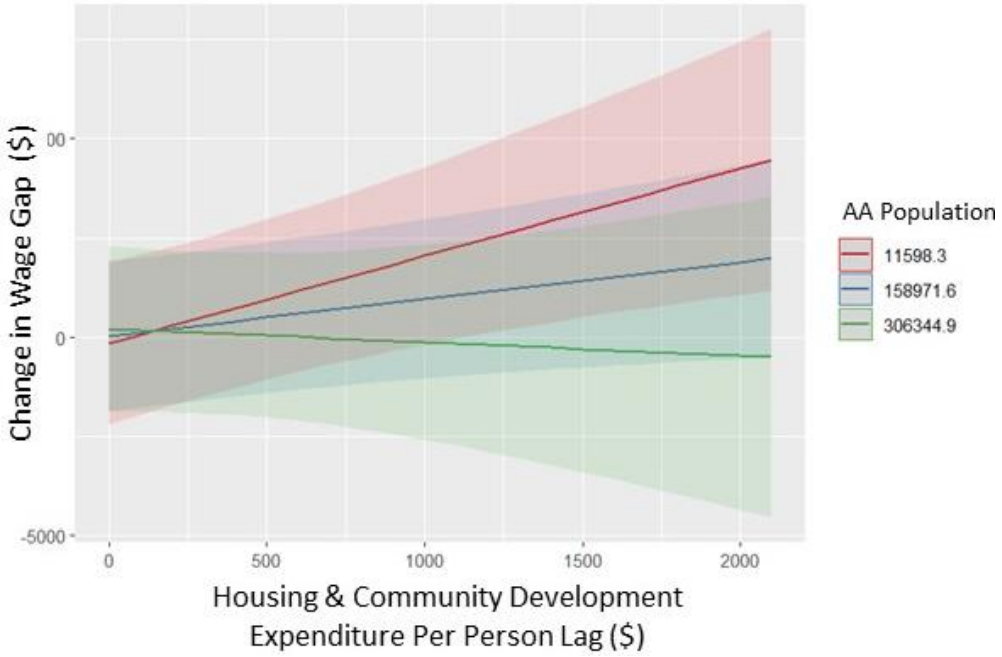


Figure 37

Effect Plot for Health Expenditure on Change in Wage Gap

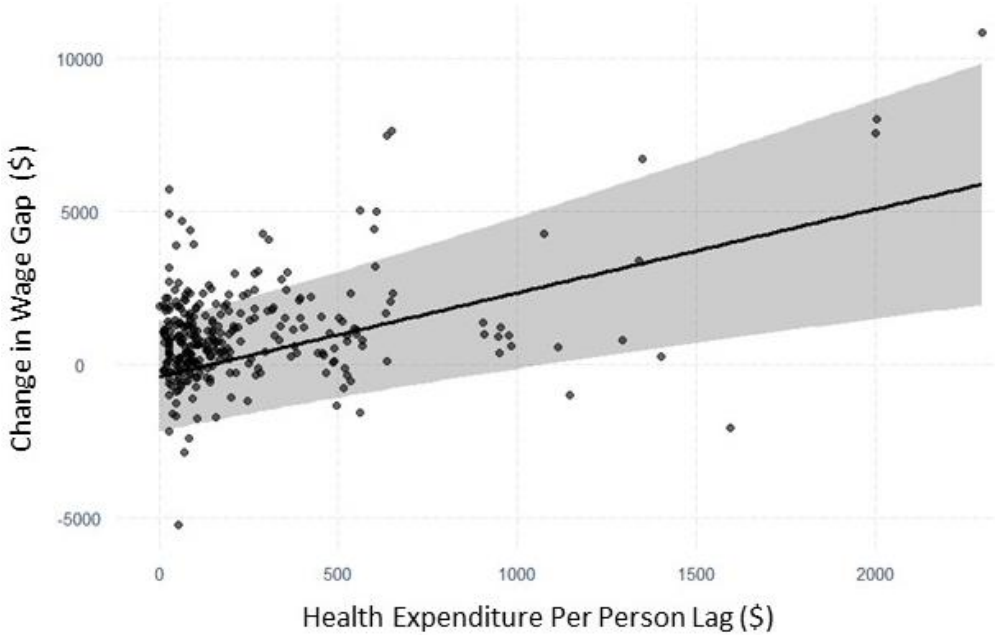


Figure 38

Effect Plot for Housing and Community Development Expenditure on Change in Wage Gap

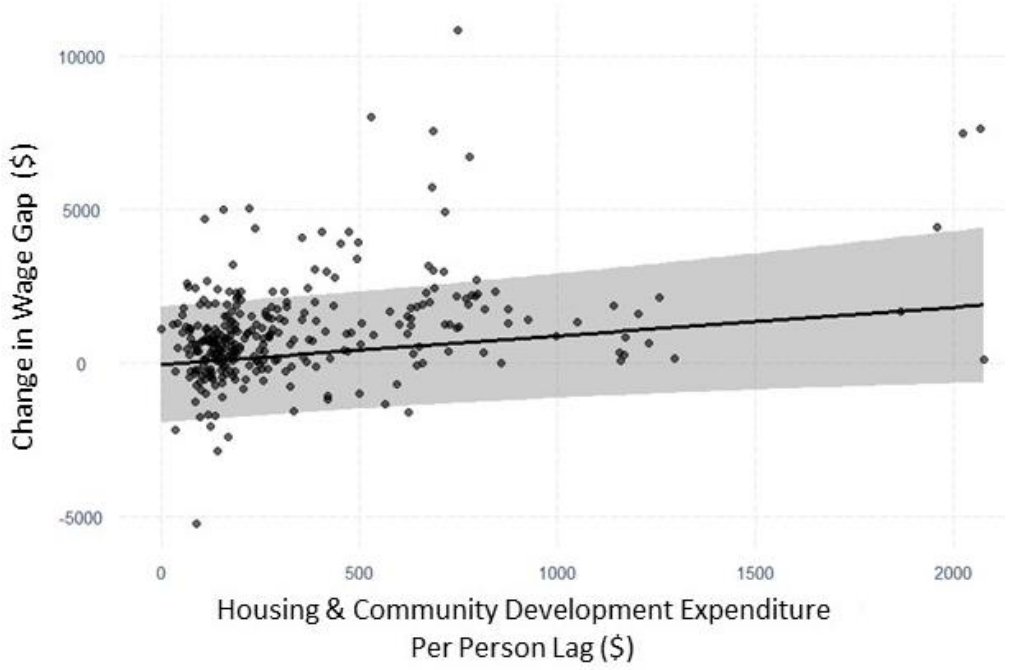


Figure 39

Effect Plot for Population on Change in Wage Gap

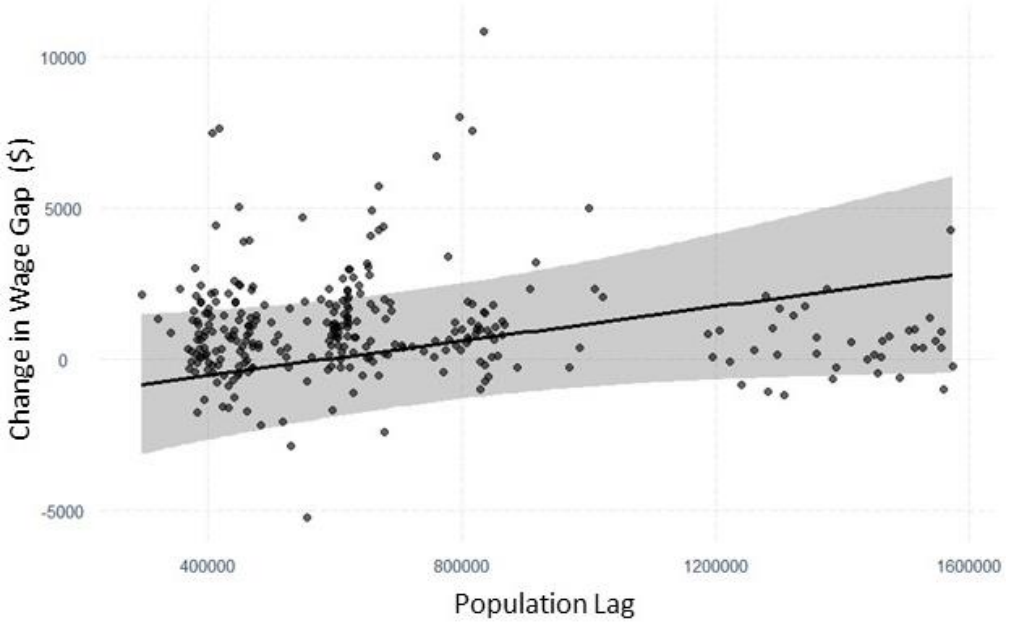
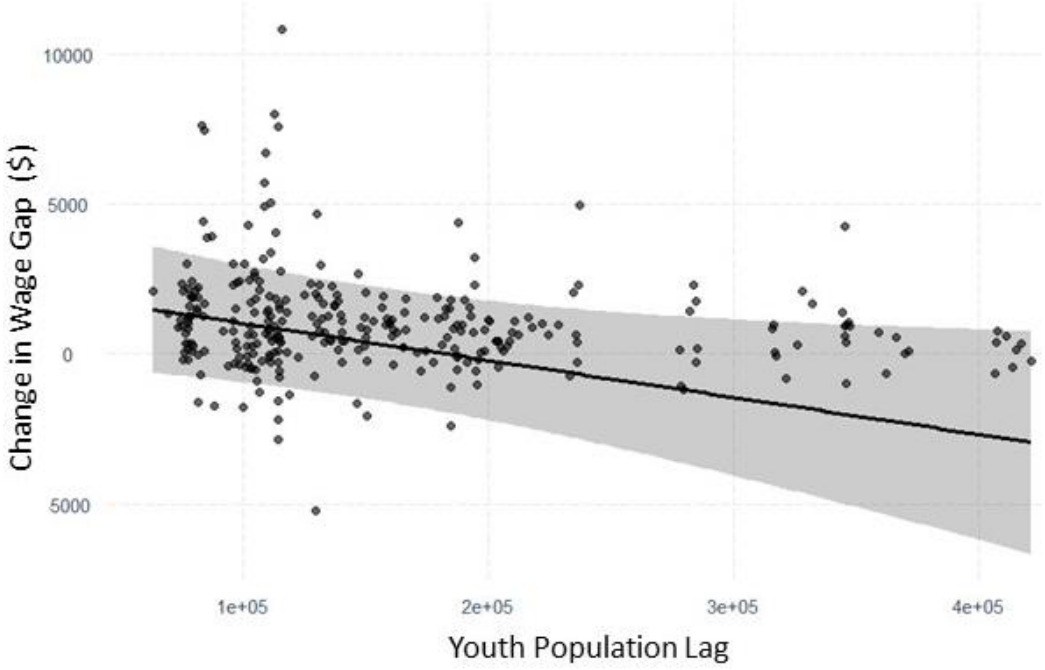


Figure 40

Effect Plot for Youth Population on Change in Wage Gap



Moderated Mediation Analysis: AA Population Segregation, and AA Affluence on Expenditures and Change in Wage Gap

Above, I included all the social, political, population, aid, and expenditure factors in the regression analysis. As previously discussed, I am interested in not only the effects of each variable on economic mobility, but to establish causal relationships between them. I expect that African American population, degree of segregation, and African American affluence impacts the budget expenditure priorities. Building on the mediation analysis in Chapter 4, I conduct moderated mediation analysis to test my hypotheses.

Table 21

Moderated Mediation: Social Factors on Mediation Effect via Expenditures on Aid vs Change in Wage Gap

Moderated Mediation: Social Factors on Mediation Effect of Expenditures on Aid vs Change in Wage Gap

Moderator Variable		Mediators: Higher Education Expenditure/pp		Elementary Education Expenditure/pp		Libraries Expenditure/pp		Cash Assistance Expenditure/pp		Other Public Welfare Expenditure/pp		Health Expenditure/pp		Housing and Community Expenditure/pp	
		Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect	Direct	Indirect
AA Population	Mean	0.3592***	-0.0138	0.3712***	-0.0195	0.2516***	0.1028***	0.1088	0.2053	0.3693***	-0.0252	0.0794	0.3014***	0.2370	0.1720***
Segregation	Mean	0.5088 ***	-0.0052	0.5117***	-0.0082	0.4172***	0.0863***	0.2310	0.2726***	0.5667***	-0.0631	0.1655	0.3380***	0.3638***	0.1398***
AA Affluence	Mean	0.3490***	-0.0000	0.3476***	0.0016	0.2553***	0.0938***	0.1418	0.2074***	0.4000***	-0.0508	0.0037	0.3454***	0.1200	0.2300***

Note: N=360. Adjusted for population, youth population, African American single female heads of household, and African American full-time employment. Bootstraps were constructed using 10 samples and 95% confidence intervals.

Results indicate that cities with larger African American populations spend less on libraries, health, and housing and community development expenditures at a given level of aid. See Figures 41-43 below. Figure 41 indicates $8 less spent on libraries at a given level of aid versus cities with lower African American populations, at all levels. Figure 42 indicates $100 less spent on health at a given level of aid versus cities with lower African American populations, at all levels. Figure 43 indicates increasing spending at a lower rate ($150 for every $1000 in aid) versus cities with lower African American populations ($240 for every $1000 in aid). Observing that the latter two categories, when considered alongside African American population, are negatively correlated with a widening wage gap, policymakers should consider directing more funds to these categories.

In addition, results indicate that cities with greater segregation spend less on libraries, health, and cash assistance expenditures at a given level of aid. Still, Figure 44 indicates

increasing library spending at a higher rate ($7 for every $1000 in aid) versus cities with lower segregation levels ($4 for every $1000 in aid). Figure 45 indicates increasing health spending at a lower rate ($230 for every $1000 in aid) versus cities with cities with lower segregation levels, above ($330 for every $1000 in aid). Figure 46 indicates increasing cash assistance spending at a lower rate ($230 for every $1000 in aid) versus cities with cities with lower segregation levels ($330 for every $1000 in aid). Perhaps surprisingly, cities with higher segregation spend more on housing and community development, up to a point. Figure 47 indicates increasing spending at a lower rate ($150 for every $1000 in aid) versus cities with cities with lower segregation levels ($200 for every $1000 in aid). Unfortunately, public investment in struggling neighborhoods can have an adverse effect–accelerated displacement of existing residents. In addition to place-based economic mobility investments, cities should consider piloting people-centric incentives like health and cash assistance in historically disinvested-in neighborhoods.

When it comes to African American affluence, results indicate that cities in which African Americans make more money spend more on libraries and cash assistance expenditures at a given level of aid. Figure 48 indicates increasing library spending at a higher rate ($10 for every $1000 in aid) versus cities with lower African American affluence ($4 for every $1000 in aid). Figure 49 indicates cash assistance spending at a slightly higher rate ($75 for every $1000 in aid) versus cities with lower African American affluence ($66 for every $1000 in aid). Relative spending varies for health and housing and community expenditures depending on level of aid (more after about $1500/pp and $2700/pp, respectively). Figure 50 indicates increasing health spending at a lower rate ($166 for every $1000 in aid) versus cities with lower African American affluence ($333 for every $1000 in aid). Figure 51 indicates increasing housing and community development spending at a higher rate ($375 for every $1000 in aid) versus cities

with lower African American affluence ($125 for every $1000 in aid). This might suggest that, as noted above, African Americans are more likely to identify with the personal struggle of low-income earners, and lean more towards people-centric initiatives.

Figure 41

Effect Plot for Interaction of AA Population and Aid Per Person on Library Expenditures

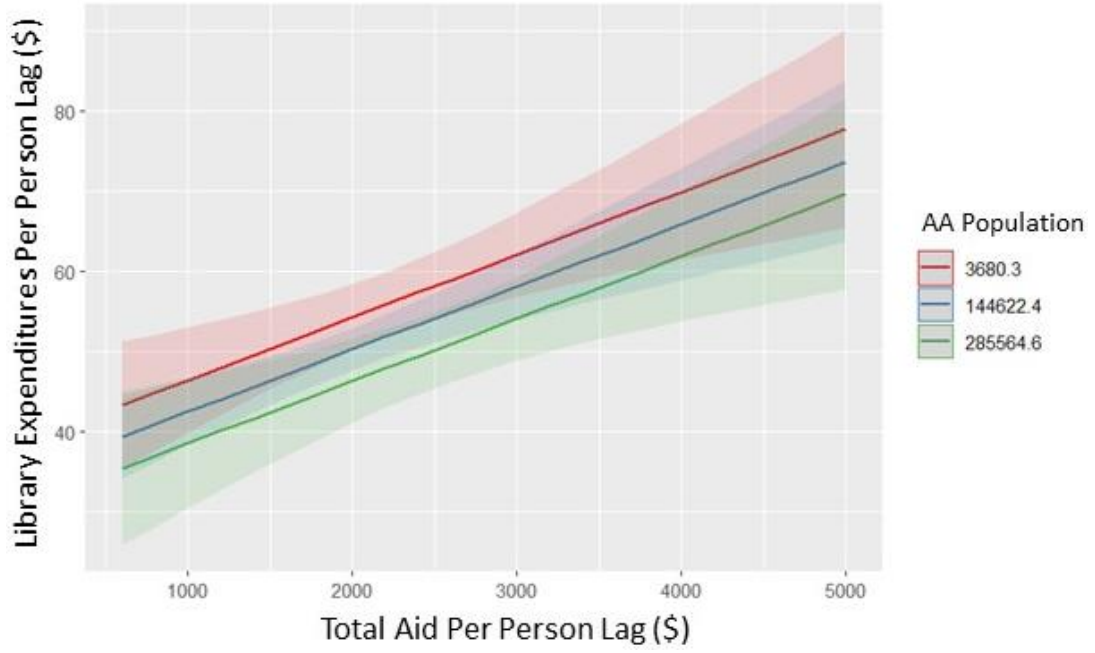


Figure 42

Effect Plot for Interaction of AA Population and Aid Per Person on Health Expenditures

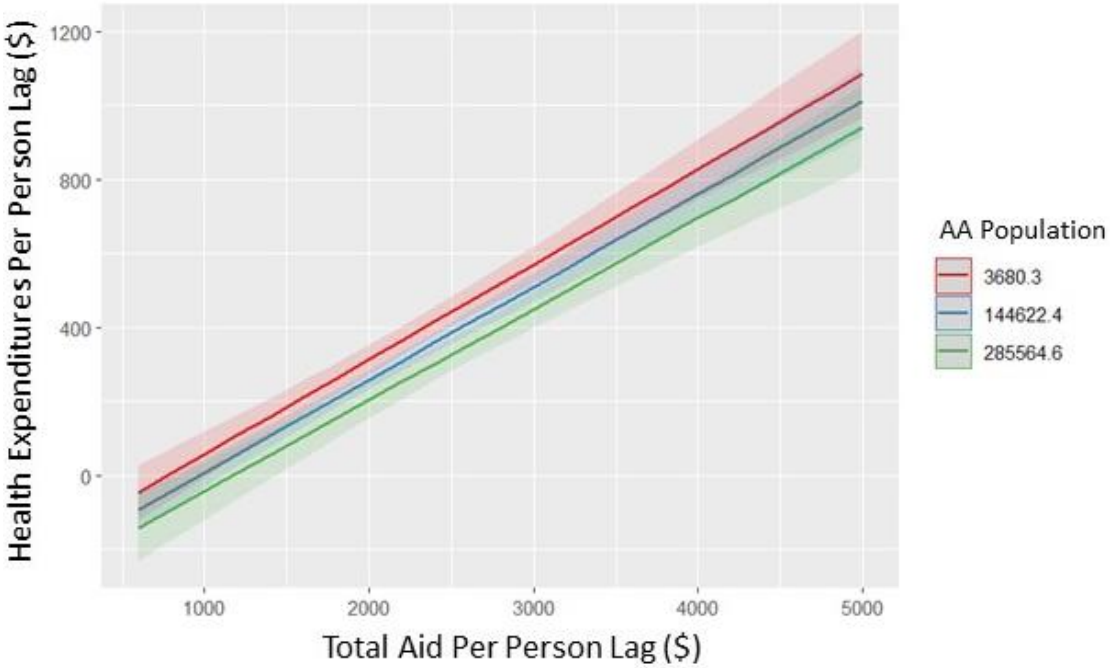


Figure 43

Effect Plot for Interaction of AA Population and Aid Per Person on Housing Expenditures

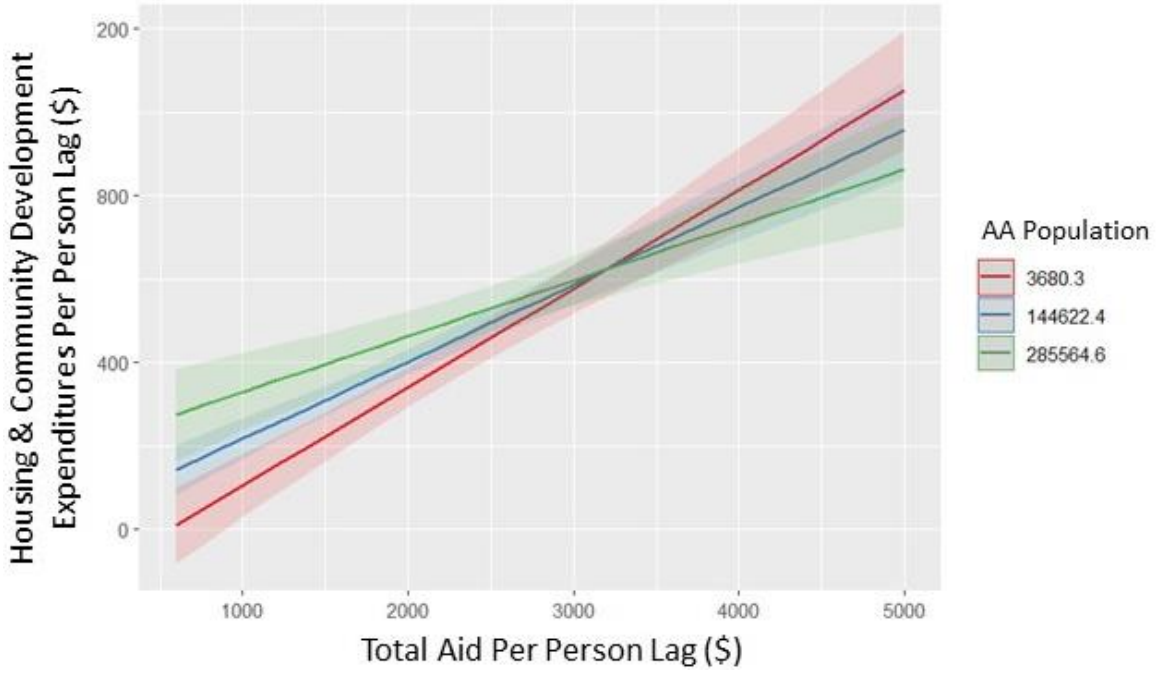


Figure 44

Effect Plot for Interaction of Segregation and Aid Per Person on Library Expenditures

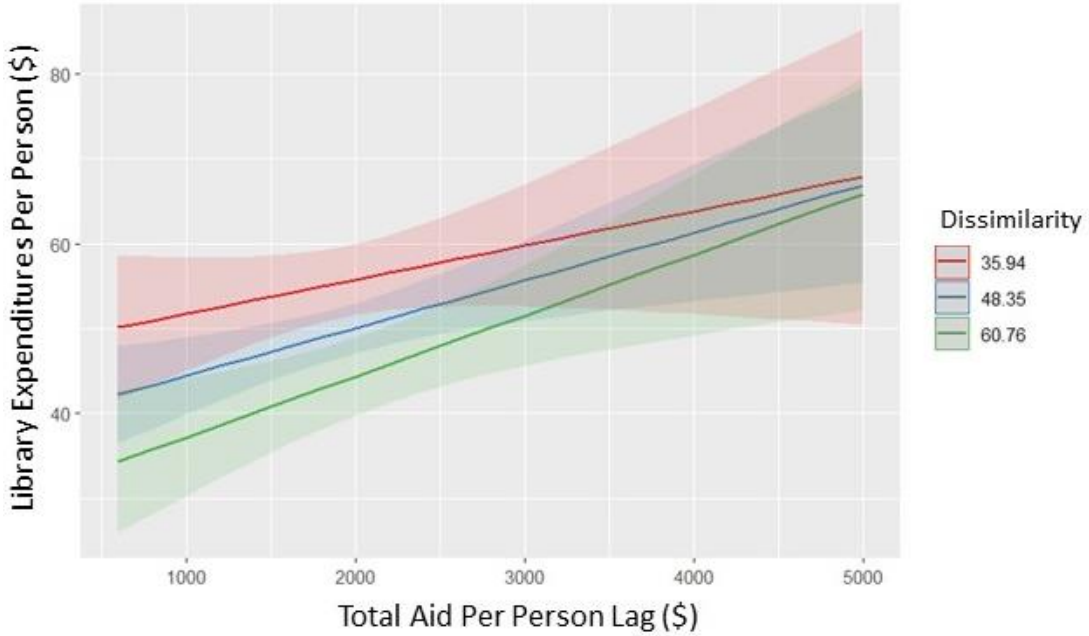


Figure 45

Effect Plot for Interaction of Segregation and Aid Per Person on Health Expenditures

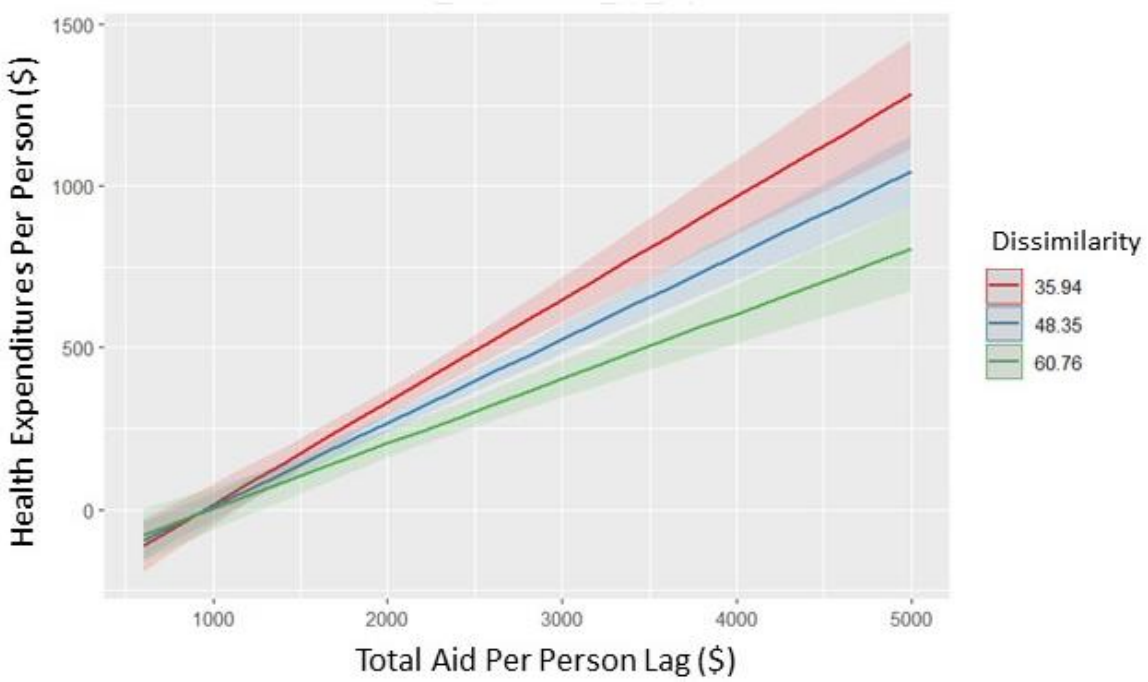


Figure 46

Effect Plot for Interaction of Segregation and Aid Per Person on Cash Expenditures

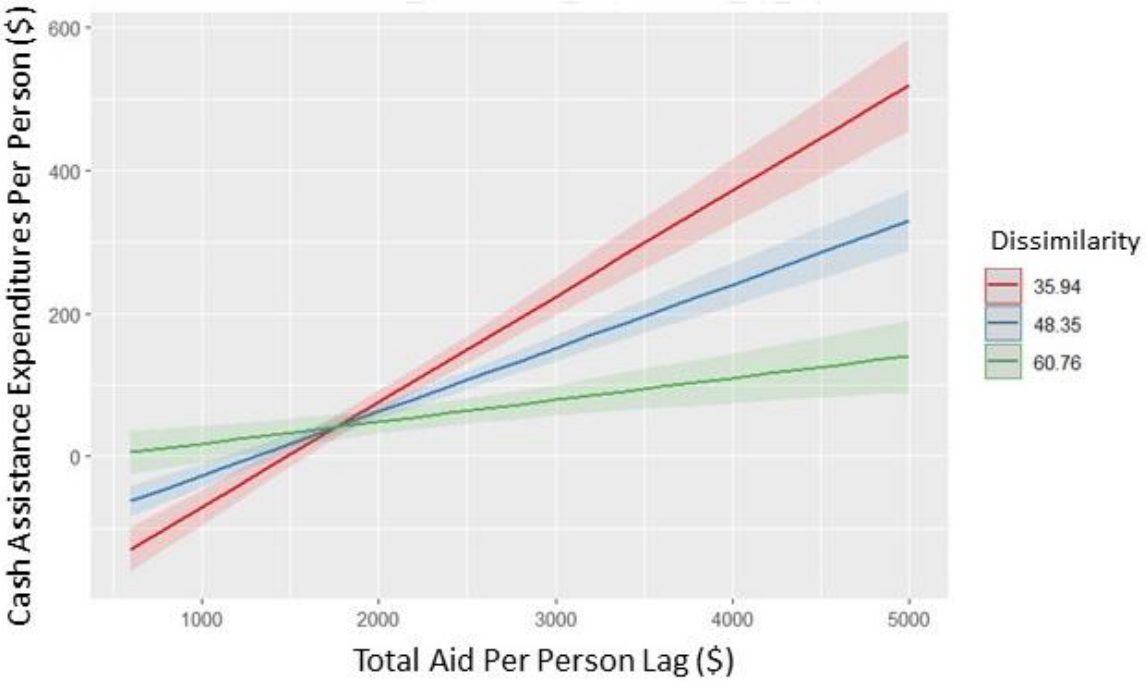


Figure 47

Effect Plot for Interaction of Segregation and Aid Per Person on Housing Expenditures

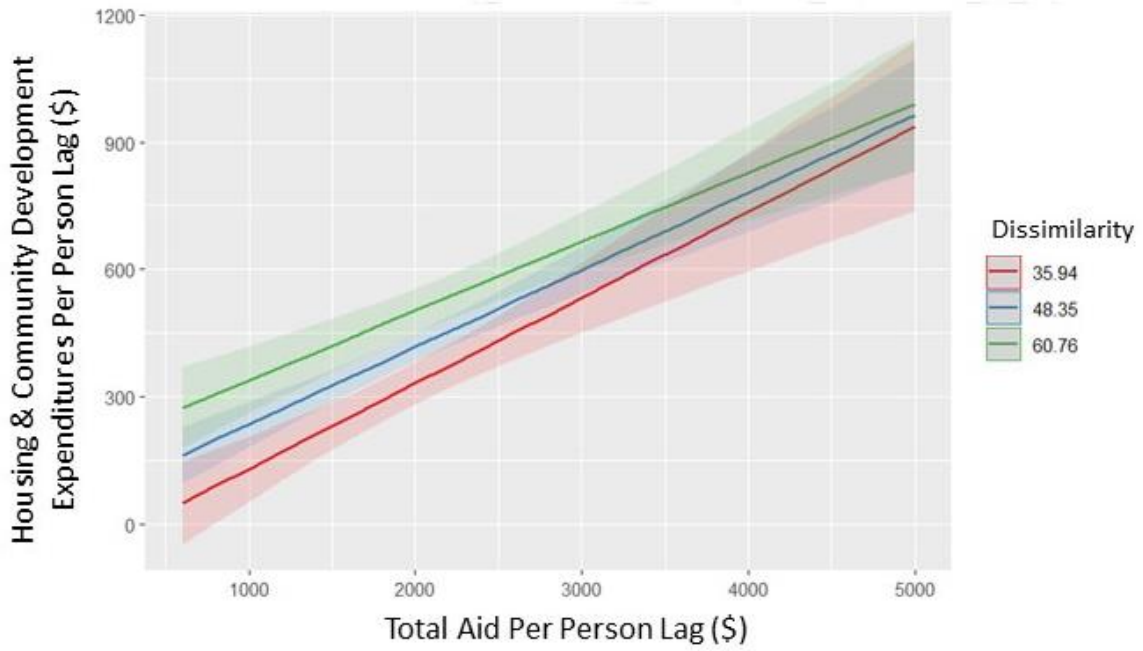


Figure 48

Effect Plot for Interaction of AA Income and Aid Per Person on Library Expenditures

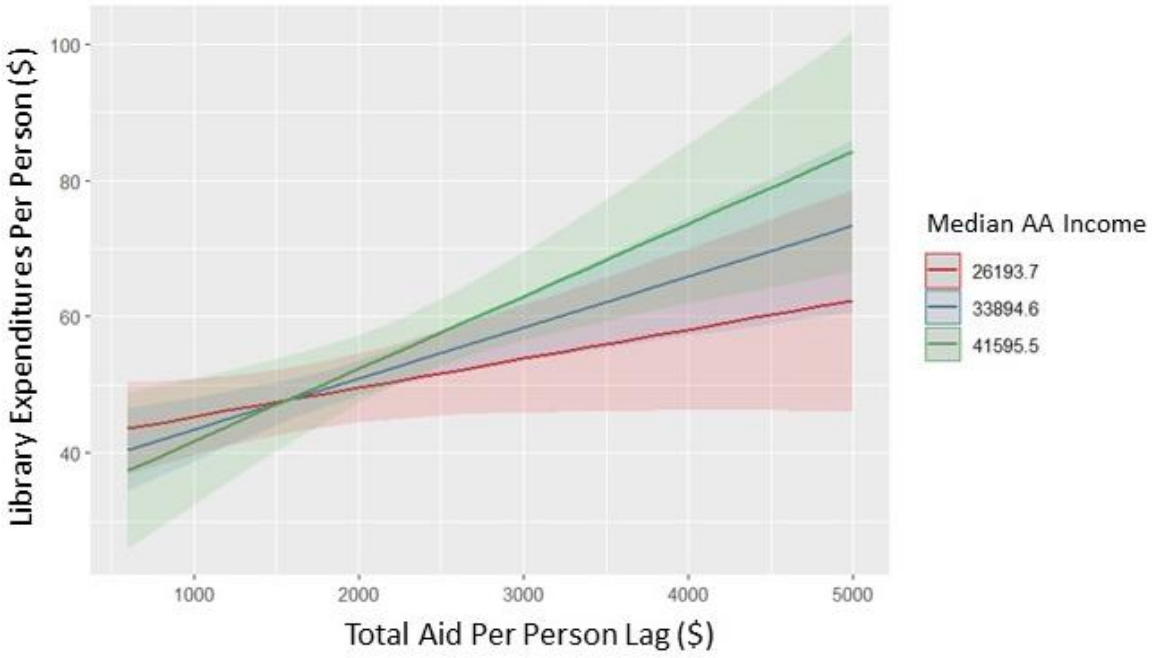


Figure 49

Effect Plot for Interaction of AA Income and Aid Per Person on Cash Expenditures

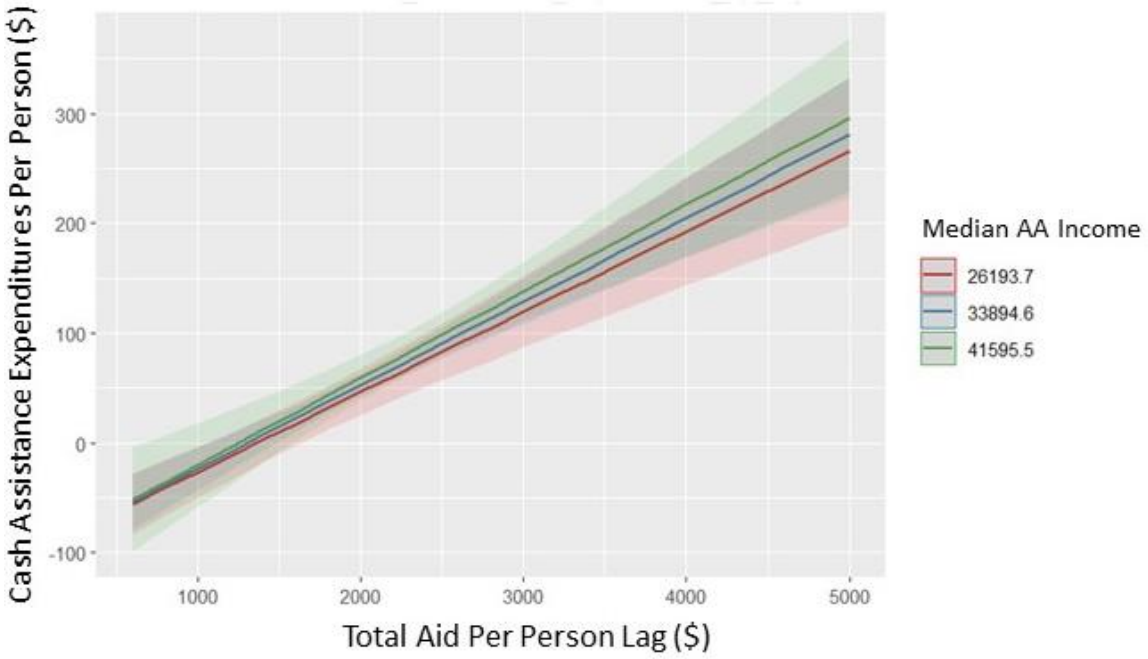


Figure 50

Effect Plot for Interaction of AA Income and Aid Per Person on Health Expenditures

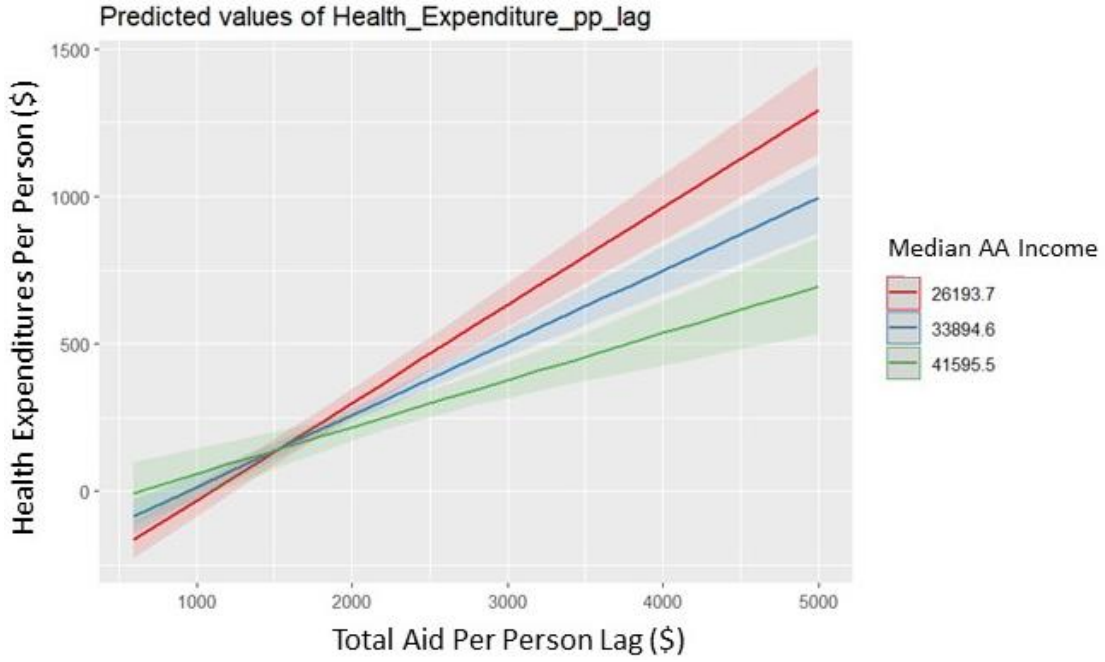
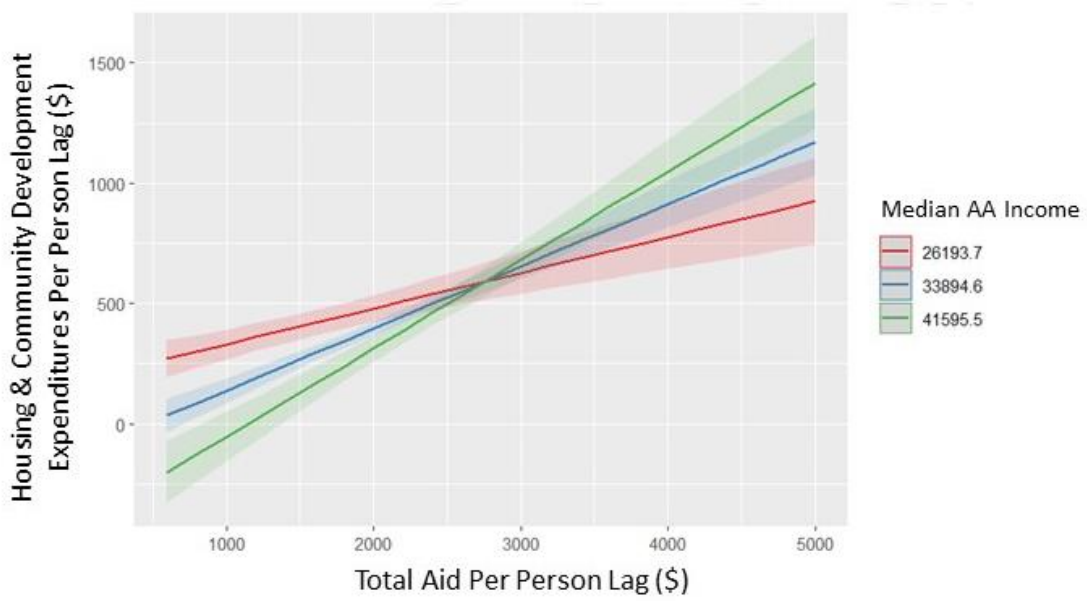


Figure 51

Effect Plot for Interaction of AA Income and Aid Per Person on Housing Expenditures



Summary

Building upon chapter 4, this chapter presented results investigating the social factors that impact economic mobility. The results of these analyses are summarized in Table 21 below.

I confirmed that in addition to political, population, and budget policy factors, segregation matters when it comes to economic mobility. However, African American affluence in a city does not appear to have a statistically significant effect on economic mobility outcomes, though it does impact how economic mobility-focused dollars are spent. African American population and its interaction with health and housing and community expenditures has a statistically significant effect on improving economic mobility.

As in Chapter 4, I presented two models as a basis for building a predictive model for directing budget policy. In this case, the engineering model did not exceed the adjusted R^2 of the theoretical model. Overall, both models indicate there remains much more to predicting mobility

than the social, political, population, and budget policy variables analyzed to this point. Given the time-series nature of the data, additional historical data would enable additional exploration of linkages between aid, expenditures, and economic mobility over time.

Due to the theoretical considerations retained in the full model, I proceed with using the full model as the basis for the optimization model in Chapter 6. Informed by the analyses in Chapters 4 and 5, I build a multi-objective optimization model for determining future economic mobility-related spending.

Table 22

Chapter 5 Research Question Results (Social Factors)

Chapter 5 Research Question: Social al Factors Hypotheses Testing			
Research Question	**Hypothesis**	**Accept/Reject**	**Table/Figure**
How do local social factors influence economic mobility differently for White and Black populations?	As AA population increases, economic mobility increases	**Accept**	Table 19
	As segregation increases, economic mobility decreases	**Accept**	Table 19
	As AA affluence increases, economic mobility increases	**Reject**	Table 19
	In a comparison of cities, those with higher AA populations spend more on economic mobility-related expenditures with a given level of aid than those with lower AA populations.	**Reject**	Table 20
	In a comparison of cities, those with less segregation spend more on economic mobility-related expenditures with a given level of aid than those with greater segregation.	**Partially Accept**	Table 20
	In a comparison of cities, those with greater AA affluence spend more on economic mobility-related expenditures with a given level of aid than those with less AA affluence.	**Partially Accept**	Table 20

Chapter 6: Multi-Objective Optimization

As a systems engineer, my foremost interest is most often in how to improve a process. As an elected official, I often find myself faced with decisions requiring a level of expertise or information I don't always have. And yet decisions must be made. After a few months in office, I started to notice that the questions I asked in my pursuit of drawing an appropriate conclusion left many a staff member wide-eyed and speechless. As surprised as they seemed to be that I was asking for data, I was equally mystified that no one had ever requested what seemed necessary information to make a policy call. This intrigued me, particularly when it came to economic mobility policy and our budget. I decided to investigate, and so, my research commenced.

I began with a case study into the budget allocation process for a local urban government, the City of Charlotte. I discussed several types of waste in the process that leads to underperforming budget policy, as it relates to economic mobility[6]. My aim is to reduce waste in and restore rational comprehensive decision making to the budget process. I seek a practical application to the question, "Is it possible to prescribe budget policy for a given city to achieve highest economic mobility?

The previous two chapters centered around building a model that specified the relationships between population, political, social and budget policy factors, and economic mobility. In Chapter 6, I use that model as the basis for a multi-objective optimization model, from which I can forecast optimal budget portfolio mixes for local urban governments. This chapter presents results investigating the role modeling and simulation can play in economic mobility budget policy optimization.

[6] Republicans might argue that the policies are performing just fine--they aren't meant to eradicate inequity. I'm defining success as zero disparity.

As already discussed in Chapter 3, the methodology adapts elements from Guo's 2020 framework for multi-objective optimization for China's rental housing public policy mix, as well as Ghazinoory's (2019) optimization of RandD public policy in Iran. Decision making is emphasized in this optimization, as the goal is to identify the optimal budget allocation to maximize economic mobility, *defined as minimizing change in wage gap and minimizing annual wage gap*. Therefore, I took a hybrid approach of deterministic compromise programming and epsilon constraint technique using Generalized Reduced Gradient nonlinear in the Excel optimization solver. I selected the GRG nonlinear algorithm due to the speed with which it arrives at a minimum versus the genetic algorithm, given the quantity of optimizations required for the analysis. The GRG nonlinear method introduces a risk of returning a local minimum rather than the global minimum. However, as this model is constrained to positive values and is bounded by the total budget constraint, this risk is sufficiently low. As a test, I ran the model with varying initial conditions for the decision variables to verify convergence on the minimum.

I ran four optimization experiments: first, the initial optimization, followed by three sensitivity analyses to see how budget allocations may change based on city economic mobility priorities and their level of aid. In the initial optimization, most cities selected housing and community development, higher education, cash assistance, and other public welfare expenditures. As minimizing the change in wage gap increased in relative importance to minimizing annual wage gap, more cities' portfolios prioritized the above, abandoning health and library investments. As the minimization of the annual wage gap grew in relative importance, the cities' portfolios reverted back to selections resembling the initial optimization. Finally, increasing aid resulted in increased expenditures in initially selected expenditure categories and, in some cases, allocations in additional categories.

Objectives

A multi-objective optimization problem takes two or more objectives, or goals, and delivers a solution that satisfies each goal without overly compromising the other. The goal of this multi-objective optimization problem is two-fold (see Table 22). First, I want to minimize the change in wage gap year-over-year. Based on how I have operationalized economic mobility, this reflects the largest relative increase of African American income versus White American income. Second, I want to reach wage parity by minimizing the wage gap (and thereby preventing the introduction of the wage gap in reverse, in which White Americans are underearning versus their African American peers). In order to do this, I constructed an objective function made up of two sub-functions to achieve both objectives: to minimize the change in wage gap and minimize the wage gap.

Table 23

Multi-Objective Optimization Variables

Variable	Function	Description	Objective
Change in Wage Gap	1	The net change in White-AA wage gap year-over-year.	Minimize
Wage Gap	2	Difference in White vs African American median household income	Minimize

Model Setup

Objective Function #1: Minimize Change in Wage Gap (Maximize Economic Mobility→ seeking the largest negative number)

The fully specified regression model (see Chapter 5, Table 19) yields the following coefficient estimates:

Table 24

Predicting Change in Wage Gap and Wage Gap (From Ch 5 Full Model)

Predicting Wage Gap and Change in Wage Gap Based on Social, Political, Population, Aid and Expenditures		
	Change in Wage Gap	Wage Gap
Home Rule	1,308.29900	11,474.18000*
	-892.34300	-4,609.65900
Total Aid $_{t-1}$	0.10500	6.43600
	-1.48300	-7.65900
Consolidated	88.81900	-5,540.86800
	-818.63800	-4,228.91300
Mayor Party Dem	-228.19300	11,554.14000
	-1,168.10200	-6,034.17000
Mayor Party Unaffiliated	2,329.76600	22,851.67000*
	-1,566.60000	-8,092.72600
Mayor Party Rep	1,817.01700	16,022.18000*
	-1,181.18900	-6,101.77700
AA Population $_{t-1}$	-0.00200	0.01900
	-0.00400	-0.01900
Dissimilarity Index $_{t-1}$	55.69800	328.09400*
	-31.07800	-160.54200
AA Median HHI $_{t-1}$	-0.01300	0.45100
	-0.05200	-0.27100
Population $_{t-1}$	0.00300	0.01300
	-0.00200	-0.00800
Under 18 Population $_{t-1}$	-0.01200*	-0.08000*
	-0.00600	-0.03000
% African American Single Female Heads of House $_{t-1}$	-2,671.52400	-7,719.81600
	-2,797.27300	-14,450.13000
African American Employment $_{t-1}$	-2,243.47500	-46,730.17000*
	-4,336.89100	-22,403.47000
Higher Education Expenditure $_{t-1}$	-0.00002	-0.00010

	-0.00002	-0.00010
Elementary Secondary Education Expenditure $_{t-1}$	-0.27000	-2.11800
	-0.49100	-2.53800
Libraries Expenditure $_{t-1}$	1.67900	167.13100*
	-7.59800	-39.24900
Cash Assistance Expenditure $_{t-1}$	0.56800	-0.65000
	-3.44900	-17.81600
Other Public Welfare Expenditure $_{t-1}$	-0.84600	-9.70100
	-2.14900	-11.10100
Health Expenditure $_{t-1}$	3.72300*	22.78100*
	-0.86200	-4.45400
Housing Community Development Expenditure $_{t-1}$	2.30800*	13.12200*
	-0.79200	-4.09000
Total Aid Per Person $_{t-1}$ and Home Rule	-0.61100	-3.34200
	-0.49300	-2.54400
Total Aid Per Person $_{t-1}$ * Consolidation	0.22600	3.74900
	-0.43200	-2.23200
Total Aid Per Person $_{t-1}$ * Mayor Party DEM $_{t-1}$	0.32000	-2.62300
	-0.85500	-4.41800
Total Aid Per Person $_{t-1}$ * Mayor Party Unaffiliated $_{t-1}$	-0.66200	-4.41900
	-0.96100	-4.96200
Total Aid Per Person $_{t-1}$ * Mayor Party REP $_{t-1}$	-0.95100	-6.02700
	-0.87000	-4.49500
Total Aid Per Person $_{t-1}$ * AA Population $_{t-1}$	0.00000	-0.00002
	0.00000	-0.00001
Total Aid Per Person $_{t-1}$* Dissimilarity Index $_{t-1}$	-0.02500	-0.10900
	-0.01500	-0.07500
Total Aid Per Person $_{t-1}$* AA Median HHI $_{t-1}$	0.00003	-0.00010
	-0.00002	-0.00010
AA Population $_{t-1}$ * Higher Education Expenditure $_{t-1}$	0.00000	0.00000
	0.00000	0.00000
AA Population $_{t-1}$* Elementary Secondary Education Expenditure $_{t-1}$	0.00000	0.00003*

	0.00000	-0.00001
AA Population $_{t-1}$ * Libraries Expenditure $_{t-1}$	0.00003	-0.00040
	-0.00005	-0.00020
AA Population $_{t-1}$ * Cash Assistance Expenditure $_{t-1}$	-0.00010	0.00020
	-0.00010	-0.00030
AA Population $_{t-1}$ * Other Public Welfare Expenditure $_{t-1}$	0.00000	0.00000
	-0.00001	-0.00010
AA Population $_{t-1}$ * Health Expenditure $_{t-1}$	-0.00001*	-0.00003
	0.00000	-0.00002
AA Population $_{t-1}$ * Housing Community Development Expenditure $_{t-1}$	-0.00001	0.00002
	-0.00001	-0.00003
Constant	-1,005.98300	-4,226.65300
	-3,267.15800	-16,877.46000
Observations	360	360
Adjusted R_2	0.40700	0.75400

Note:

'p<0.1;*p<0.05; **p<0.01; ***p<0.001

I completed an analogous analysis for the annual wage gap, the second dependent variable in the multi-objective optimization. Given the adjusted R2 was so high (.7544), I concluded this model maintained theoretical merit.

Therefore, the sub-objective function f(x)1 is to minimize the following:

*=1308*Home Rule + 0.105*Total Aid pp Lag + 88.8*Consolidated - 228*Mayor Party DEM + 2330*Mayor Party UNA + 1817*Mayor Party REP -0.002*AA Population Lag + 55.70*Dissimilarity Index -0.013*AA Median HHI Lag + 0.003*Population Lag - 0.012*Under 18 Population Lag - 2671*% African American Single Female Heads of House Lag - 2243*African American Employment Lag +0*Higher Education Expenditure Lag - 0.27*Elementary Secondary Education Expenditure Lag +1.679*Libraries Expenditure Lag + 0.568*Cash Assistance Expenditure Lag - 0.846*Other Public Welfare Expenditure Lag + 3.723*Health Expenditure Lag +2.308*Housing Community Development Expenditure Lag - 0.611*Total Aid Per Person Lag*Home Rule + 0.226*Total Aid Per Person Lag* Consolidation + 0.32*Total Aid Per Person Lag*Mayor Party DEM Lag - 0.662*Total Aid Per Person Lag*Mayor Party Unaffiliated Lag - 0.951*Total Aid Per Person Lag*Mayor Party REP Lag + 0*Total Aid Per Person Lag*AA Population Lag - 0.25*Total Aid Per Person Lag*Dissimilarity Index Lag+ 0*Total Aid Per Person Lag*AA Median HHI Lag + 0*AA Population Lag*Higher Education Expenditure Lag + 0*AA Population Lag*Elementary Secondary Education Expenditure Lag + 0*AA Population Lag *Libraries Expenditure Lag + 0*AA Population*

*Lag*Cash Assistance Expenditure Lag + 0*AA Population Lag*Other Public Welfare Expenditure Lag - 0.00001*AA Population Lag*Health Expenditure Lag - 0.00001*AA Population Lag*Housing Community Development Expenditure Lag - 1006*

(6)

As (6) above indicates, the optimization model utilizes the coefficient values from Table 2 to provide city specific estimates/solutions for the change in wage gap objective.

Objective Function #2: Minimize Wage Gap

The second objective is to minimize the annual wage gap itself. In a separate exercise, I conducted an analogous analysis in the previous two chapters with the annual wage gap as the dependent variable. Results are captured in Table 23.

Therefore, the objective function f(x)2 is to minimize the following:

*=11,474.180*Home Rule + 6.436*Total Aid pp Lag + -5,540.87*Consolidated + 11,554.14*Mayor Party DEM + 22,851.670*Mayor Party UNA + 16,022*Mayor Party REP + 0.019*AA Population Lag + 328*Dissimilarity Index + 0.451*AA Median HHI Lag + 0.013*Population Lag - 0.080*Under 18 Population Lag - 7719*% African American Single Female Heads of House Lag - 46,730*African American Employment Lag - 0.0001*Higher Education Expenditure Lag - 2.118*Elementary Secondary Education Expenditure Lag + 161*Libraries Expenditure Lag - 17.816*Cash Assistance Expenditure Lag - 11.101*Other Public Welfare Expenditure Lag + 22.781*Health Expenditure Lag + 13.122*Housing Community Development Expenditure Lag - 3.342*Total Aid Per Person Lag*Home Rule + 3.749*Total Aid Per Person Lag*Consolidation - 2.623*Total Aid Per Person Lag*Mayor Party DEM Lag - 4.419*Total Aid Per Person Lag*Mayor Party Unaffiliated Lag - 6.027*Total Aid Per Person Lag*Mayor Party REP Lag - 0.00002*Total Aid Per Person Lag*AA Population Lag - 0.109*Total Aid Per Person Lag*Dissimilarity Index Lag - 0.0001*Total Aid Per Person Lag*AA Median HHI Lag + 0*AA Population Lag*Higher Education Expenditure Lag + 0.00003*AA Population Lag*Elementary Secondary Education Expenditure Lag - 0.0004*AA Population Lag*Libraries Expenditure Lag + 0.0002*AA Population Lag*Cash Assistance Expenditure Lag + 0*AA Population Lag*Other Public Welfare Expenditure Lag - 0.00003*AA Population Lag*Health Expenditure Lag + 0.00002*AA Population Lag*Housing Community Development Expenditure Lag - 4,226.65*

(7)

As (7) above indicates, the optimization model utilizes the coefficient values from Table 2 to provide city specific estimates/solutions for the change in wage gap objective.

To reflect relative importance of objectives, the weighted-sum method was employed as outlined in (8) (Marler, et al, 2010):

$$F(x) = \sum_{1}^{i} w_i * f_i(x) \quad (8)$$

where *i* is the number of objective sub-functions

As a starting point, I assigned equal weights, 0.5, to each of the two objectives, representing equal importance of each objective.

Input Variables

For each city, I loaded the latest available social, political, population and aid factors into the solver. These were used to calculate the economic mobility and wage gap in the optimization.

Decision Variables

The decision variables are the expenditure categories, described in Chapter 3: higher education (x1), elementary and secondary education (x_2), libraries (x_3), cash assistance (x_4), other public welfare (x_5), health (x_6), and housing and community (x_7).

Constraints

To better reflect real-world conditions, I imposed four constraints on the optimization model. Because cities cannot allocate negative money, I constrained the model such that all real dollar amounts must be non-negative values. Second, as the goal is to close the wealth gap, I set the lower bound of $f_2(x)$ to \$0.00, preventing a reversal of the wealth gap, in which White Americans were outearned by their African American counterparts. In addition, I required each city to spend an amount equal to their total spending in the economic mobility-related

categories[7]. Finally, to ensure portfolio diversity, I constrained spending in each category to no more than 20% of the budget. As mentioned previously, though economic mobility-focused revenue can come from sources other than federal and state aid, I assumed the majority of economic mobility-focused funding to come from these two sources, with the vast majority of local revenue directed towards operating expenses.

Formulation

The complete multi-objective optimization problem is defined in (9) as

Minimize F(x) =

0.5(1308*Home Rule + 0.105*Total Aid pp Lag + 88.8*Consolidated - 228*Mayor Party DEM + 2330*Mayor Party UNA + 1817*Mayor Party REP -0.002*AA Population Lag + 55.70*Dissimilarity Index -0.013*AA Median HHI Lag + 0.003*Population Lag - 0.012*Under 18 Population Lag - 2671*% African American Single Female Heads of House Lag - 2243*African American Employment Lag +0*Higher Education Expenditure Lag - 0.27*Elementary Secondary Education Expenditure Lag +1.679*Libraries Expenditure Lag + 0.568*Cash Assistance Expenditure Lag - 0.846*Other Public Welfare Expenditure Lag + 3.723*Health Expenditure Lag +2.308*Housing Community Development Expenditure Lag - 0.611*Total Aid Per Person Lag*Home Rule + 0.226*Total Aid Per Person Lag*Consolidation + 0.32*Total Aid Per Person Lag*Mayor Party DEM Lag - 0.662*Total Aid Per Person Lag*Mayor Party Unaffiliated Lag - 0.951*Total Aid Per Person Lag*Mayor Party REP Lag + 0*Total Aid Per Person Lag*AA Population Lag - 0.25*Total Aid Per Person Lag*Dissimilarity Index Lag + 0*Total Aid Per Person Lag*AA Median HHI Lag + 0*AA Population Lag*Higher Education Expenditure Lag + 0*AA Population Lag*Elementary Secondary Education Expenditure Lag + 0*AA Population Lag*Libraries Expenditure Lag + 0*AA Population Lag*Cash Assistance Expenditure Lag + 0*AA Population Lag*Other Public Welfare Expenditure Lag - 0.00001*AA Population Lag*Health Expenditure Lag - 0.00001*AA Population Lag*Housing Community Development Expenditure Lag - 1006)*

+

0.5(11,474.180*Home Rule + 6.436*Total Aid pp Lag + -5,540.87*Consolidated + 11,554.14*Mayor Party DEM + 22,851.670*Mayor Party UNA + 16,022*Mayor Party REP + 0.019*AA Population Lag + 328*Dissimilarity Index + 0.451*AA Median HHI Lag + 0.013*Population Lag - 0.080*Under 18 Population Lag - 7719*% African American Single Female Heads of House Lag - 46,730*African American Employment Lag - 0.0001*Higher Education Expenditure Lag - 2.118*Elementary Secondary Education Expenditure Lag + 161*Libraries Expenditure Lag - 17.816*Cash Assistance Expenditure Lag - 11.101*Other*

[7] Because some cities did use other sources of revenue towards economic mobility related items, total 2017 economic mobility-related expenditures exceed total aid.

*Public Welfare Expenditure Lag + 22.781*Health Expenditure Lag + 13.122*Housing Community Development Expenditure Lag - 3.342*Total Aid Per Person Lag*Home Rule + 3.749*Total Aid Per Person Lag*Consolidation - 2.623*Total Aid Per Person Lag*Mayor Party DEM Lag - 4.419*Total Aid Per Person Lag*Mayor Party Unaffiliated Lag - 6.027*Total Aid Per Person Lag*Mayor Party REP Lag - 0.00002*Total Aid Per Person Lag*AA Population Lag - 0.109*Total Aid Per Person Lag*Dissimilarity Index Lag - 0.0001*Total Aid Per Person Lag*AA Median HHI Lag + 0*AA Population Lag*Higher Education Expenditure Lag + 0.00003*AA Population Lag*Elementary Secondary Education Expenditure Lag - 0.0004*AA Population Lag*Libraries Expenditure Lag + 0.0002*AA Population Lag*Cash Assistance Expenditure Lag + 0*AA Population Lag*Other Public Welfare Expenditure Lag - 0.00003*AA Population Lag*Health Expenditure Lag + 0.00002*AA Population Lag*Housing Community Development Expenditure Lag - 4,226.65)*

$$\text{subject to } \sum_1^7 x_i \geq 0$$

$$f_2(x) \geq 0$$

$$\sum_1^7 x_i = Total\ 2017\ Expenditures$$

$$\frac{x_i}{(Total\ 2017\ Expenditures)} \leq 20\%$$

(9)

Results and Analysis

Based on the model above, I ran an initial optimization for each city to identify budget priorities based on each locality's political, social, aid, and population characteristics (see Figure 52). (For better visualization and comparison across analyses, I divided the cities into five groups, from largest to smallest.)

For Dallas, Jacksonville, Columbus, Charlotte, Indianapolis, Baltimore, Milwaukee, Atlanta, and New Orleans–cities with significant Black populations and racial segregation–higher education, elementary and secondary education, other public welfare, health, and housing and community development expenditures were prioritized.

For Philadelphia, the bulk of spending was allocated to higher education, libraries, cash assistance, other public welfare, health, and less than $25 on housing and community development expenditures. Unlike any other city in the initial optimization, library expenditures were prioritized over cash assistance. Despite having similar per person aid levels as San Francisco, which is also a home rule, consolidated, Democratic-led city, Philadelphia has a higher segregation index and operates under a consolidated form of government. Recall from Figure 26 that consolidated cities spend more money on libraries for a given level of aid versus unconsolidated cities.

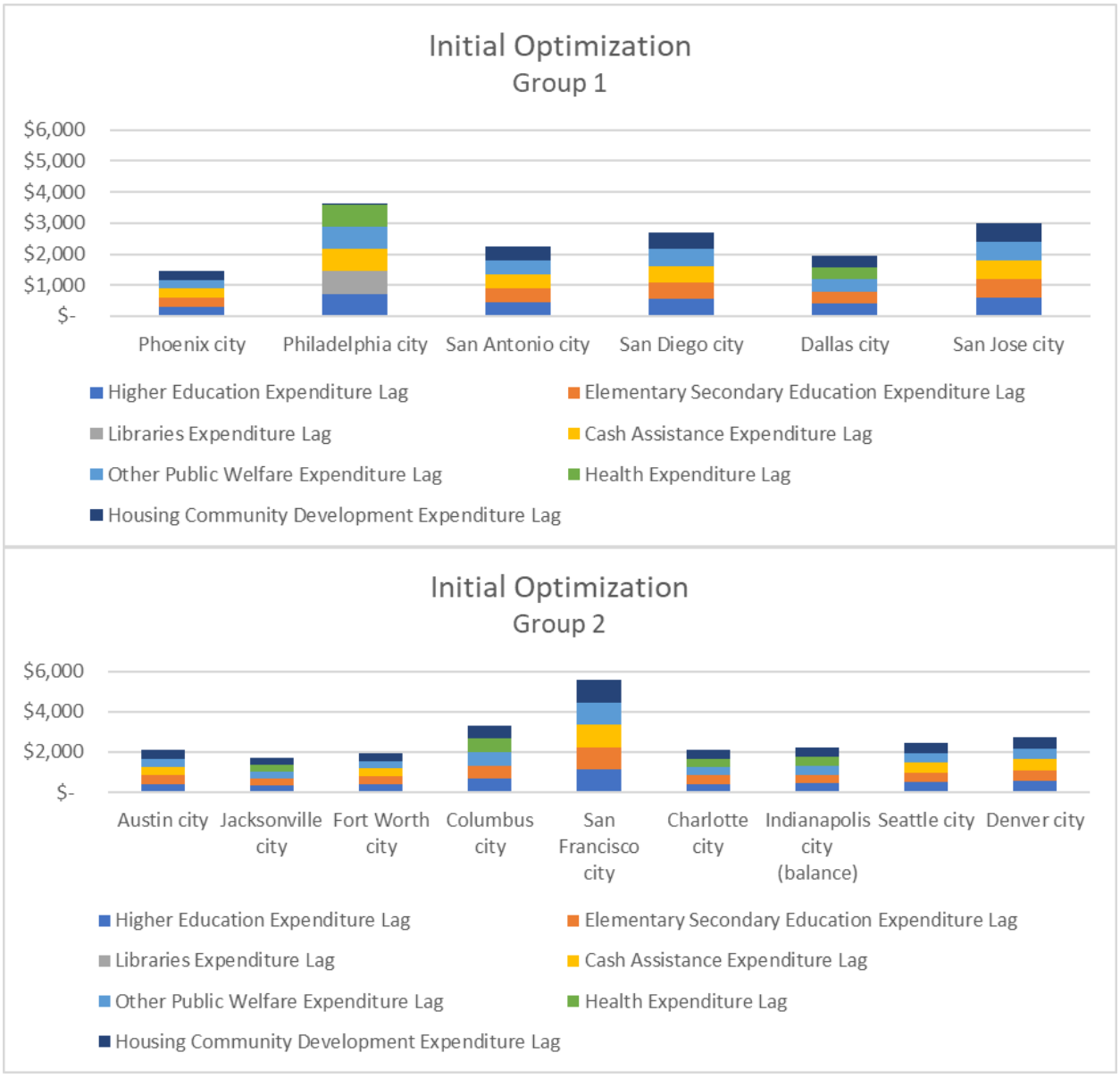
For Detroit, with a very high black population compared to other cities, every expenditure category was selected with the exception of housing and community development. Elementary and secondary education was funded last. For Memphis, cash assistance and housing and community development expenditures were excluded. For all remaining cities, higher education, elementary and secondary education, cash assistance, other public welfare, and housing and community development expenditures were prioritized.

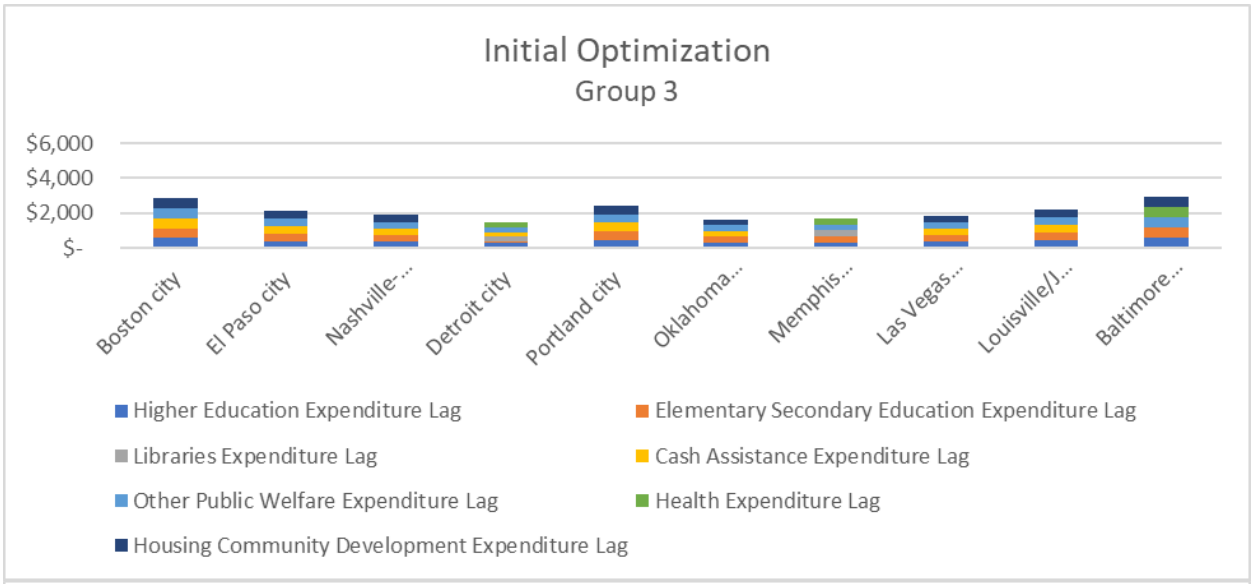
In considering the data in the aggregate, a few observations can be made. First, the model returned health as a priority expenditure category for cities with larger African American populations. African Americans have lower life expectancies, in part due to the lack of healthy food options in Black neighborhoods as well as the availability of health insurance in lower paying hourly jobs (in which Black people are disproportionately represented). Because these workers must call out of work when faced with health challenges, they miss opportunities to earn, contributing to the wage gap. Investing in healthcare in these cities can improve health–and therefore, economic–outcomes for those in the lower income quintile, thereby reducing the wage gap or slowing the pace of its widening.

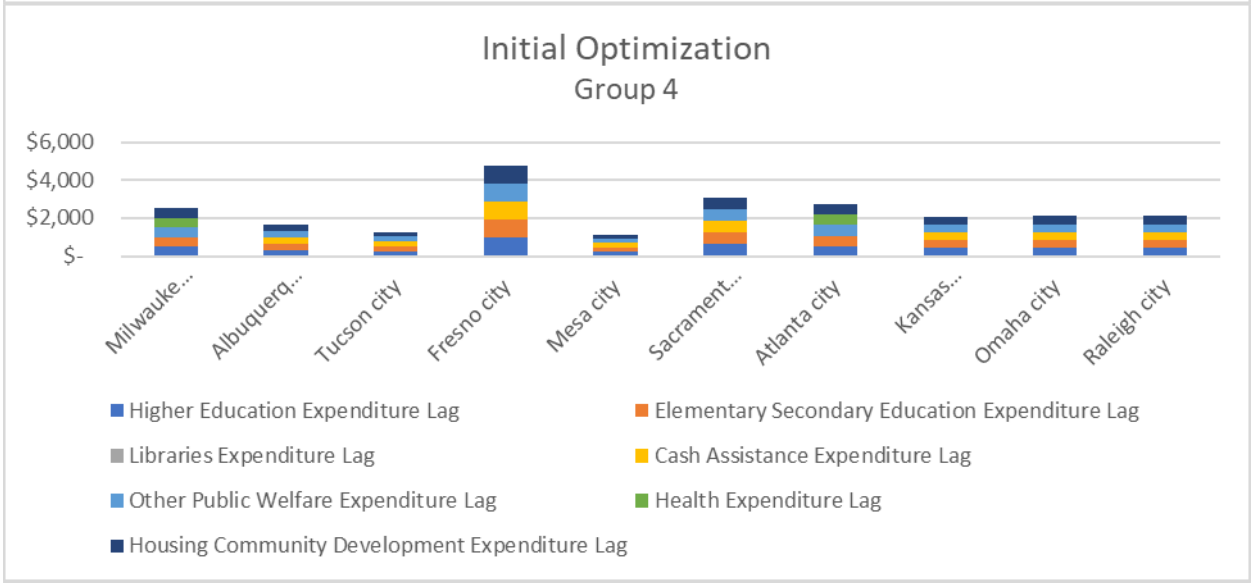
When it comes to public investment besides healthcare, the simulated results for California cities are outpacing the rest of the country–with one exception. San Diego, California's lone Republican-led big city, returned model results significantly lower than not only its California counterparts, but also cities of much smaller size. However, some of this disparity could be attributed to total aid received from the state and federal government, as it does seem to be on par with its similarly funded peers.

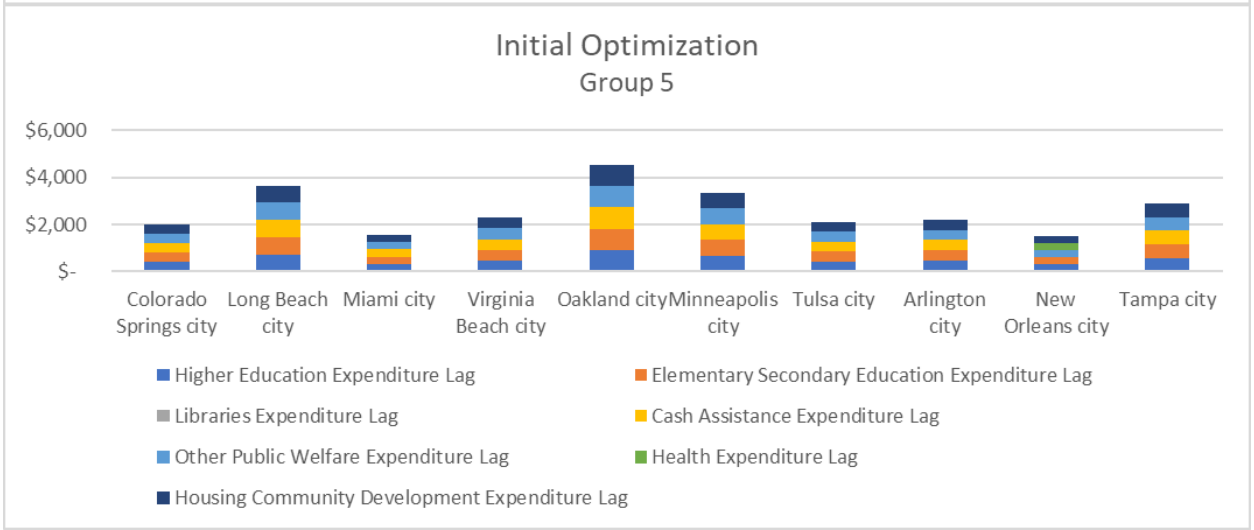
Figure 52

Initial Optimization




Initial Optimization
Group 3
$6,000
$4,000
$2,000
$-
Boston city
El Paso city
Nashville-...
Detroit city
Portland city
Oklahoma...
Memphis...
Las Vegas...
Louisville/J...
Baltimore...
Higher Education Expenditure Lag
Elementary Secondary Education Expenditure Lag
Libraries Expenditure Lag
Cash Assistance Expenditure Lag
Other Public Welfare Expenditure Lag
Health Expenditure Lag
Housing Community Development Expenditure Lag

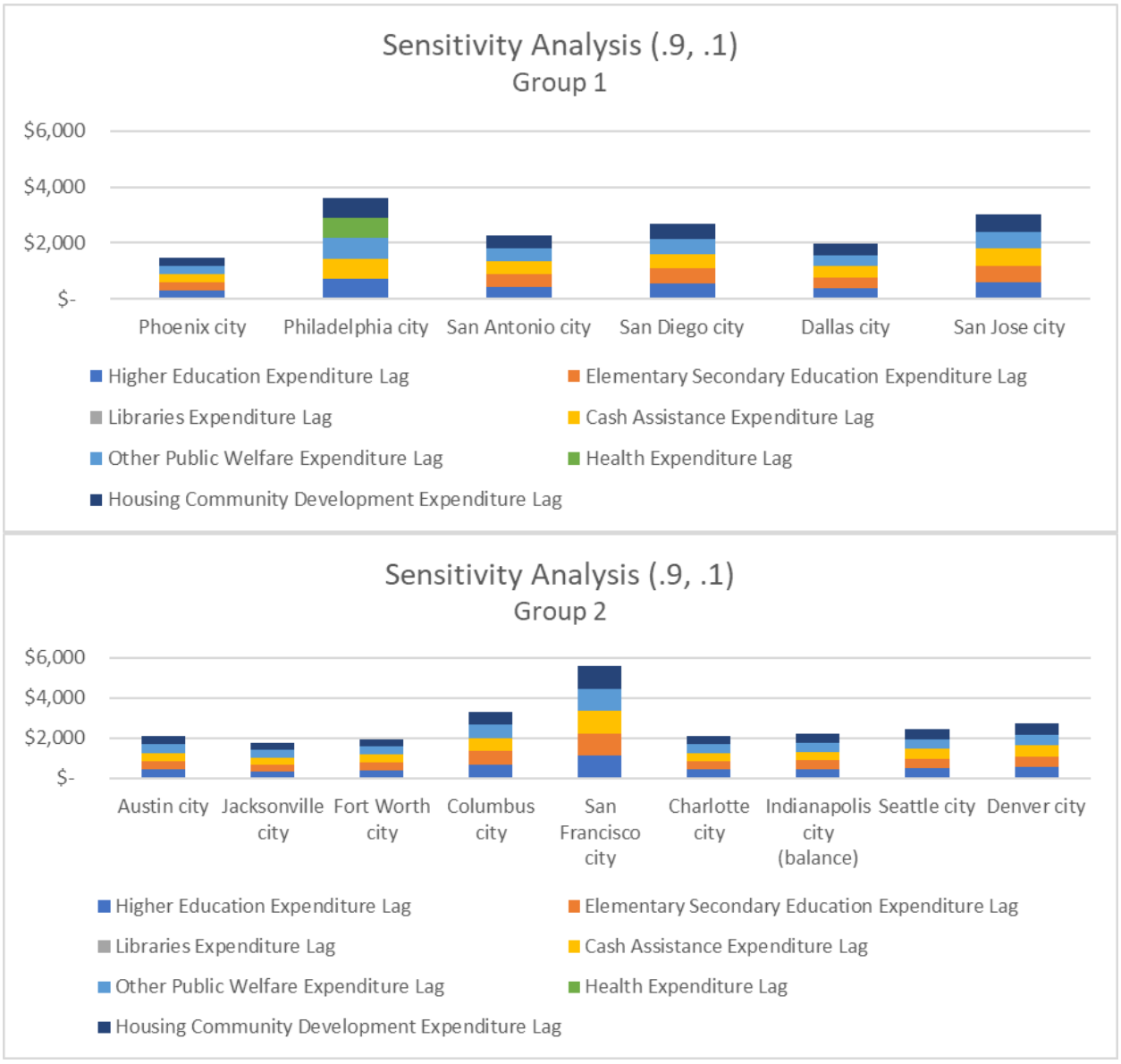

Initial Optimization
Group 4
$6,000
$4,000
$2,000
$-
Milwauke...
Albuquerq...
Tucson city
Fresno city
Mesa city
Sacrament...
Atlanta city
Kansas...
Omaha city
Raleigh city
Higher Education Expenditure Lag
Elementary Secondary Education Expenditure Lag
Libraries Expenditure Lag
Cash Assistance Expenditure Lag
Other Public Welfare Expenditure Lag
Health Expenditure Lag
Housing Community Development Expenditure Lag

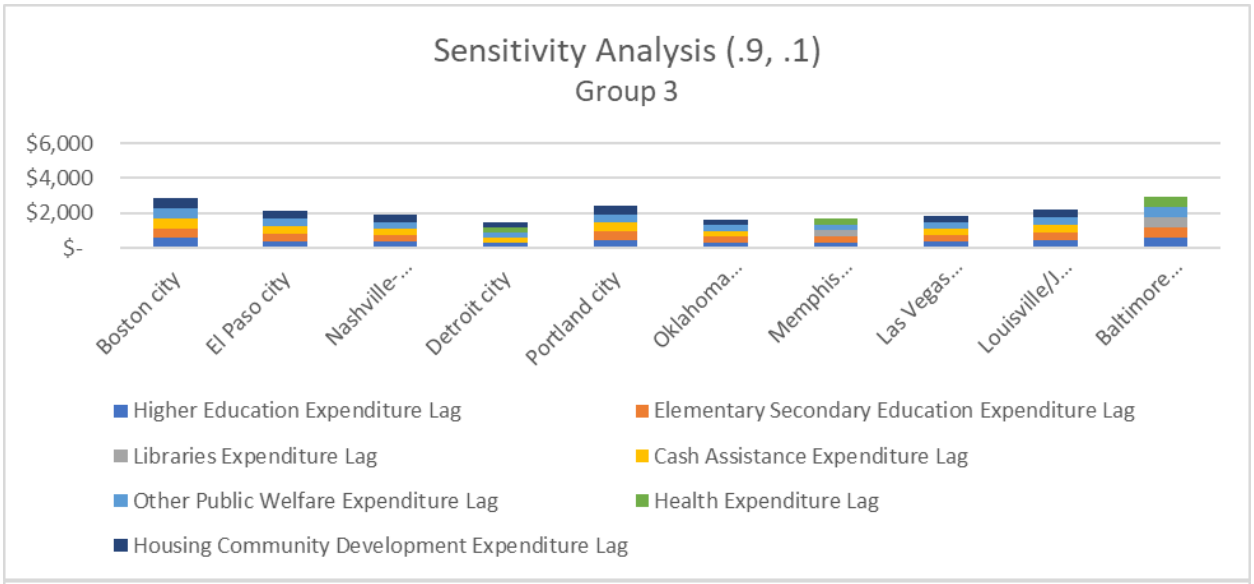

Initial Optimization
Group 5
$6,000
$4,000
$2,000
$-
Colorado Springs city
Long Beach city
Miami city
Virginia Beach city
Oakland city
Minneapolis city
Tulsa city
Arlington city
New Orleans city
Tampa city
Higher Education Expenditure Lag
Elementary Secondary Education Expenditure Lag
Libraries Expenditure Lag
Cash Assistance Expenditure Lag
Other Public Welfare Expenditure Lag
Health Expenditure Lag
Housing Community Development Expenditure Lag

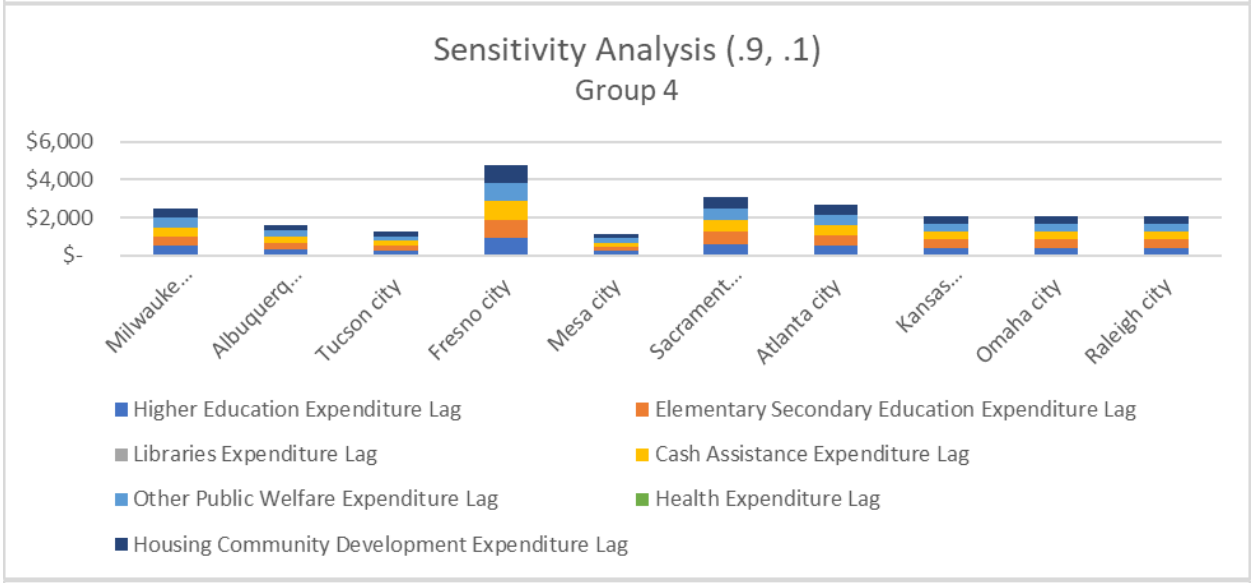
I next wanted to understand how changing the importance of each objective might impact the budget prioritizations. To investigate, I ran the first of two sensitivity analyses, varying the weights of objectives 1 and 2 from 0.5 each to 0.9 and 0.1, respectively. Figure 53 illustrates that, with the change in wage gap carrying significantly more importance, there were a number of allocation adjustments made. For Philadelphia, libraries expenditures were exchanged for greater investment in housing and community development. For Dallas, Jacksonville, Columbus, Charlotte, Indianapolis, Milwaukee, Atlanta, and New Orleans, cash assistance was prioritized over health expenditures. This is to be expected given that direct cash infusions would impact the year-over-year income per person, even if they would not necessarily translate to higher wages relative to their white counterparts. Baltimore traded housing and community development in favor of libraries. Conversely, for Detroit, elementary and secondary education and library expenditures were removed, while housing and community development expenditures were added. Differences between these two similar cities can be attributed to Detroit's home rule authority versus Baltimore's lack thereof, as well as its nonpartisan governing board. Detroit, still recovering from its economic downturn, boasts a substantially larger African American population, so the total impact of housing and community development investment is bolstered by its interaction effect with the Black population. All remaining cities–those with comparatively smaller Black population percentages–remained the same versus initial optimization.

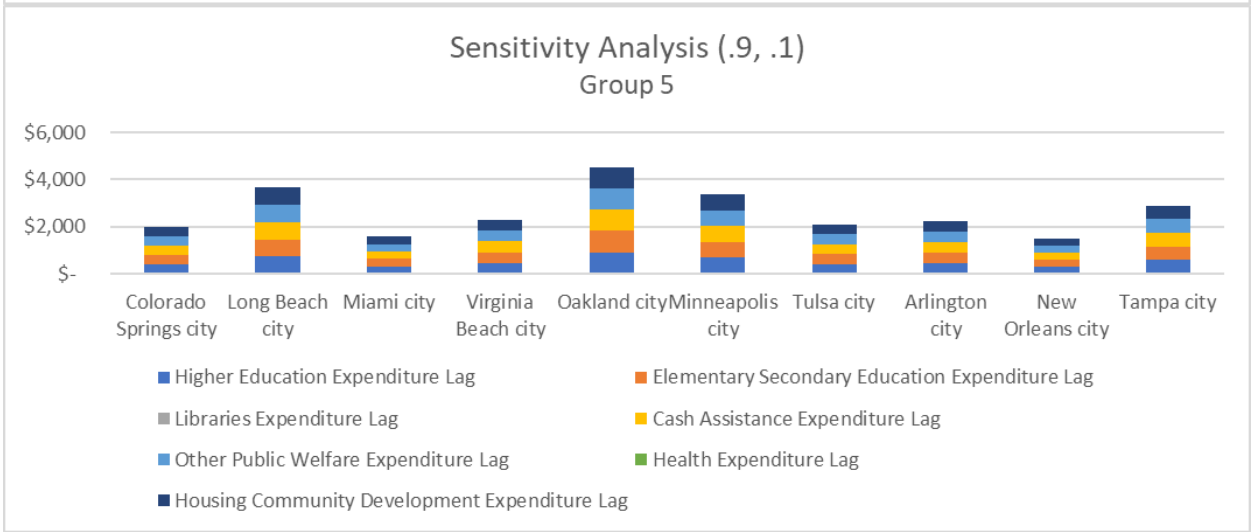
Figure 53

Sensitivity Analysis (0.9, 0.1)




Sensitivity Analysis (.9, .1)
Group 3
$6,000
$4,000
$2,000
$-
Boston city
El Paso city
Nashville-...
Detroit city
Portland city
Oklahoma...
Memphis...
Las Vegas...
Louisville/J...
Baltimore...
Higher Education Expenditure Lag
Elementary Secondary Education Expenditure Lag
Libraries Expenditure Lag
Cash Assistance Expenditure Lag
Other Public Welfare Expenditure Lag
Health Expenditure Lag
Housing Community Development Expenditure Lag

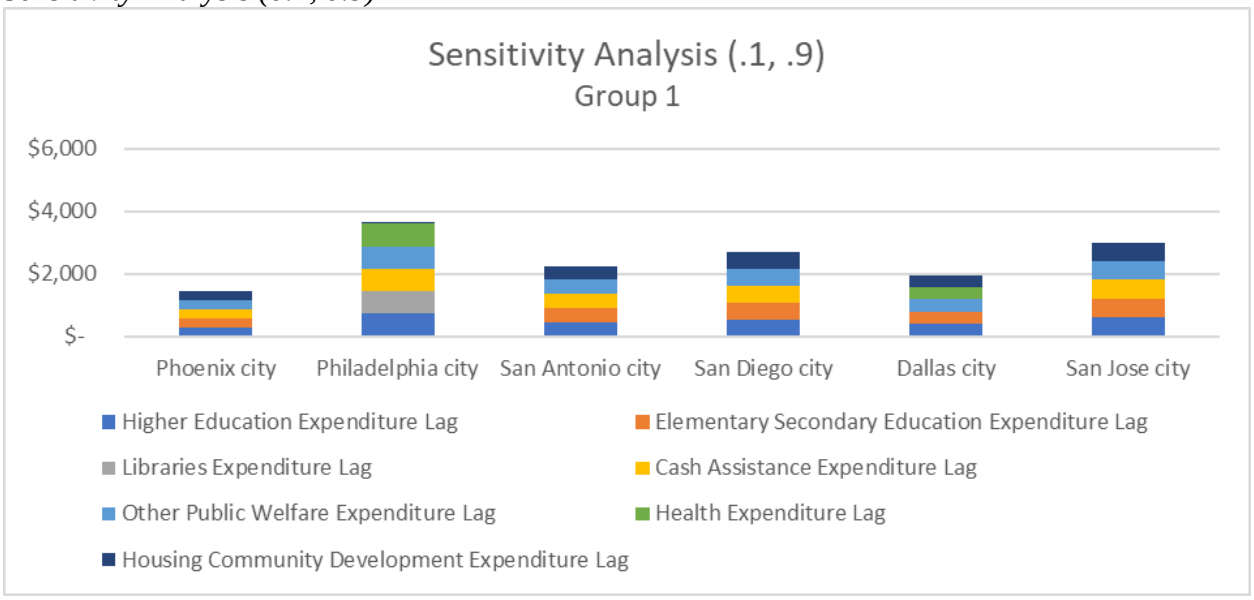

Sensitivity Analysis (.9, .1)
Group 4
$6,000
$4,000
$2,000
$-
Milwauke...
Albuquerq...
Tucson city
Fresno city
Mesa city
Sacrament...
Atlanta city
Kansas...
Omaha city
Raleigh city
Higher Education Expenditure Lag
Elementary Secondary Education Expenditure Lag
Libraries Expenditure Lag
Cash Assistance Expenditure Lag
Other Public Welfare Expenditure Lag
Health Expenditure Lag
Housing Community Development Expenditure Lag

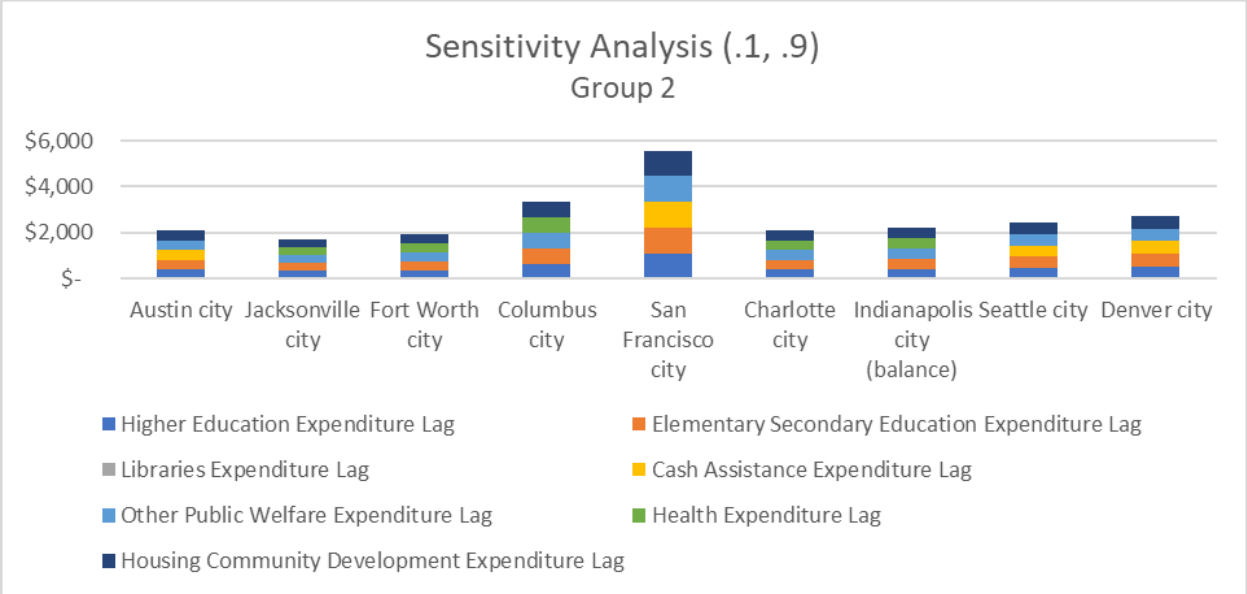

Sensitivity Analysis (.9, .1)
Group 5
$6,000
$4,000
$2,000
$-
Colorado Springs city
Long Beach city
Miami city
Virginia Beach city
Oakland city
Minneapolis city
Tulsa city
Arlington city
New Orleans city
Tampa city
Higher Education Expenditure Lag
Elementary Secondary Education Expenditure Lag
Libraries Expenditure Lag
Cash Assistance Expenditure Lag
Other Public Welfare Expenditure Lag
Health Expenditure Lag
Housing Community Development Expenditure Lag

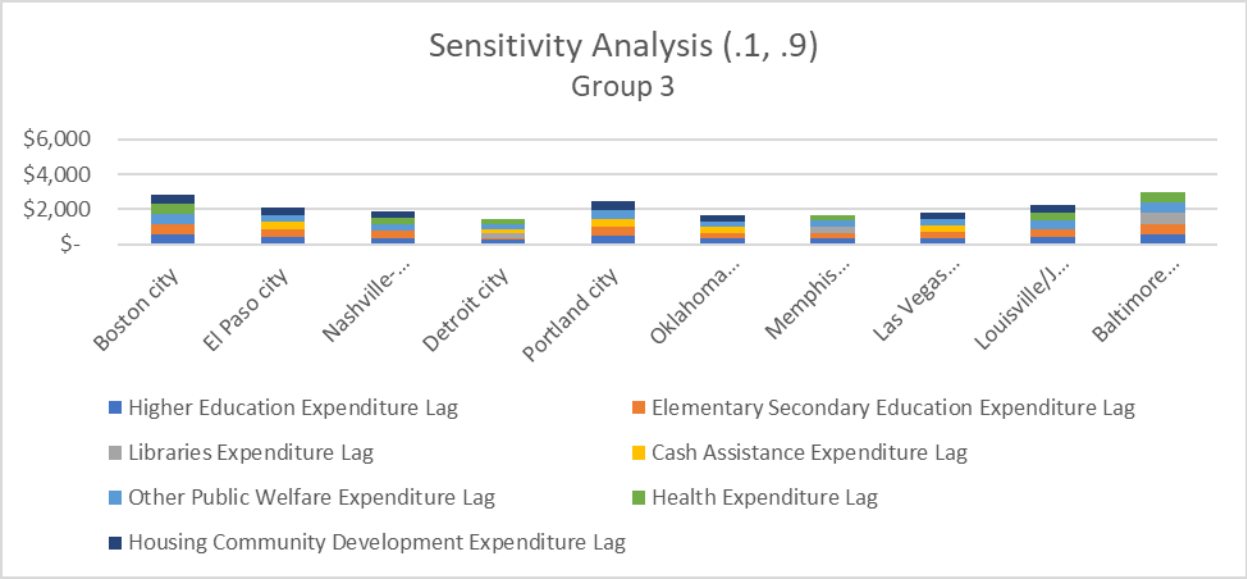
I then reversed the weights of each objective, making the minimization of the annual wage gap objective of greater importance than the minimization of the change in wage gap objective (see Figure 54). This time, the results for each city resembled the initial optimization, with a few exceptions. The mixes for Phoenix, Fort Worth, Boston, Nashville, Kansas City, and Raleigh each exchanged cash assistance for health expenditure allocations. Again, this follows the linkages between health care and economic mobility explored in the initial optimization, given that these cities average about forty percent of full-time Black workers. For Baltimore, library expenditures were favored over housing and community development. Finally, the mixes for three cities, Sacramento, Omaha, and Miami, two of which are more conservative and all of which are decidedly less Black, added housing and community development expenditures.

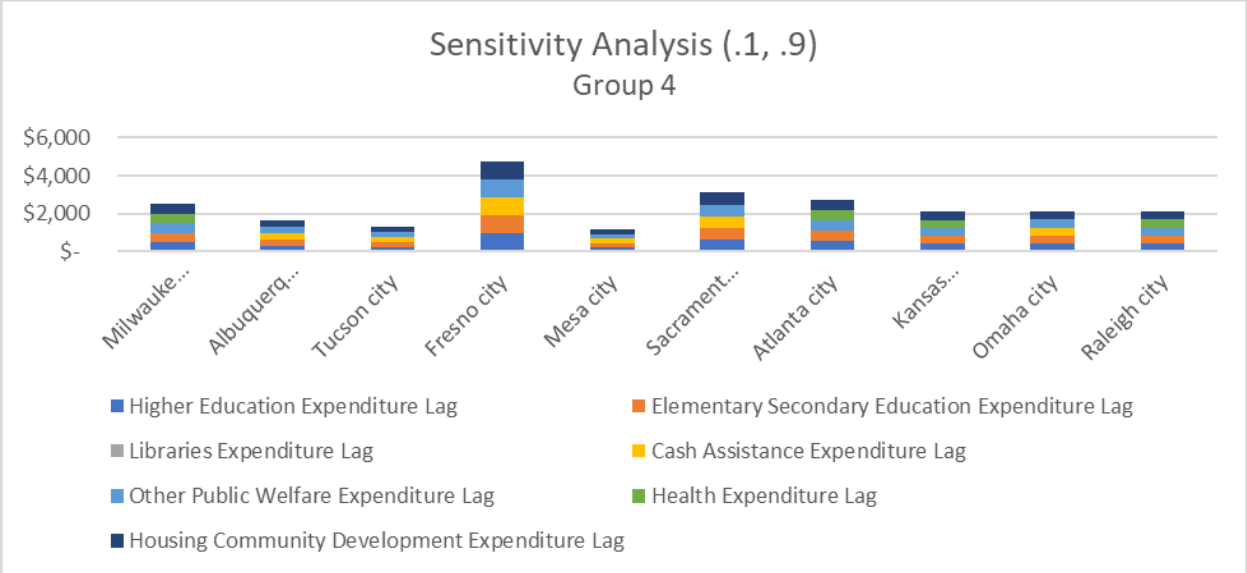
Figure 54

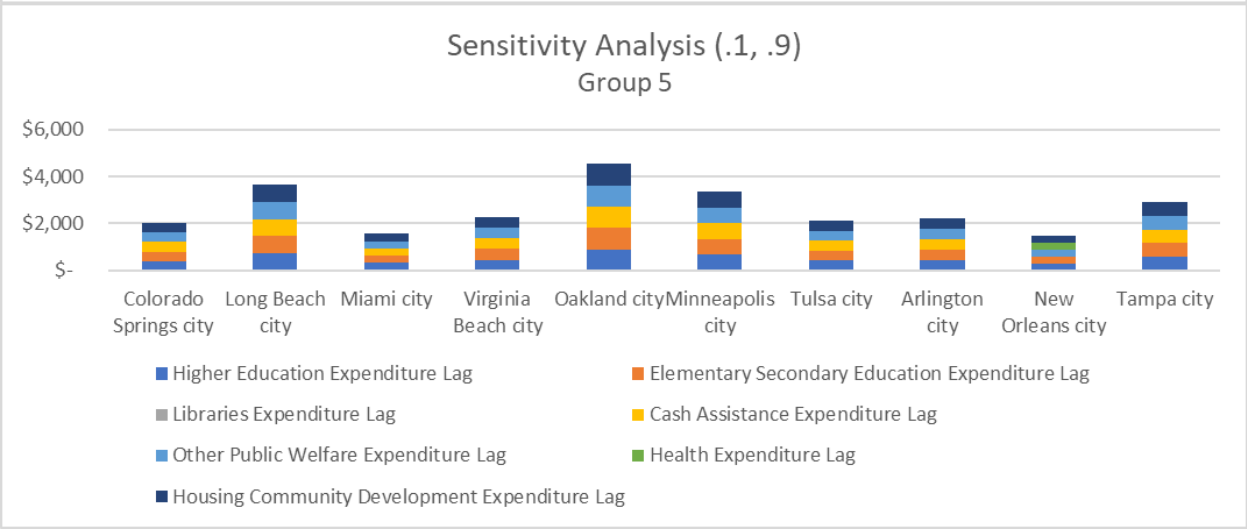
Sensitivity Analysis (0.1, 0.9)




Sensitivity Analysis (.1, .9)
Group 2
$6,000
$4,000
$2,000
$-
Austin city
Jacksonville city
Fort Worth city
Columbus city
San Francisco city
Charlotte city
Indianapolis city (balance)
Seattle city
Denver city
Higher Education Expenditure Lag
Elementary Secondary Education Expenditure Lag
Libraries Expenditure Lag
Cash Assistance Expenditure Lag
Other Public Welfare Expenditure Lag
Health Expenditure Lag
Housing Community Development Expenditure Lag


Sensitivity Analysis (.1, .9)
Group 3
$6,000
$4,000
$2,000
$-
Boston city
El Paso city
Nashville-...
Detroit city
Portland city
Oklahoma...
Memphis...
Las Vegas...
Louisville/J...
Baltimore...
Higher Education Expenditure Lag
Elementary Secondary Education Expenditure Lag
Libraries Expenditure Lag
Cash Assistance Expenditure Lag
Other Public Welfare Expenditure Lag
Health Expenditure Lag
Housing Community Development Expenditure Lag



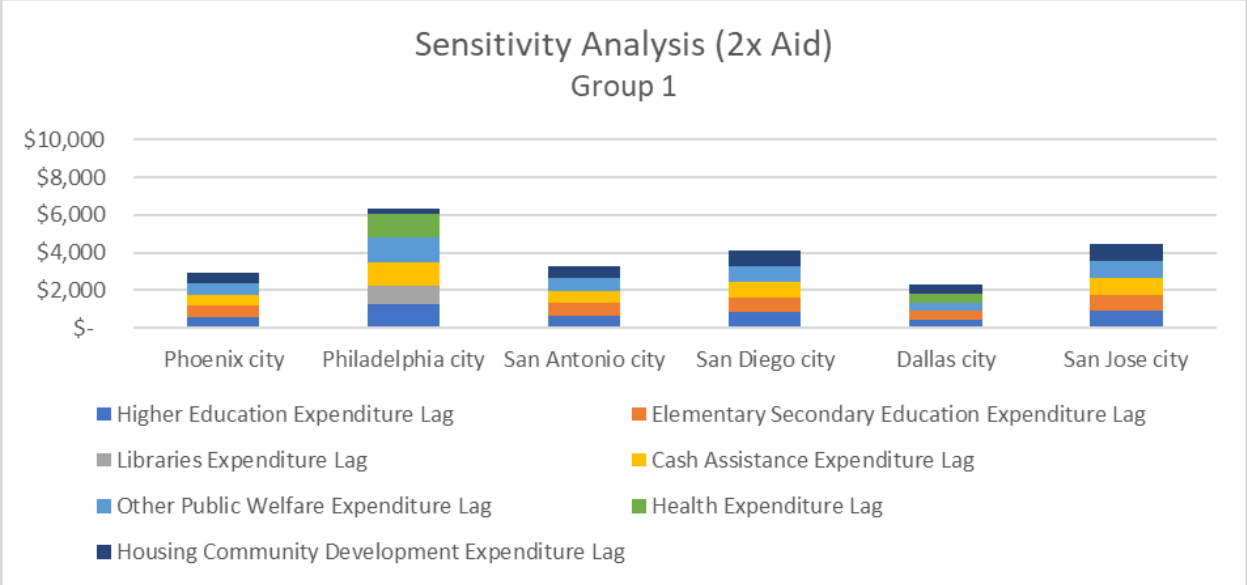


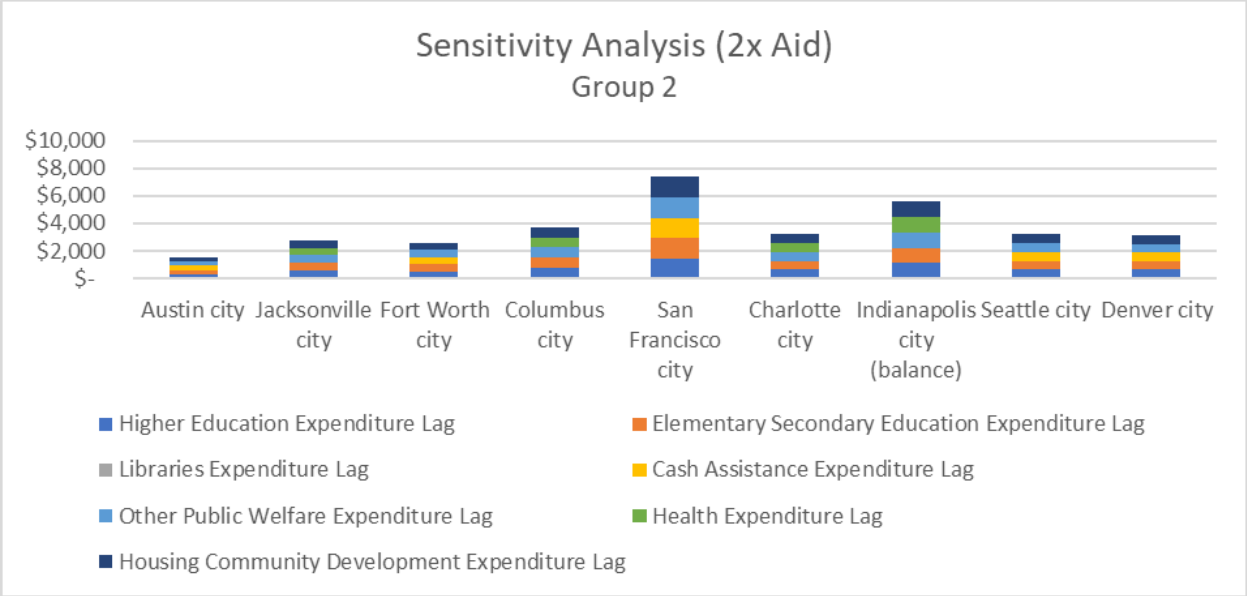
Finally, I was interested in understanding how spending might change with an increase in aid. I ran an additional sensitivity analysis with twice the amount of total aid to each city, the results of which are shown in Figure 55. In this analysis, I set the budget constraint to the increased aid amount, rather than the total 2017 expenditures as before. It is important to note that the total available resources for economic mobility-related investment did not necessarily double for each city. Instead, they increased by some proportion depending on what a city was spending from other sources beyond total state and federal aid. For Phoenix, spending doubled in

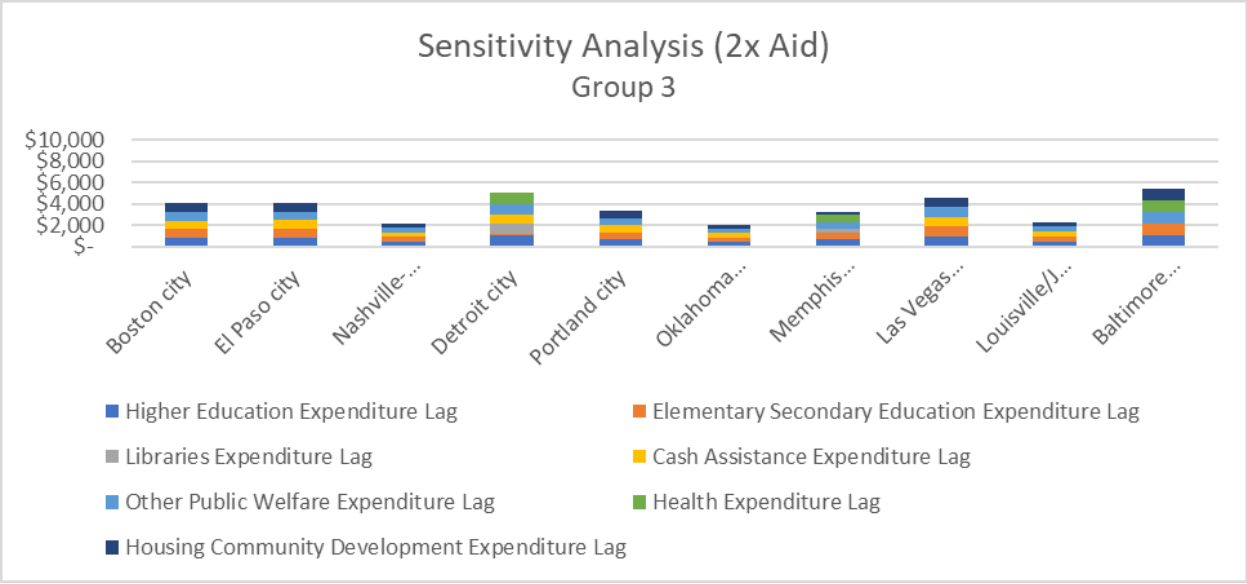
all categories. Philadelphia saw increases across the board in the same categories initially prioritized; however, libraries and housing and community development were the last categories to be funded after the others were maxed out. The Detroit model maxed out four of its initially selected categories, leaving remaining resources to be divided among elementary and secondary education and cash assistance. Similarly, the Memphis and Fresno models each maxed out four of each city's initially selected categories, leaving remaining resources to be divided among libraries and housing and community development. All other cities increased to the max in their five initially selected categories.

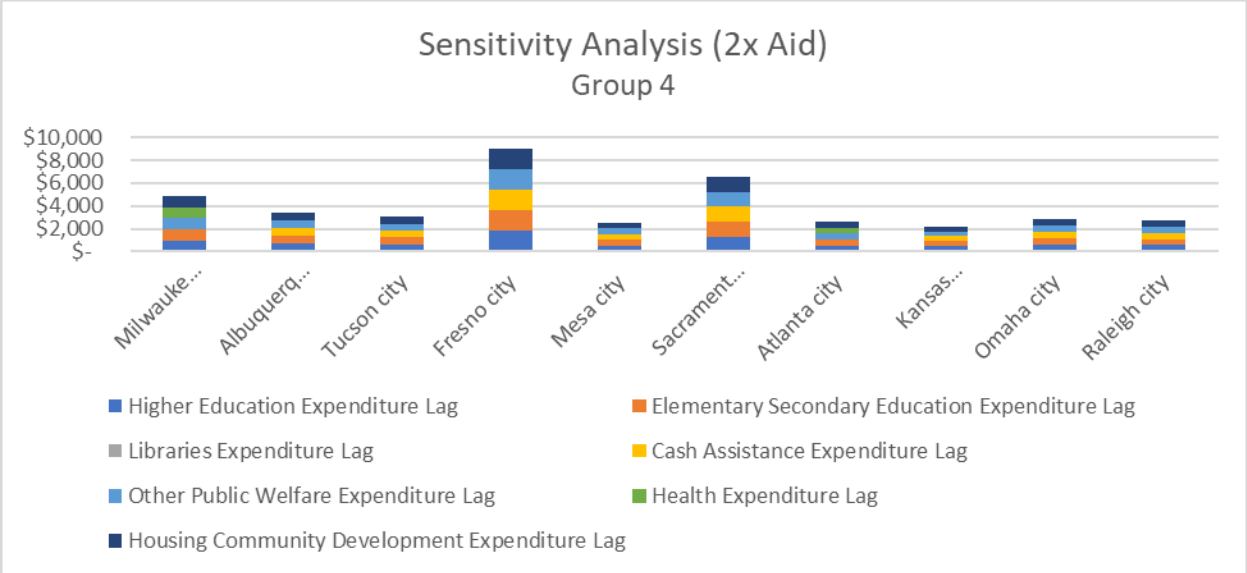
Figure 55

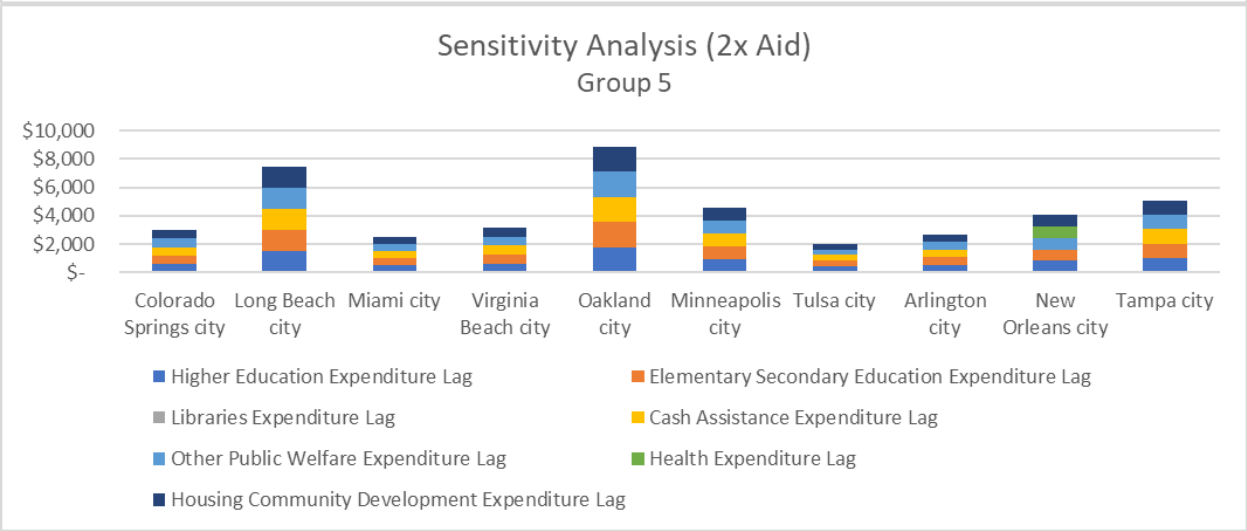
Sensitivity Analysis (2x Aid)




Sensitivity Analysis (2x Aid)
Group 2
$10,000
$8,000
$6,000
$4,000
$2,000
$-
Austin city
Jacksonville city
Fort Worth city
Columbus city
San Francisco city
Charlotte city
Indianapolis city (balance)
Seattle city
Denver city
Higher Education Expenditure Lag
Elementary Secondary Education Expenditure Lag
Libraries Expenditure Lag
Cash Assistance Expenditure Lag
Other Public Welfare Expenditure Lag
Health Expenditure Lag
Housing Community Development Expenditure Lag


Sensitivity Analysis (2x Aid)
Group 3
$10,000
$8,000
$6,000
$4,000
$2,000
$-
Boston city
El Paso city
Nashville-...
Detroit city
Portland city
Oklahoma...
Memphis...
Las Vegas...
Louisville/J...
Baltimore...
Higher Education Expenditure Lag
Elementary Secondary Education Expenditure Lag
Libraries Expenditure Lag
Cash Assistance Expenditure Lag
Other Public Welfare Expenditure Lag
Health Expenditure Lag
Housing Community Development Expenditure Lag





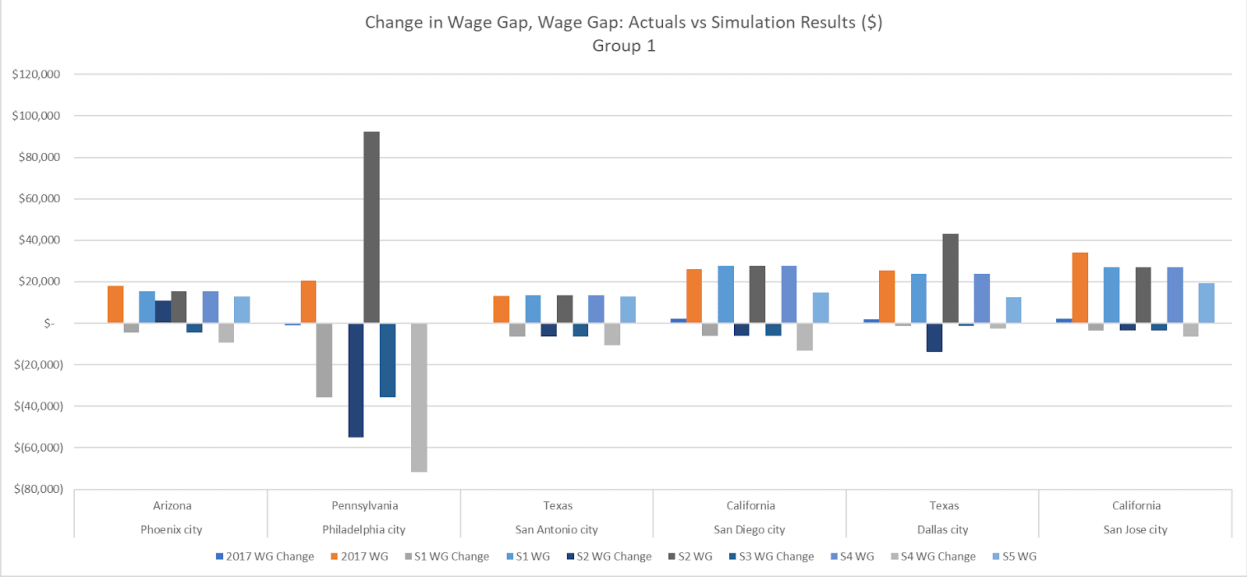
Expenditures on Economic Mobility: City Outcomes by Scenario

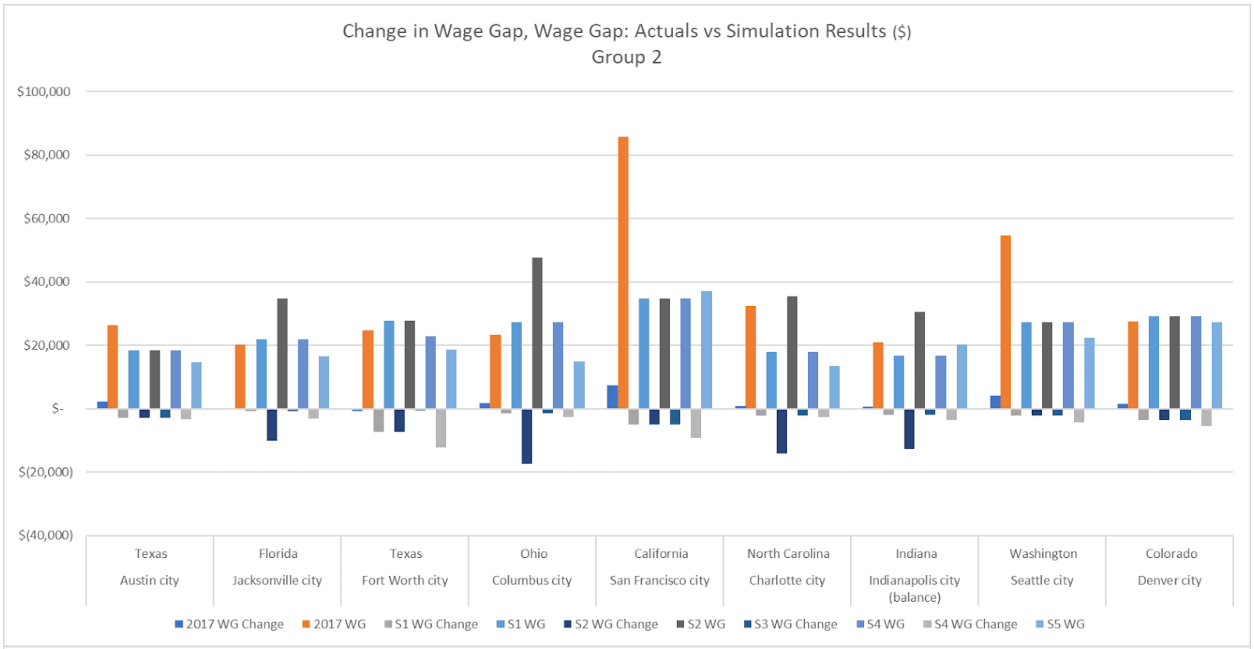
After reviewing the changes in expenditures, I plotted the 2017 change in wage gap and wage gap actuals, along with the projected outcomes for each city in the four scenarios (see Figure 56). Results show that, in the initial optimization, the change in wage gap versus 2017 actuals ranged from -$34,594 in Philadelphia to $1,472 in Memphis. Comparing the cities with the lowest changes in wage gap to those with higher changes, I found no readily discernible difference in characteristics or expenditures. For many of the cities, the wage gap in the first three scenarios remained relatively flat. Because the model is built on the best fit line of the city

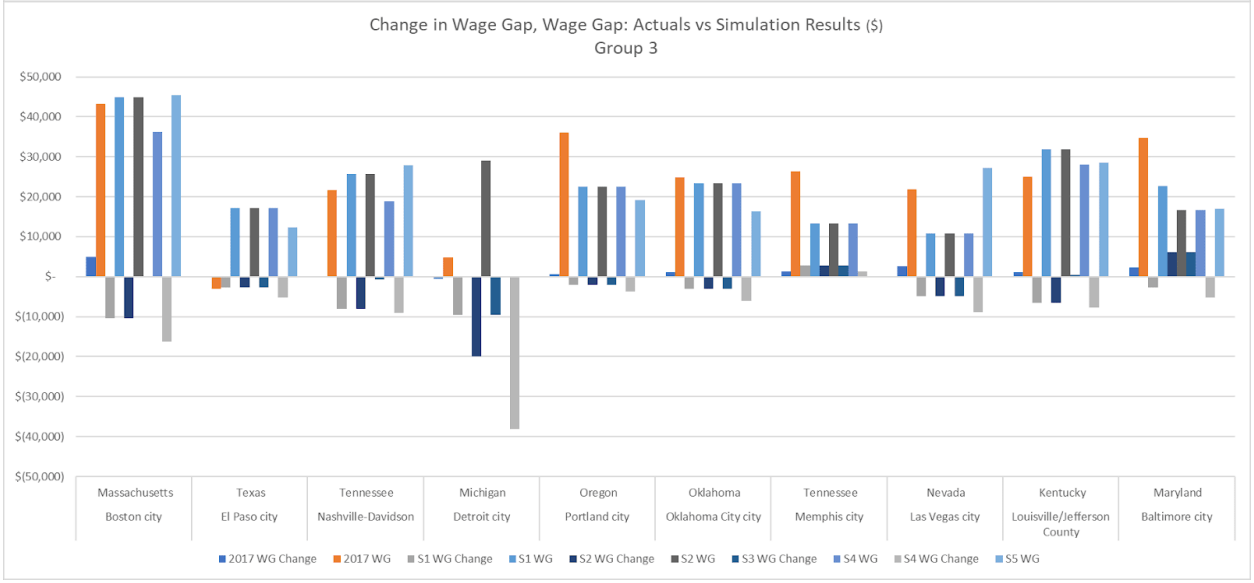
data (and due to other factors not captured in the regression), about half of the cities (many of them smaller) reflect a projected wage gap in the first three scenarios higher than the actual wage gap reported in 2017. For all but nine of the cities, however, increasing aid resulted in greater negative changes in wage gap and a lower annual wage gap versus the three other scenarios and 2017 actuals. Regardless of optimal portfolio mix, in the case of public investment, more is better.

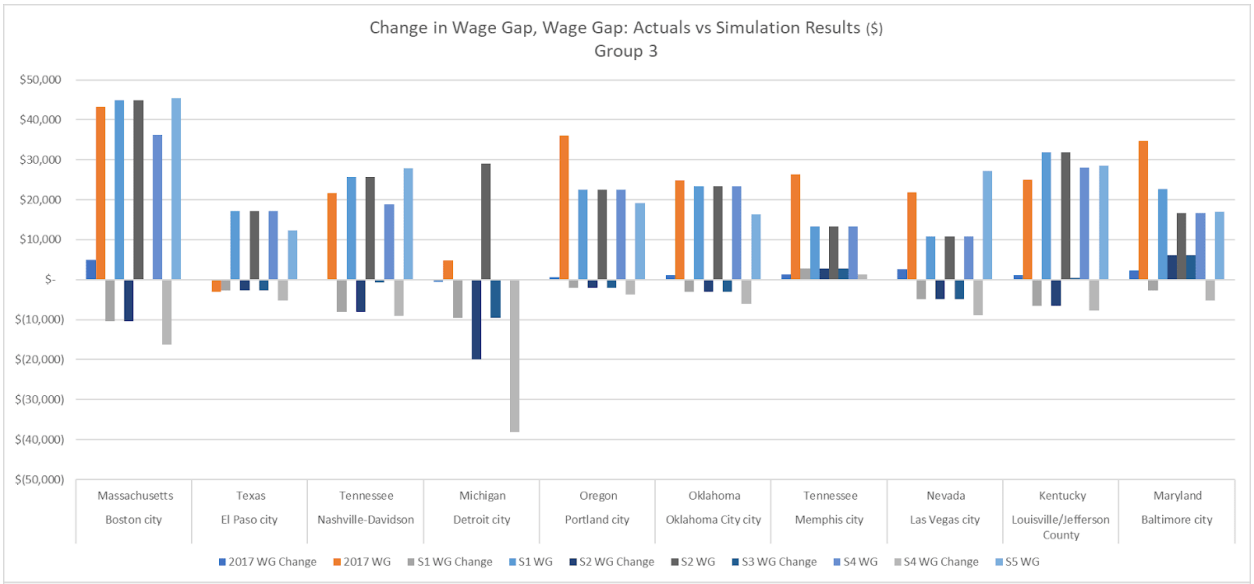
Figure 56

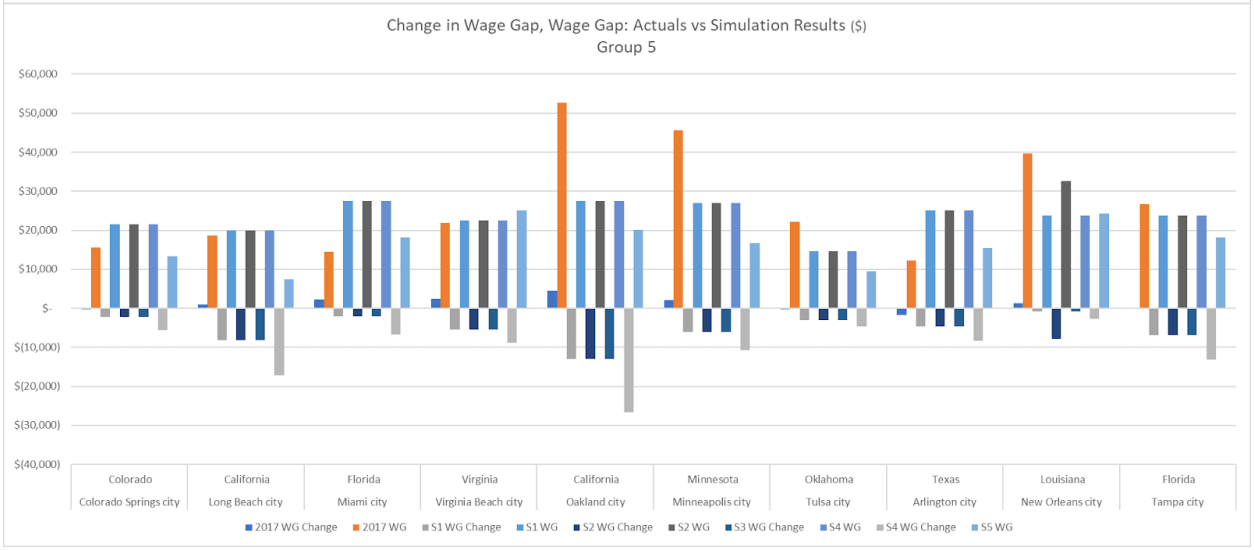
Change in Wage Gap, Wage Gap: Actuals vs Simulation Results




Change in Wage Gap, Wage Gap: Actuals vs Simulation Results ($)
Group 2
$100,000
$80,000
$60,000
$40,000
$20,000
$-
$(20,000)
$(40,000)
Texas
Austin city
Florida
Jacksonville city
Texas
Fort Worth city
Ohio
Columbus city
California
San Francisco city
North Carolina
Charlotte city
Indiana
Indianapolis city (balance)
Washington
Seattle city
Colorado
Denver city
2017 WG Change
2017 WG
S1 WG Change
S1 WG
S2 WG Change
S2 WG
S3 WG Change
S4 WG
S4 WG Change
S5 WG


Change in Wage Gap, Wage Gap: Actuals vs Simulation Results ($)
Group 3
$50,000
$40,000
$30,000
$20,000
$10,000
$-
$(10,000)
$(20,000)
$(30,000)
$(40,000)
$(50,000)
Massachusetts
Boston city
Texas
El Paso city
Tennessee
Nashville-Davidson
Michigan
Detroit city
Oregon
Portland city
Oklahoma
Oklahoma City city
Tennessee
Memphis city
Nevada
Las Vegas city
Kentucky
Louisville/Jefferson County
Maryland
Baltimore city
2017 WG Change
2017 WG
S1 WG Change
S1 WG
S2 WG Change
S2 WG
S3 WG Change
S4 WG
S4 WG Change
S5 WG





Case Study: Charlotte

As a final exercise, I completed a more detailed analysis of the city of Charlotte simulation results by scenario. As shown in Figure 56, four scenario-based outcomes reflect how change in wage gap and wage gap can be impacted by budget policy. In the initial optimization, Charlotte's selected priorities (higher education, elementary and secondary education, other public welfare, health, and housing and community development) were each funded at $417 per

person. This yielded a change in wage gap of -$2237 and an annual wage gap for the funded year of $19,195.

In the second simulation, in which economic mobility is assigned greater importance, Charlotte's funding selections shifted from health expenditure to cash assistance, all others being equal. This resulted in a change in wage gap of -$14,910 and an annual wage gap for the funded year of $38,426. How is it possible that increased mobility would result in a greater wage gap than the initial optimization? One opportunity for future iterations of the model is to include the previous year's wage gap in the objective function development, in order to ground the wage gap numbers to observed values for each city, rather than the aggregate model fit. Still, this analysis informs the iterative process and provides confirmation that the function itself is appropriately responsive.

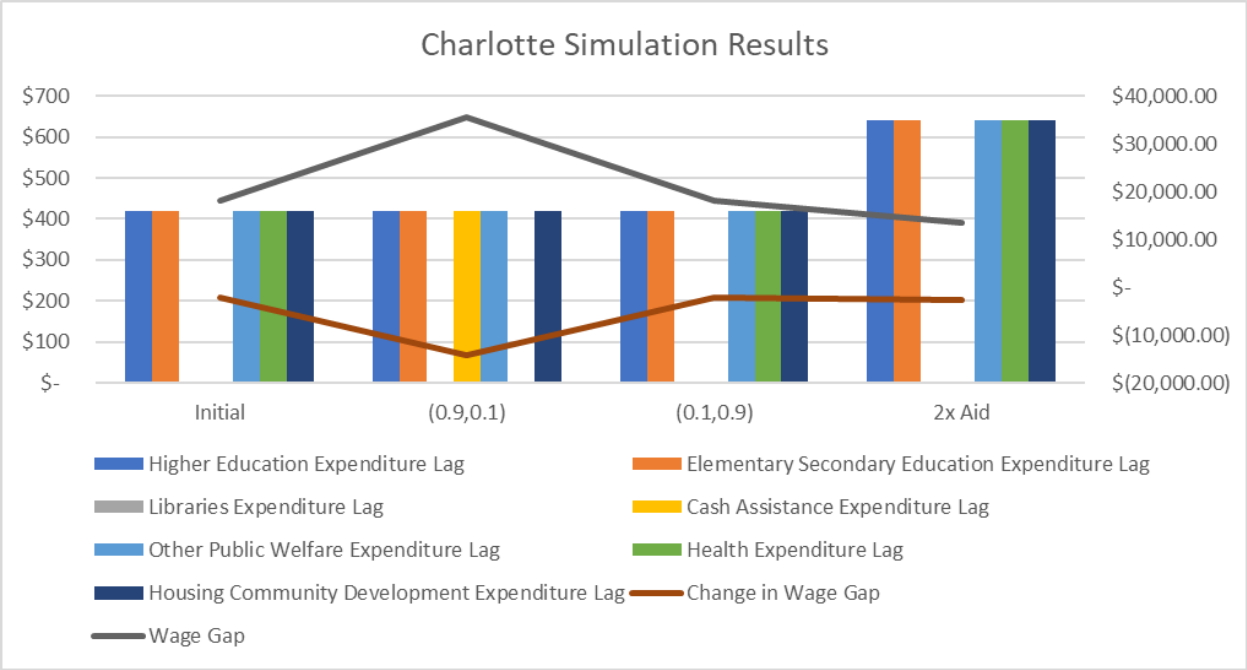
In the third simulation, which gives deference to the annual wage gap, Charlotte's prioritized categories once again reflect the initial optimization. I conclude that there is a "tipping point" 0.5 and 0.9 in which the change in wage gap influences the choice between health and cash assistance expenditures. In practice, this could inform policy choices and multi-year wrap around service strategies for families receiving public assistance.

In the fourth simulation, in which aid is increased, Figure 56 illustrates the potential incremental gains for additional funding. At -$2,857 and $14,158, it is apparent that additional aid resulted in better results for both change in wage gap and annual wage gap versus the initial optimization, as indicated in the overall summary in the previous section. However, results are not proportionate to increased investment (27% positive economic mobility and 26% reduction in wage gap for a 100% aid increase). In order to present a feasible budget plan to deliver economic mobility goals, Charlotte leaders will need to leverage private investment. This tool

can be used to determine fundraising goals and best fit potential partners (based on category spending needs) for public-private partnerships.

Figure 57

Charlotte Simulation Results



Summary

In this chapter, I presented results investigating the use of modeling and simulation to forecast optimal economic mobility budget allocations, using the regression analysis results from the previous chapters. In addition, I ran three sensitivity analyses to observe the impact of objective relative importance and increased aid on budget allocations.

First, the model returned health as a priority expenditure category for cities with larger African American populations. When it comes to public investment besides healthcare, the simulated results for California cities are outpacing the rest of the country. Of course, this is due

in large part to the populations of cities in the state amounting to more aid and more aid per person.

In the second simulation, cities with significant Black populations and racial segregation prioritized higher education, elementary and secondary education, other public welfare, health, and housing and community development expenditures over libraries and cash assistance.

Analyzing the results after the third simulation uncovered that there was a "tipping point" between 0.5 and 0.9 in which the change in wage gap influenced the choice between health and cash assistance expenditures for cities with substantial populations of Black full-time workers.

Varying the budget parameters resulted in mixed results, depending on whether individual cities (as of 2017) fell above or below the model fit line. In order to increase the accuracy of the model, additional input into the objective function is required. Two variables that could immediately increase the quality of the objective function (and, therefore, the forecast) are previous-year wage gap and previous-year spending. In addition, enhancement could be to extend the analysis over a longer time period. That said, preliminary results indicate that multi-objective optimization is a viable method to forecasting budget policy. I've demonstrated throughout this chapter potential ways to use and interpret the tool in order to optimize spending based on mobility goals, select true peer cities from which to benchmark, assess return on investment at various levels of spending, and identify potential private partners based on additional investment needs to achieve community aims.

Chapter 7: Summary and Conclusions

There exists an opportunity in public policy research to incorporate systems engineering methods as a means of identifying and evaluating policy alternatives. Using a hybrid engineering and social science approach, I aimed to 1) investigate the impact of population, political, social, and budget policy factors on aid, expenditures, and economic mobility, from which to 2) develop a multi-objective optimization model as a budget forecasting decision support tool.

Key Research Findings

In this dissertation, I aimed to investigate the impact of population, political, social, and budget policy factors on aid, expenditures, and economic mobility. The results indicate that each of these factors plays a role in the level of aid that each city receives. In particular, the co-partisanship at the local and state level pays dividends in state and federal funding. However, the results also challenge the notion that Democrats spend more readily than Republicans on economic mobility. Taken on its face, this challenges the long-held notion that the Democratic Party is the most valuable political ally to the economic position of American descendants of slavery. As Black Americans are the most unified voting block in the country, this has tremendous implications. With a departure from (or diminished) allegiance to the Democratic Party, Black voters could drive a resurgence in Republican leadership in our most populous voting districts, saving the GOP from otherwise imminent distinction in this generation.

Of course, budget policy without social programs that enable access to opportunity–race-based affirmative action, for instance–can potentially hinder utilization of set aside resources, and ultimately economic mobility for African Americans. This may explain why Chapter 5

results indicate that, despite differences in spending, when controlling for race, Democratic leadership is associated with positive (though not statistically significant) economic mobility for African Americans, while the inverse is true for Republican-led cities.

Regarding expenditures, further results show that political and social factors like partisanship, local authority, and African American affluence do influence how public funding is spent, namely partisanship and African American affluence in a city. I found that the relative spending across parties varies by expenditure category. My research confirms existing social contact theory that segregation and presence of African Americans positively impacts economic mobility. Interestingly, I found that while African American affluence does impact spending choices, budget policy alone does not drive economic mobility outcomes. My research underscores punctuated equilibrium theory, while also indicating that other factors influence periods of punctuation beyond the dynamics of political institutions at the elected and administration levels (Flink, 2017). In addition, aid and expenditure data supports the theory that the responsibility and capacity of driving economic mobility lies outside city limits (Peterson, 1981). Additionally, results indicate that economic mobility is a problem of increasing magnitude, and there are very few budget categories that are actually reversing those trends. Expenditure categories that are more effectively contributing to economic mobility are higher education, elementary and secondary education, and other public welfare. Finally, results illustrate that multi-objective optimization is a viable decision support tool.

Contribution

The optimization model is the main contribution of my research to both the systems engineering and public policy fields. There exists currently no known quantitative and automated means by which to accomplish economic mobility-related budget allocation. It is the basis for a

practical decision support tool that can be utilized to help cities determine where to direct funding for greater gains in economic mobility. As discussed in the introduction, restoring rational comprehensive decision making increases the efficiency of government processes and the effectiveness of taxpayer dollars.

Multi-objective optimization provides resource-limited public sector organizations a simple means by which to optimize spending based on mobility goals, select true peer cities from which to benchmark, assess return on investment at various levels of spending, and identify potential private partners based on additional investment needs to achieve community aims. In addition, by leveraging national data, the tool can mediate the tendency of more experienced, stable administrations to lean toward incremental change by expanding the capacity of the organization and administrators' ability to anticipate windows of opportunity. This will result in more frequent of periods of punctuation in economic mobility policy.

I embarked upon this dissertation holding in tension two viewpoints–that of a social scientist as well as an engineer. The social scientist approach formed the theoretical basis from which to explore causal relationships between political actors within the construct of a federalist government structure. In comparison, under the engineering approach I concerned myself less with the conceptualization of interdependencies and more with building a quantitative framework within which to operationalize complex social constructs as a means to controlling social outcomes.

Ultimately, I concluded that these two methods do not exist in converse relationship to each other, but are, rather, complements to each other. Both perspectives provided valuable insight to the public policy process, and decision making was improved because they were leveraged in concert.

Limitations

In the real world, only so much aid can be put to effective use in a community. Eventually, additional dollars reach a point of diminishing returns as demand tapers off, whether due to burdensome bureaucratic processes or an oversaturation in the market (for example, certifying more HVAC technicians than a city has need for). Of course, with limited resources at all levels of government, program implementation constraints, and private market factors, it is neither a politically nor practically feasible expectation that we can provide enough public aid to eliminate the wage gap. Taxpayers in states with high fiscal capacity generally expect to receive adequate return on investment of their public dollars, so Congressmembers from these states are not inclined to redistribute federal dollars to cities in states whom cannot pay their share. Therefore, ability to match federal dollars through local and state revenue limits the amount of aid received within a municipality, regardless of need. In order to demonstrate local benefits and bolster their chances for re-election, elected officials spend more of their time on shiny so-called "pork barrel" programs to which they can point as evidence of their effectiveness. In addition, states leaders are keen to avoid becoming a "welfare magnet": an economic environment that would incentivize poor residents from other states to relocate within their borders (Peterson, 2012). As it is currently constructed, the model does not account for this. Nor does it reflect the near-impossibility of wholly excluding budget categories from funding.

Furthermore, my model does not provide insight at the more granular program level. Without optimizing the spending within a category based on the individual program assessments, one must expect variability in economic mobility outcomes even when the spending scheme at the macro level is identical. In addition, my model does not reflect any private dollars leveraged for public good.

Future Research

This research served as an introductory investigation. To increase robustness, precision, and accuracy to a point of usefulness for local urban governments, several improvements to the preliminary tool are required. The first of such enhancements could be to add additional explanatory variables to the regression analyses that feed the model. Two variables that could immediately increase the quality of the objective function (and, therefore, the forecast) are previous-year wage gap and previous-year spending. Considering the previous wage gap and previous-year spending creates a sense of meaning for the wage gap equation as it is adjusted based on the spending choices. In addition, a more detailed approach to modeling state and federal institutional structures, as well as their aid disbursement, could provide extremely useful insight into how cities can best lobby for limited resources no matter the makeup of Congress, the ideology of the Executive Office, or the composition of their respective state legislatures. In addition to public explanatory variables, a comprehensive model would have to consider the availability of private investment dollars within the local community. Public-private partnerships are a fundamental part of the way in which cities leverage limited resources for maximum output.

The second and perhaps more impactful, enhancement could be to extend the analysis over a longer time period. The current data suggests that cities are struggling to keep pace with a rapidly widening wage gap, rather than truly exercising control over the outcome year over year. Increasing the lag period would enable the model to better represent causal effects of demographics, sociopolitical factors, and public investment on economic mobility. Similarly, updating the model in order to enable multi-year forecasting could provide meaningful insight into a city's strategic plan, and support long-range fiscal planning.

The third model component upon which future work could improve is the constraint set. In this base model, rudimentary constraints were imposed on spending as a starting point (maximum spending by category and total spending requirement). In practice, due to societal needs, political pressures, federalism and the nature of restricted aid, realistic constraints are far more complicated and would need to be incorporated into the model for better accuracy. Still, a fourth improvement to the model can be made–expanding it to include other racial demographics. It is quite possible that cities with large Latinx or Asian communities, each with their own unique socioeconomic characteristics, may respond differently to budget policy choices. That should be reflected in the simulation to improve accuracy and better forecasting value.

Finally, any model intended for use by local government practitioners would no doubt require a more sophisticated user interface for improved data entry, as well as model automation.

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Appendix A: Major Federal Legislation Impacting Economic Mobility of the 20th and 21st Century

Year	Legislation
July 22, 1932	Federal Home Loan Bank Act
12-May-33	Federal Emergency Relief Act, Pub. L. 73–15, 48 Stat. 55
18-May-33	Tennessee Valley Authority
13-Jun-33	Homeowners Refinancing Act, Pub. L. 73–43, 48 Stat. 128
27-Jun-34	National Housing Act of 1934, Pub. L. 73–479, 48 Stat. 1246
1-Sep-37	Housing Act of 1937, Pub. L. 75–412, 50 Stat. 888
3-Feb-38	National Housing Act Amendments of 1938, Pub. L. 75–424, 52 Stat. 8
25-Jun-38	Fair Labor Standards Act of 1938, Pub. L. 75–718, 52 Stat. 1060
1-Jul-44	Public Health Service Act, Pub. L. 78–410, 58 Stat. 682
20-Dec-44	Federal-Aid Highway Act of 1944, Pub. L. 78–521, 58 Stat. 838
20-Feb-46	Employment Act of 1946, Pub. L. 79–304, 60 Stat. 23
15-Jul-49	Housing Act of 1949, Pub. L. 81–171, 63 Stat. 413
26-Oct-49	Fair Labor Standards Amendment, Pub. L. 81–393, 63 Stat. 910
25-Jun-52	Federal-Aid Highway Act of 1952, Pub. L. 82–413, 66 Stat. 158
3-Jul-53	Small Business Act, Pub. L. 83–163, Title II, 67 Stat. 232
2-Aug-54	Housing Act of 1954, Pub. L. 83–560, 68 Stat. 590 (including Federal National Mortgage Association Charter Act)
16-Aug-54	Federal Unemployment Tax Act, §1(d), 68A Stat. 439
29-Jun-56	Federal Aid Highway Act of 1956, (National Interstate and Defense Highways Act), Pub. L. 84–627, 70 Stat. 374
1-Aug-56	Social Security Amendments of 1956 (Social Security Disability Insurance), Pub. L. 84–880, 70 Stat. 807
12-Aug-58	Transportation Act of 1958, Pub. L. 85–625, 72 Stat. 568
14-Sep-59	Labor Management Reporting and Disclosure Act of 1959 (Landrum–Griffin Act), Pub. L. 86–257, 73 Stat. 519
6-May-60	Civil Rights Act of 1960, Pub. L. 86–449, 74 Stat. 86
5-Oct-61	Community Health Services and Facilities Act, Pub. L. 87–395, 75 Stat. 824
15-Mar-62	Manpower Development and Training Act, Pub. L. 87–415, 76 Stat. 23
11-Oct-62	Trade Expansion Act, Pub. L. 87–794, 76 Stat. 872
10-Jun-63	Equal Pay Act of 1963, Pub. L. 88–38, 77 Stat. 56

2-Jul-64	Civil Rights Act of 1964, Pub. L. 88–352, 78 Stat. 241
9-Jul-64	Urban Mass Transportation Act of 1964 (Federal Transit Act), Pub. L. 88–365, 78 Stat. 302
20-Aug-64	Economic Opportunity Act of 1964, Pub. L. 88–452, 78 Stat. 508
31-Aug-64	Food Stamp Act of 1964, Pub. L. 88–525, 78 Stat. 703
11-Apr-65	Elementary and Secondary Education Act, Pub. L. 89–10, 79 Stat. 77
30-Jul-65	Social Security Amendments of 1965, Pub. L. 89–97, 79 Stat. 286 (including Medicaid and Medicare)
6-Aug-65	Voting Rights Act of 1965, Pub. L. 89–110, 79 Stat. 437
10-Aug-65	Housing and Urban Development Act of 1965, Pub. L. 89–117, 79 Stat. 451
26-Aug-65	Public Works and Economic Development Act of 1965, Pub. L. 89–136, 79 Stat. 552
9-Sep-65	Department of Housing and Urban Development Act, Pub. L. 89–174, 79 Stat. 667
22-Oct-65	Highway Beautification Act, Pub. L. 89–285, 79 Stat. 1028
8-Nov-65	Higher Education Act of 1965, Pub. L. 89–329, 79 Stat. 1219
8-Nov-65	Vocational Rehabilitation Act Amendments Pub. L. 89–333, 79 Stat. 1282
11-Oct-66	Child Nutrition Act, Pub. L. 89–642, 80 Stat. 885
15-Oct-66	Department of Transportation Act, Pub. L. 89–670, 80 Stat. 931
3-Nov-66	Comprehensive Health, Planning and Service Act, Pub. L. 89–749, 80 Stat. 1180
3-Nov-66	Demonstration Cities and Metropolitan Development Act, Pub. L. 89–754, 80 Stat. 1255
29-Jun-67	Education Professions Development Act, Pub.L. 90-35
15-Dec-67	Age Discrimination in Employment Act of 1967, Pub. L. 90–202, 81 Stat. 602
11-Apr-68	Civil Rights Act of 1968, Pub. L. 90–284, 82 Stat. 73
19-Jun-68	Omnibus Crime Control and Safe Streets Act of 1968, Pub. L. 90–351, 82 Stat. 197
1-Aug-68	Housing and Urban Development Act of 1968, Pub. L. 90–448, 82 Stat. 476
23-Aug-68	Federal-Aid Highway Act of 1968, Pub. L. 90–495, 82 Stat. 815
30-Dec-69	Tax Reform Act of 1969, Pub. L. 91–172, 83 Stat. 487
15-Aug-70	Economic Stabilization Act of 1970, Pub. L. 91–379, Title II, 84 Stat. 799
15-Oct-70	Urban Mass Transportation Act of 1970, Pub. L. 91–453, 84 Stat. 962
27-Oct-70	Comprehensive Drug Abuse Prevention and Control Act of 1970, Pub. L. 91–513, 84 Stat. 1236
27-Oct-70	Controlled Substances Act, Pub. L. 91–513, Title II, 84 Stat. 1242
24-Dec-70	Family Planning Services and Population Research Act of 1970, Pub. L. 91–572
29-Dec-70	Occupational Safety and Health Act (OSHA), Pub. L. 91–596, 84 Stat. 1590
31-Dec-70	Clean Air Act Extension, Pub. L. 91–604, 84 Stat. 1676

31-Dec-70	Housing and Urban Development Act of 1970, Pub. L. 91–609, 84 Stat. 1770, including title VII, National Urban Policy and New Community Development Act of 1970, 84 Stat. 1791
24-Mar-72	Equal Employment Opportunity Act of 1972, Pub. L. 92–261, 86 Stat. 103
23-Jun-72	Education Amendments of 1972, Pub. L. 92–318, 86 Stat. 235
13-Aug-73	Federal-Aid Highway Act of 1973, Pub. L. 93–87, Title I, 87 Stat. 250
28-Dec-73	Comprehensive Employment and Training Act, Pub. L. 93–203, 87 Stat. 839
22-Aug-74	Housing and Community Development Act of 1974, Pub. L. 93–383, 88 Stat. 633
2-Sep-74	Employee Retirement Income Security Act of 1974 (ERISA), Pub. L. 93–406, 88 Stat. 829
7-Sep-74	Juvenile Justice and Delinquency Prevention Act, Pub. L. 93–415, 88 Stat. 1109
28-Oct-74	Equal Credit Opportunity Act, Pub. L. 93–495, Title V, 88 Stat. 1521
26-Nov-74	National Mass Transportation Assistance Act, Pub. L. 93–503, 88 Stat. 1565
4-Jan-75	Federal-Aid Highway Amendments of 1974, Pub. L. 93–643, 88 Stat. 2281
29-Nov-75	Education for All Handicapped Children Act, Pub. L. 94–142, 89 Stat. 773
22-Dec-75	Energy Policy and Conservation Act, Pub. L. 94–163, 89 Stat. 871
5-Feb-76	Railroad Revitalization and Regulatory Reform Act, Pub. L. 94–210, 90 Stat. 31
12-Oct-76	Overhaul of vocational education programs Pub. L. 94–482, 90 Stat. 2169
12-Oct-77	Community Reinvestment Act, Pub. L. 95–128, Title VIII, 91 Stat. 1147
18-Nov-77	Soil and Water Conservation Act, Pub. L. 95–192, 91 Stat. 1407
27-Dec-77	Clean Water Act of 1977, Pub. L. 95–217, 91 Stat. 1566
13-Oct-78	Civil Service Reform Act of 1978, Pub. L. 95–454, 92 Stat. 1111
13-Oct-78	Drug Abuse Prevention, Treatment, and Rehabilitation Act, Pub. L. 95–461, 92 Stat. 1268
26-Oct-78	Ethics in Government Act, Pub. L. 95–521, 92 Stat. 1824
27-Oct-78	Humphrey–Hawkins Full Employment Act, Pub. L. 95–523, 92 Stat. 1887
31-Oct-78	Pregnancy Discrimination Act, Pub. L. 95–555, 92 Stat. 2076
8-Nov-78	Indian Child Welfare Act, Pub. L. 95–608, 92 Stat. 3069
17-Oct-79	Department of Education Organization Act, Pub. L. 96–88, 93 Stat. 668
31-Mar-80	Depository Institutions Deregulation and Monetary Control Act, Pub. L. 96–221, 94 Stat. 132
13-Aug-81	Economic Recovery Tax Act of 1981 (ERTA or Kemp-Roth Tax Cut), Pub. L. 97–34, 95 Stat. 172
13-Oct-82	Job Training Partnership Act of 1982, Pub. L. 97–300, 96 Stat. 1322
24-Mar-83	Temporary Emergency Food Assistance Act of 1983, Pub. L. 98–8, Title II, 97 Stat. 35
20-Apr-83	Social Security Amendments of 1983, Pub. L. 98–21, 97 Stat. 65

12-Oct-84	Comprehensive Crime Control Act of 1984, Pub. L. 98–473, Title II, 98 Stat. 1976
19-Oct-84	Carl D. Perkins Vocational and Technical Education Act, Pub. L. 98–524, 98 Stat. 2435
23-Dec-85	Food Security Act of 1985, Pub. L. 99–198, 99 Stat. 1354
31-Oct-86	Age Discrimination in Employment Act of 1986, Pub. L. 99–572, 100 Stat. 3342
5-Feb-88	Housing and Community Development Act of 1987, Pub. L. 100–242, 101 Stat. 1815
22-Mar-88	Civil Rights Restoration Act of 1987, Pub. L. 100–259, 102 Stat. 28
4-Aug-88	Worker Adjustment and Retraining Notification Act of 1988, Pub. L. 100–379, 102 Stat. 890
18-Nov-88	Anti-Drug Abuse Act of 1988, Pub. L. 100–690, 102 Stat. 4181, (including Child Protection and Obscenity Enforcement Act, Alcoholic Beverage Labeling Act)
26-Jul-90	Americans with Disabilities Act of 1990, Pub. L. 101–336, 104 Stat. 327
21-Nov-91	Civil Rights Act of 1991, Pub. L. 102–166, 105 Stat. 1071
28-Oct-92	Housing and Community Development Act of 1992, Pub. L. 102–550, 106 Stat. 3672
5-Feb-93	Family and Medical Leave Act of 1993, Pub. L. 103–3, 107 Stat. 6
13-Sep-94	Violent Crime Control and Law Enforcement Act, Pub. L. 103–322, 108 Stat. 1796 (including the Violence Against Women Act)
20-Oct-94	Improving America's Schools Act of 1994, Pub. L. 103–382, 108 Stat. 3518
28-Nov-95	National Highway System Designation Act of 1995, Pub. L. 104–59 (text) (PDF), 109 Stat. 568
20-Aug-96	Small Business Job Protection Act of 1996, Pub. L. 104–188 (text) (PDF), 110 Stat. 1755
21-Aug-96	Health Insurance Portability and Accountability Act (HIPAA), Pub. L. 104–191 (text) (PDF), 110 Stat. 1936
22-Aug-96	Personal Responsibility and Work Opportunity Act (Welfare Reform Act), Pub. L. 104–193 (text) (PDF), 110 Stat. 2105
9-Jun-98	Transportation Equity Act for the 21st Century, Pub. L. 105–178 (text) (PDF), 112 Stat. 107
7-Aug-98	Workforce Investment Act of 1998, Pub. L. 105–220 (text) (PDF), 112 Stat. 936
21-Aug-96	Health Insurance Portability and Accountability Act (HIPAA), Pub. L. 104–191 (text) (PDF), 110 Stat. 1936
22-Aug-96	Personal Responsibility and Work Opportunity Act (Welfare Reform Act), Pub. L. 104–193 (text) (PDF), 110 Stat. 2105
9-Jun-98	Transportation Equity Act for the 21st Century, Pub. L. 105–178 (text) (PDF), 112 Stat. 107
7-Aug-98	Workforce Investment Act of 1998, Pub. L. 105–220 (text) (PDF), 112 Stat. 936
7-Jun-01	Economic Growth and Tax Relief Reconciliation Act of 2001, Pub. L. 107–16 (text) (PDF), 115 Stat. 38
8-Jan-02	No Child Left Behind Act, Pub. L. 107–110 (text) (PDF), 115 Stat. 1425
11-Jan-02	Small Business Liability Relief and Brownfields Revitalization Act, Pub. L. 107–118 (text) (PDF), 115 Stat. 2356
9-Mar-02	Job Creation and Worker Assistance Act of 2002, Pub. L. 107–147 (text) (PDF), 116 Stat. 21

13-May-02	Farm Security and Rural Investment Act of 2002, Pub. L. 107–171 (text) (PDF), 116 Stat. 134
28-May-03	Jobs and Growth Tax Relief Reconciliation Act of 2003, Pub. L. 108–27 (text) (PDF), 117 Stat. 752
8-Dec-03	Medicare Prescription Drug, Improvement, and Modernization Act, Pub. L. 108–173 (text) (PDF), 117 Stat. 2066
10-Aug-05	Transportation Equity Act of 2005, Pub. L. 109–59 (text) (PDF), 119 Stat. 1144
13-Feb-08	Economic Stimulus Act of 2008, Pub. L. 110–185 (text) (PDF), 122 Stat. 613
30-Jul-08	Housing and Economic Recovery Act of 2008, Pub. L. 110–289 (text) (PDF), 122 Stat. 2654
3-Oct-08	Emergency Economic Stabilization Act of 2008, Pub. L. 110–343 (text) (PDF), 122 Stat. 3765
29-Jan-09	Lilly Ledbetter Fair Pay Act of 2009, Pub. L. 111–2 (text) (PDF), 123 Stat. 5
4-Feb-09	Children's Health Insurance Program Reauthorization Act (SCHIP), Pub. L. 111–3 (text) (PDF), 123 Stat. 8
17-Feb-09	American Recovery and Reinvestment Act of 2009 (ARRA), Pub. L. 111–5 (text) (PDF), 123 Stat. 115
20-May-09	Helping Families Save Their Homes Act of 2009, Pub. L. 111–22 (text) (PDF), 123 Stat. 1632
6-Nov-09	Worker, Homeownership, and Business Assistance Act of 2009, Pub. L. 111–92 (text) (PDF), 123 Stat. 2984
18-Mar-10	Hiring Incentives to Restore Employment Act, Pub. L. 111–147 (text) (PDF), 124 Stat. 71
23-Mar-10	Patient Protection and Affordable Care Act, Pub. L. 111–148 (text) (PDF), 124 Stat. 119
30-Mar-10	Health Care and Education Reconciliation Act of 2010, including the Student Aid and Fiscal Responsibility Act, Pub. L. 111–152 (text) (PDF), 124 Stat. 1029
27-Sep-10	Small Business Jobs Act of 2010, Pub. L. 111–240 (text) (PDF), 124 Stat. 2504
13-Dec-10	Healthy, Hunger-Free Kids Act of 2010, Pub. L. 111–296 (text) (PDF), 124 Stat. 3183
17-Dec-10	Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010, Pub. L. 111–312 (text) (PDF), 124 Stat. 3296
22-Feb-12	Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. 112–96 (text) (PDF), 126 Stat. 156
5-Apr-12	Jumpstart Our Business Startups Act (JOBS Act), Pub. L. 112–106 (text) (PDF), 126 Stat. 306
6-Jul-12	Moving Ahead for Progress in the 21st Century Act (MAP-21 Act), Pub. L. 112–141 (text) (PDF), 126 Stat. 405
2-Jan-13	American Taxpayer Relief Act of 2012, Pub. L. 112–240 (text) (PDF), 126 Stat. 2313
9-Aug-13	Bipartisan Student Loan Certainty Act of 2013, Pub. L. 113–28 (text) (PDF), 127 Stat. 506
21-Mar-14	Homeowner Flood Insurance Affordability Act of 2014, Pub. L. 113–89 (text) (PDF), 128 Stat. 1020
23-Jul-14	Workforce Innovation and Opportunity Act, Pub. L. 113–128 (text) (PDF), 128 Stat. 1425
16-Apr-15	Medicare Access and CHIP Reauthorization Act of 2015, Pub. L. 114–10 (text) (PDF)

4-Dec-15	Fixing America's Surface Transportation (FAST) Act, Pub. L. 114–94 (text) (PDF)
10-Dec-15	Every Student Succeeds Act, Pub. L. 114–95 (text) (PDF)
20-Jul-16	Global Food Security Act of 2016, Pub. L. 114–195 (text) (PDF)
22-Dec-17	Tax Cuts and Jobs Act of 2017, Pub. L. 115–97 (text) (PDF)
24-May-18	Economic Growth, Regulatory Relief and Consumer Protection Act, Pub. L. 115–174 (text) (PDF)
16-Jan-19	Government Employee Fair Treatment Act of 2019, Pub. L. 116–1 (text) (PDF)
27-Mar-20	CARES Act (Coronavirus Aid, Relief, and Economic Security Act), Pub. L. 116–136 (text) (PDF)
24-Apr-20	Paycheck Protection Program and Health Care Enhancement Act, Pub. L. 116–139 (text) (PDF)
11-Mar-21	American Rescue Plan Act of 2021, Pub. L. 117–2 (text) (PDF)
15-Nov-21	Infrastructure Investment and Jobs Act, Pub. L. 117–58 (text) (PDF)

Appendix B: Data File

Name: DatasetDefinitionandDataTables_6.20.2023_Primary_Data_Table

File Type: Microsoft Excel Comma Separated Values

Size: 316 KB

Required Application Software: Microsoft Excel

Appendix C: R Program File

Name: Regression-Analysis-and-MOO-Model-v5-LAGGED-DATA-JW

File Type: RMD

Size: 138 KB

Required Application Software: R Studio

Appendix D: Bivariate Plots

Figure B.1

Wage Gap by Year Group 1

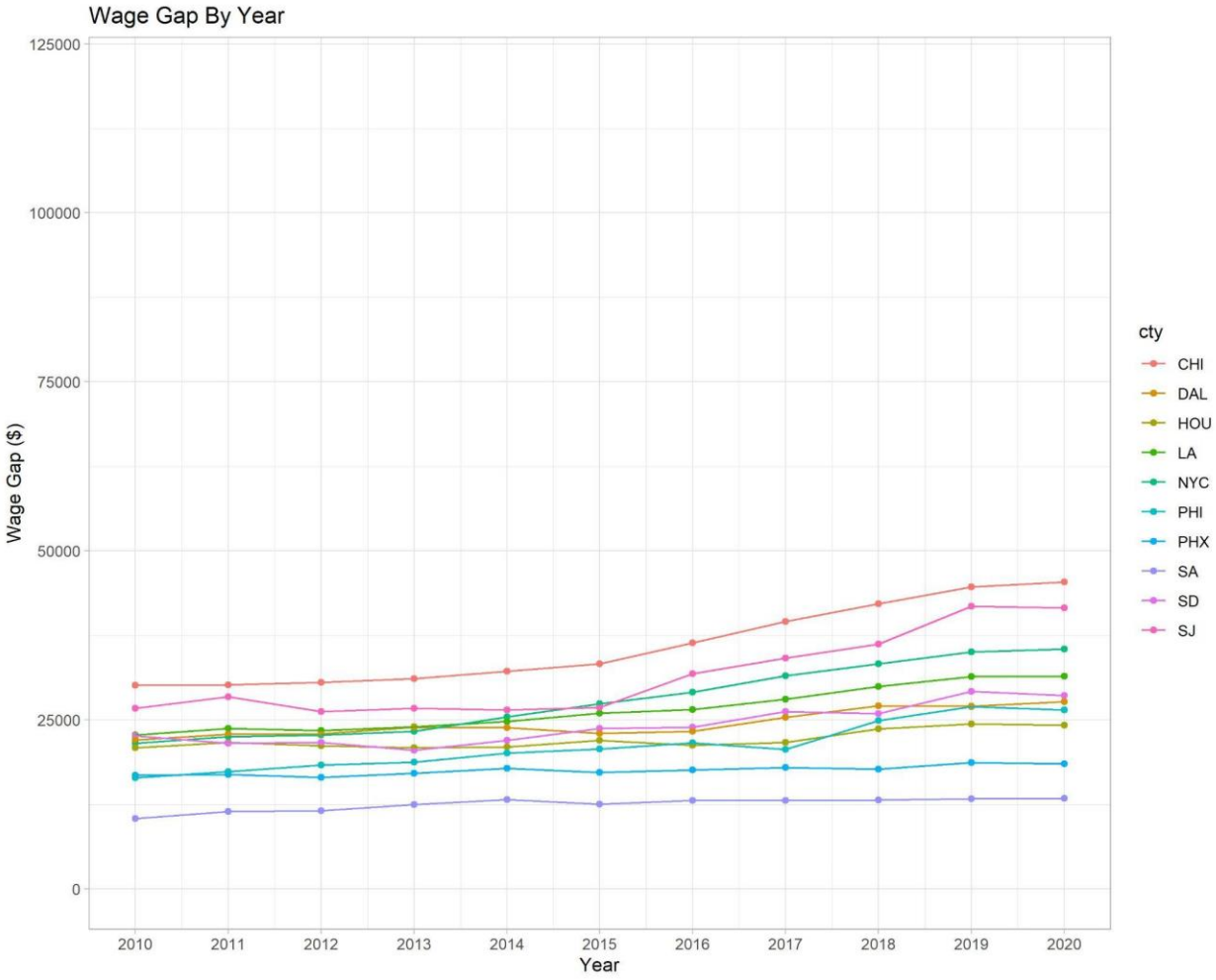


Figure B.2

Wage Gap by Year Group 2

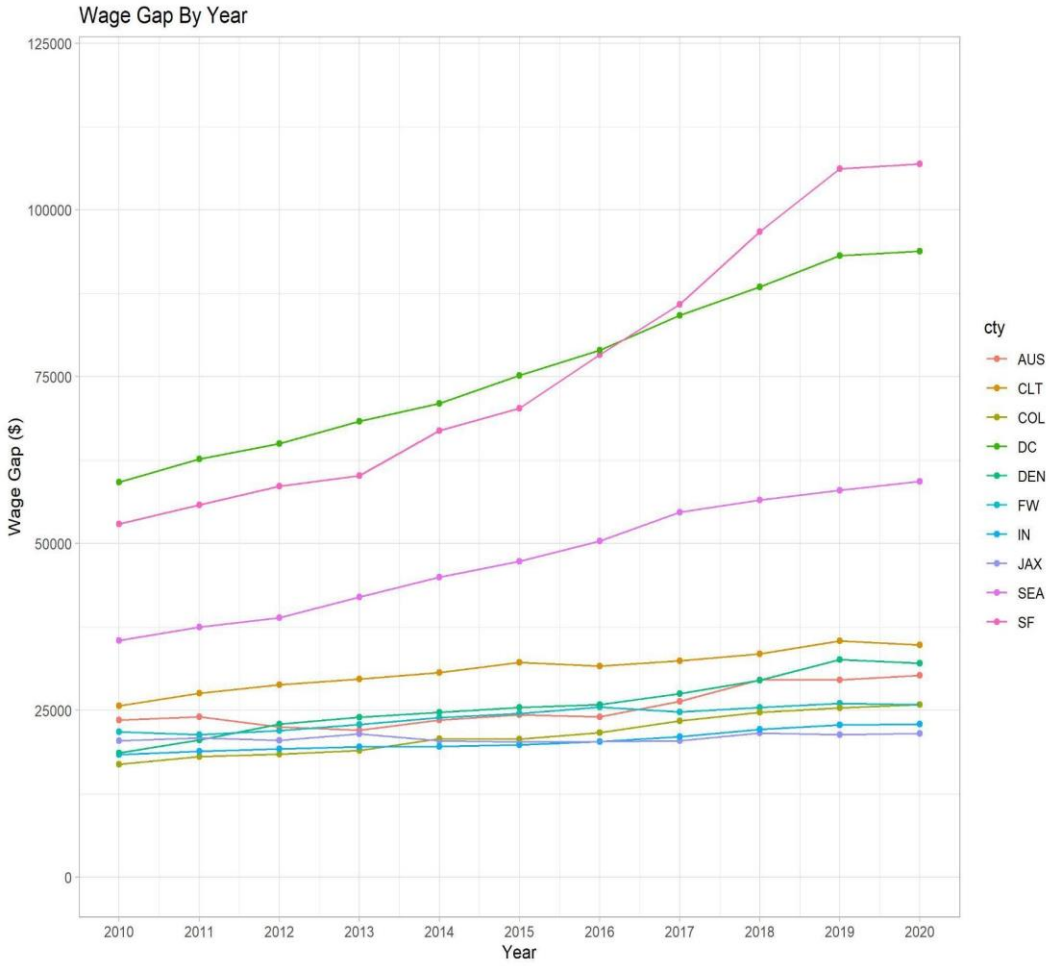


Figure B.3

Wage Gap by Year Group 3

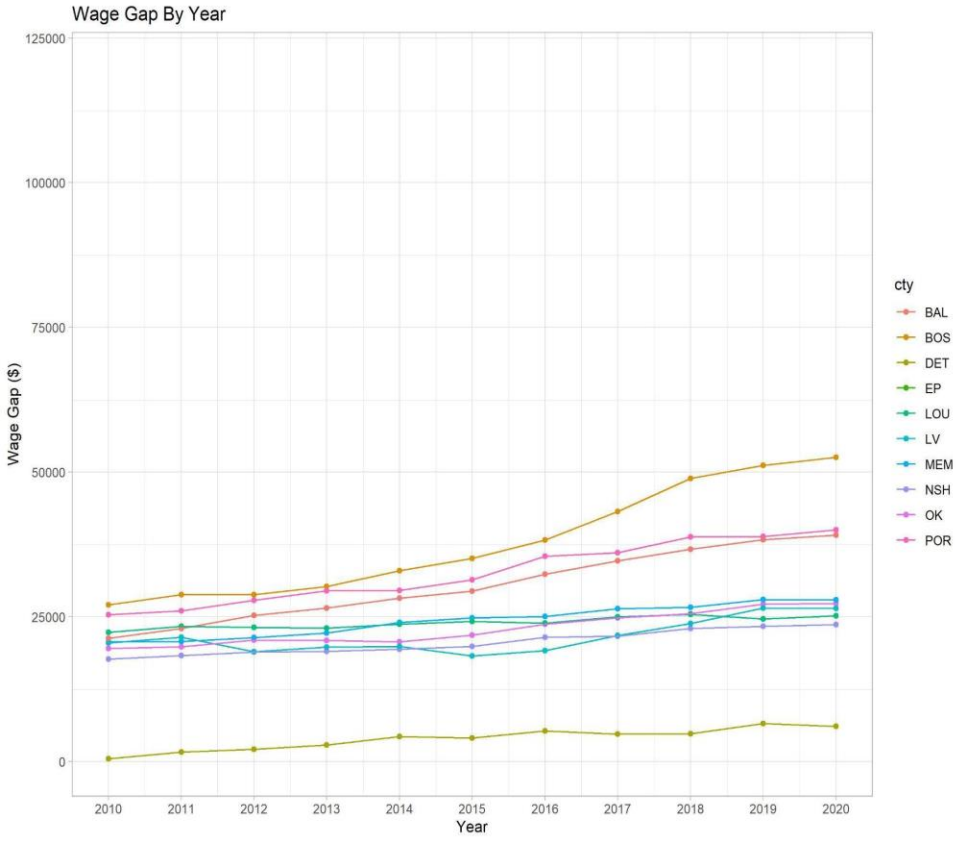


Figure B.4

Wage Gap by Year Group 4

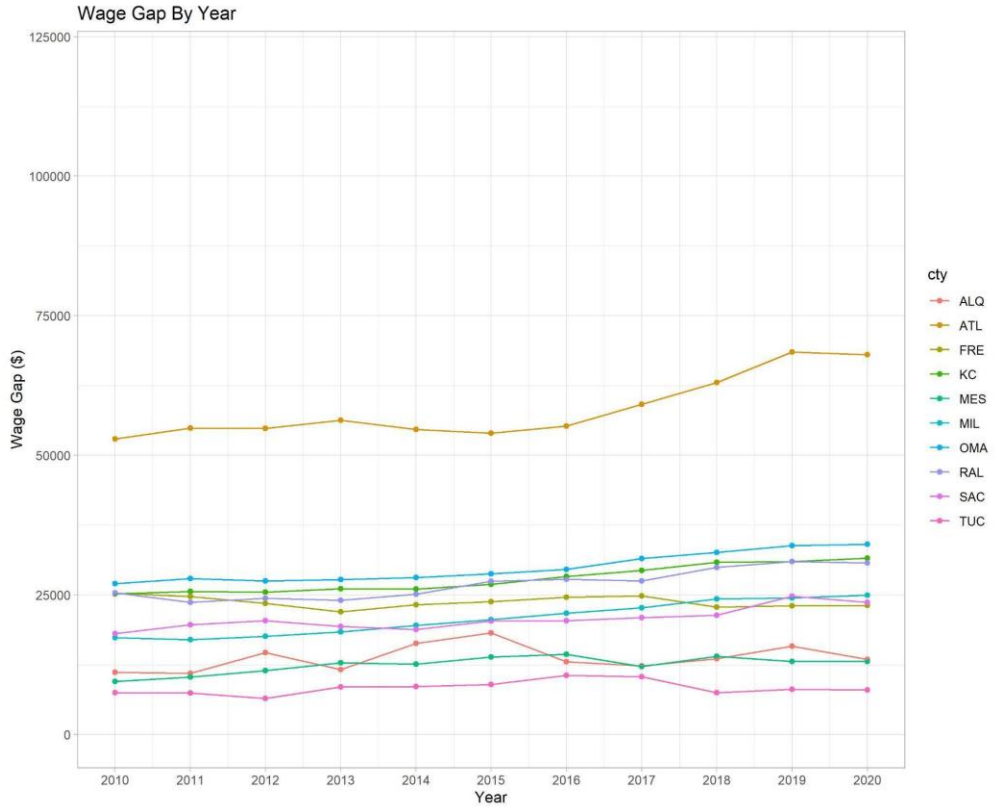


Figure B.5

Wage Gap by Year Group 5

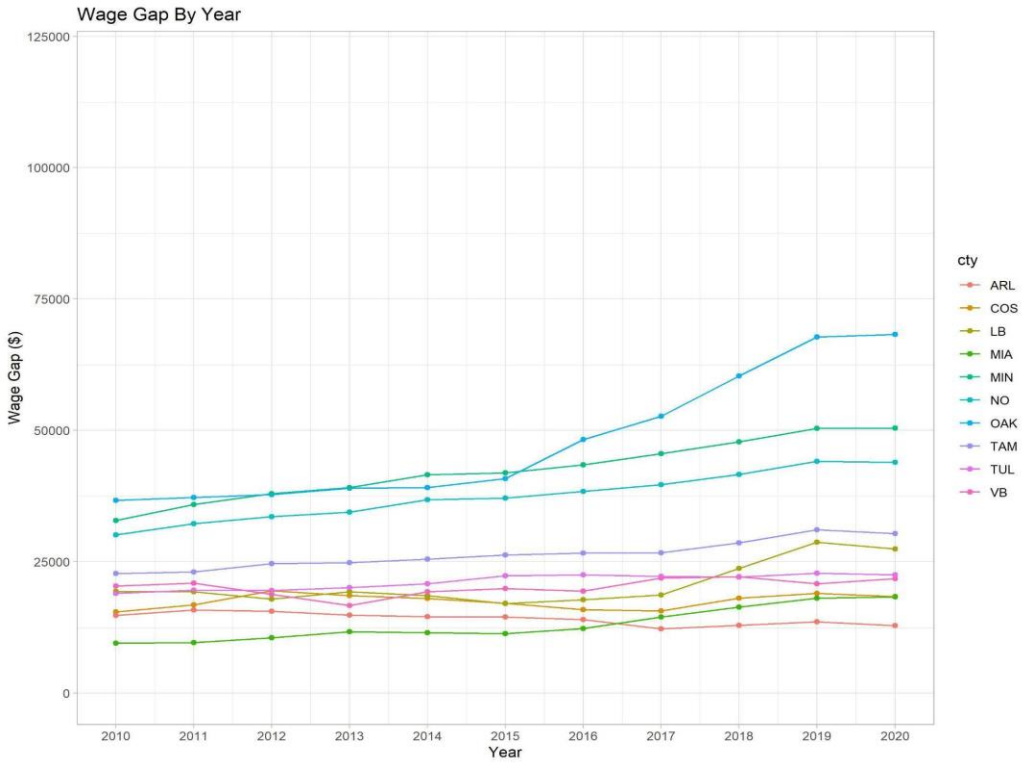


Figure B.6

Federal Aid by Year Group 1

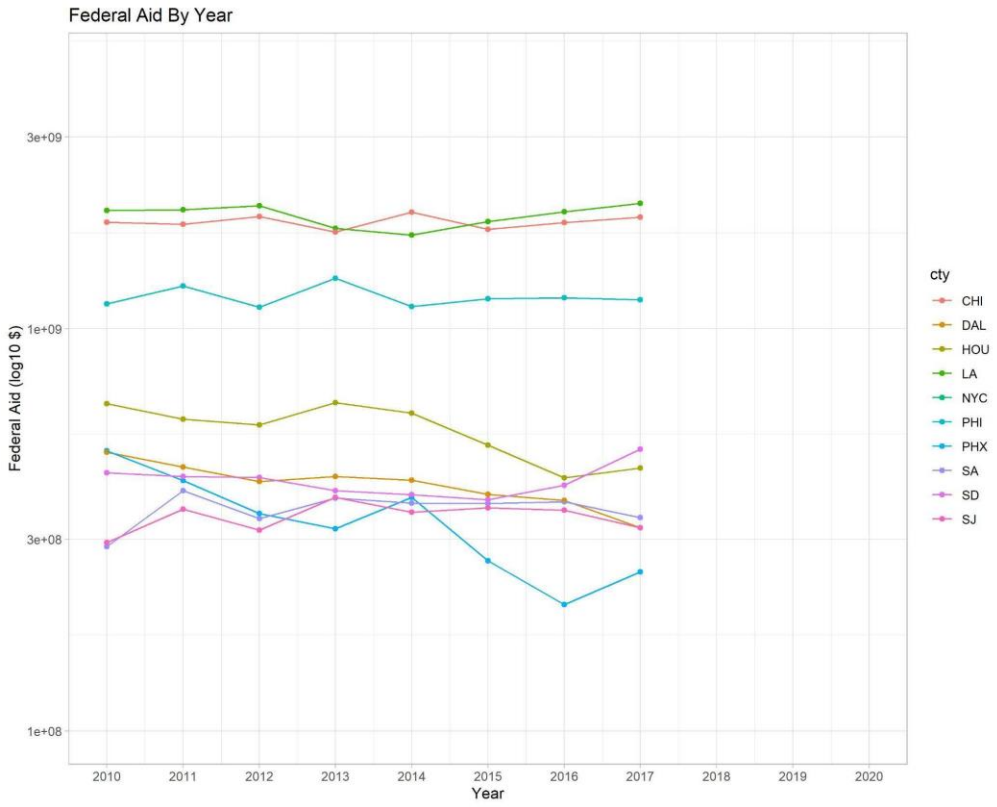


Figure B.7

Federal Aid by Year Group 2

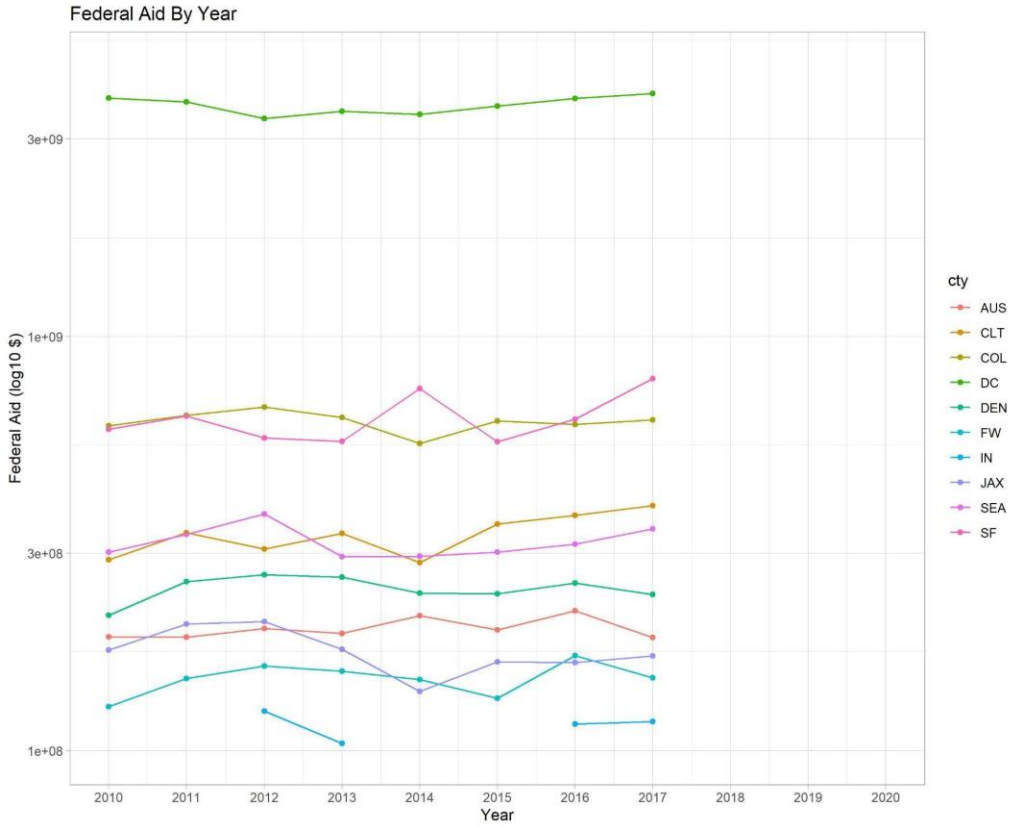


Figure B.8

Federal Aid by Year Group 3

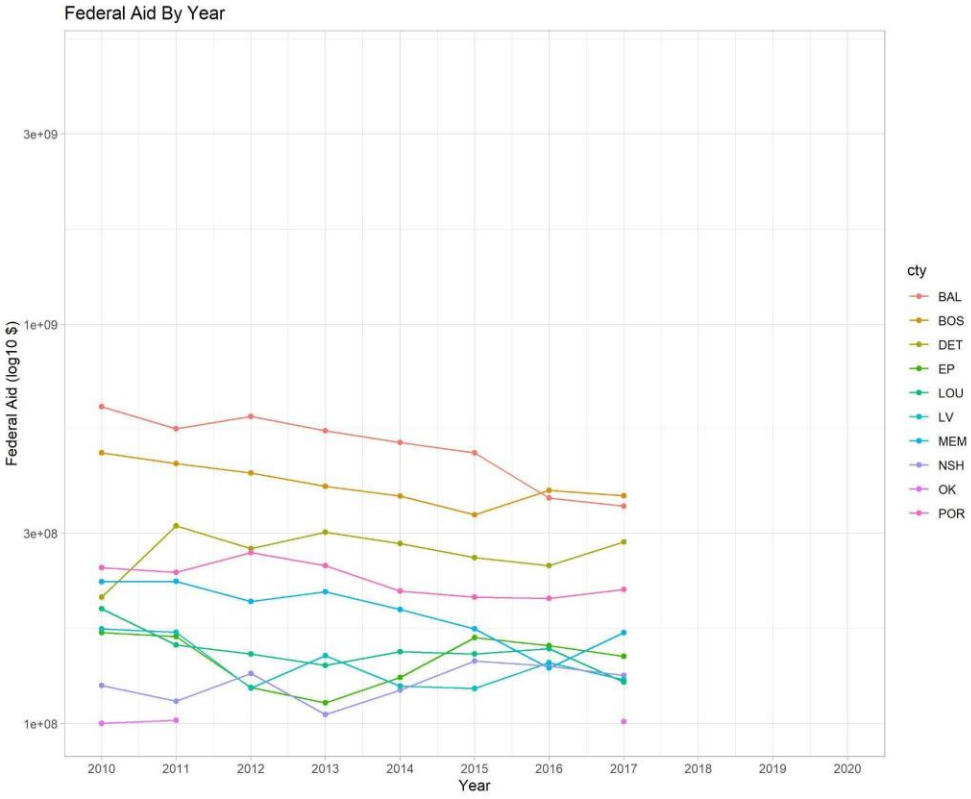


Figure B.9

Federal Aid by Year Group 4

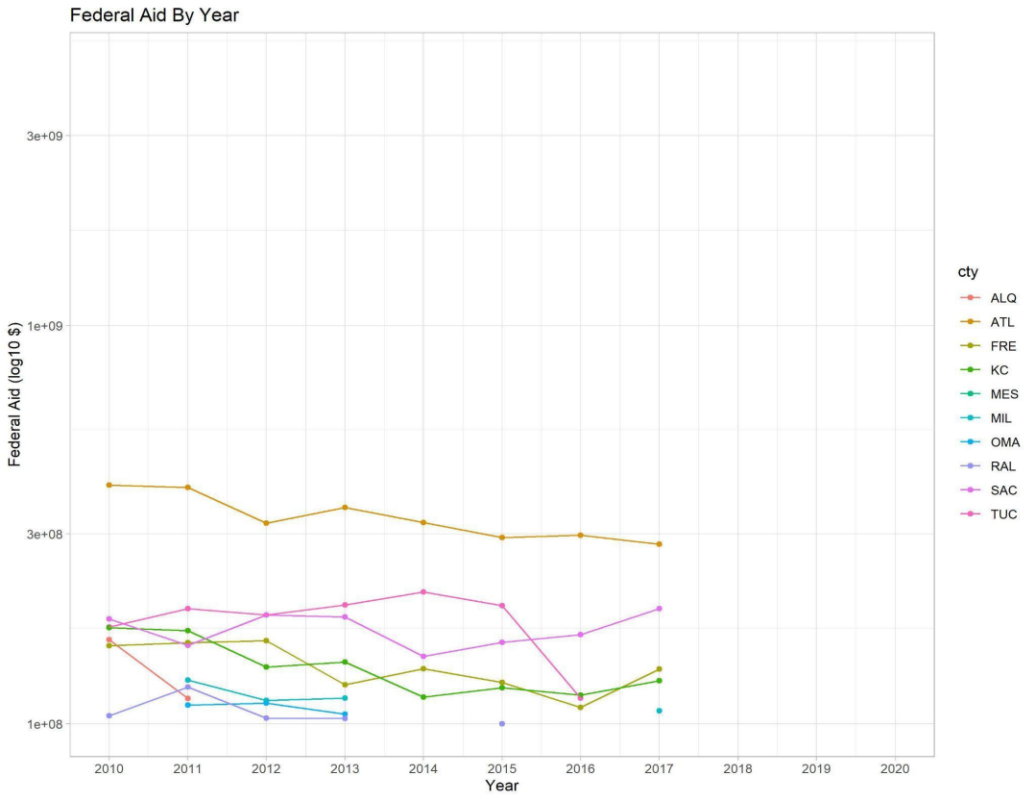


Figure B.10

Federal Aid by Year Group 5

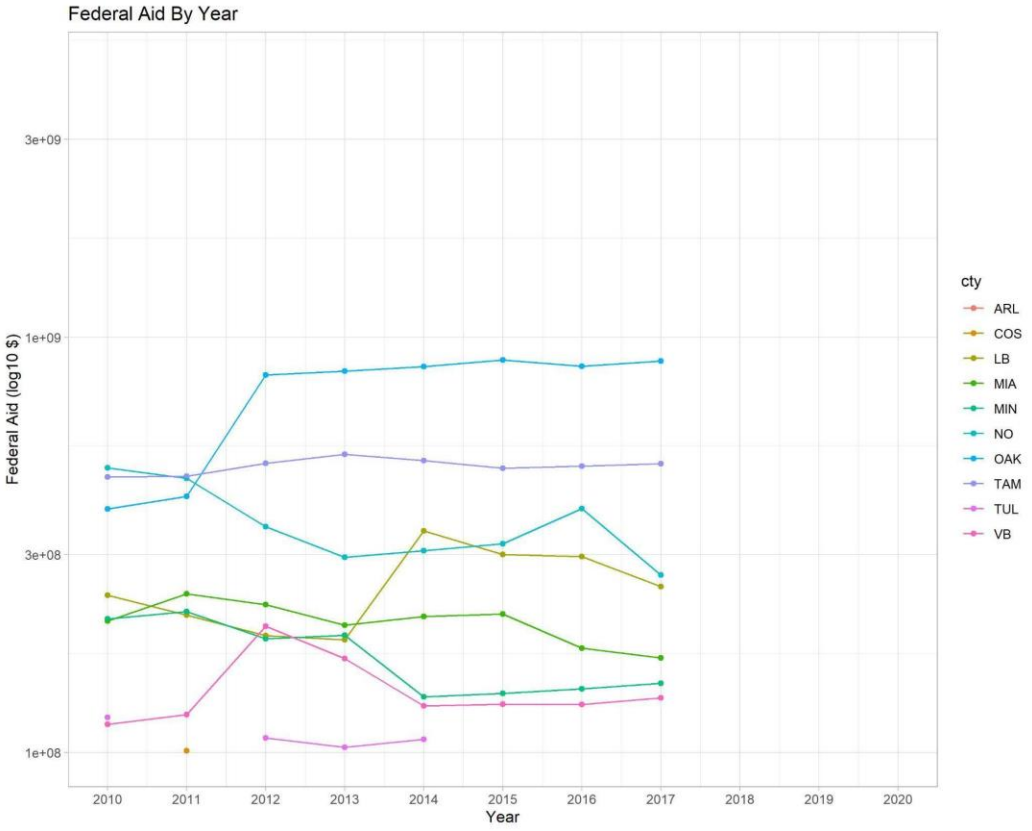


Figure B.11

Federal Aid by Wage Gap Group

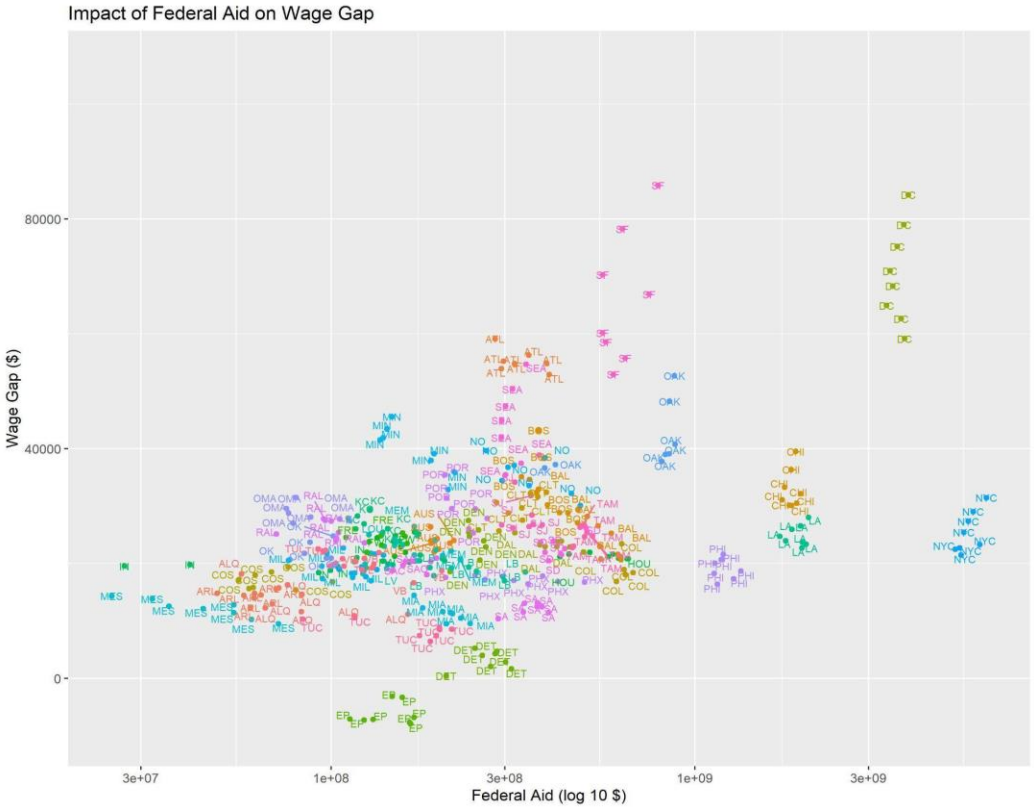


Figure B.12

State Aid by Year Group 1

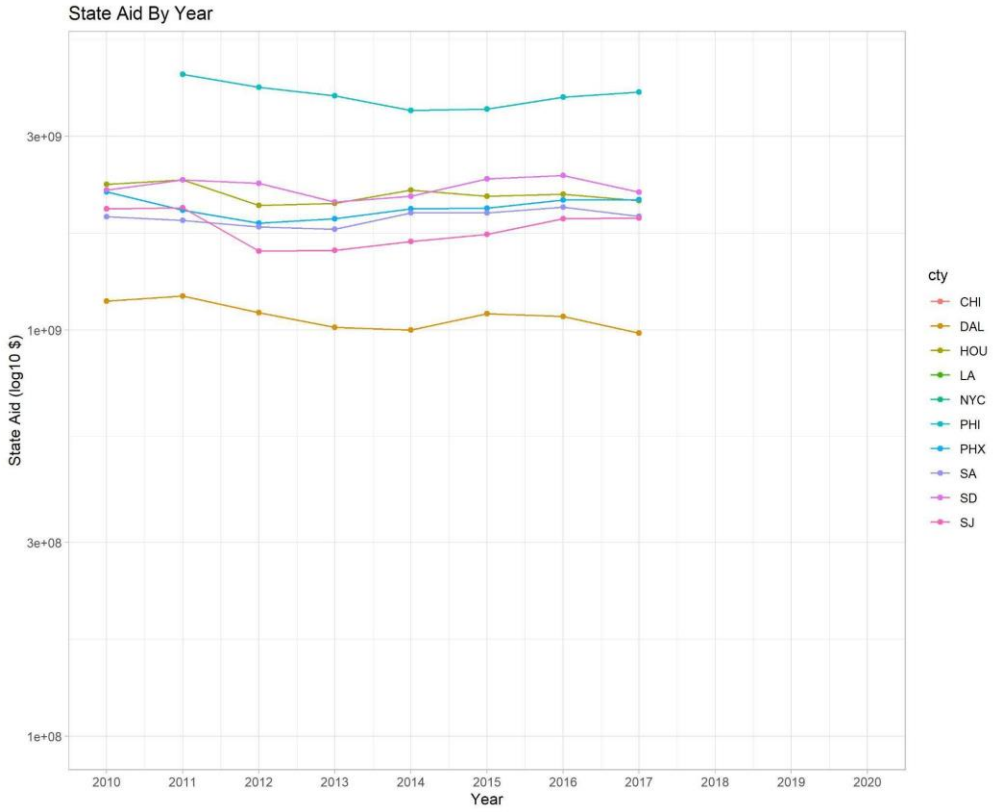


Figure B.13

State Aid by Year Group 2

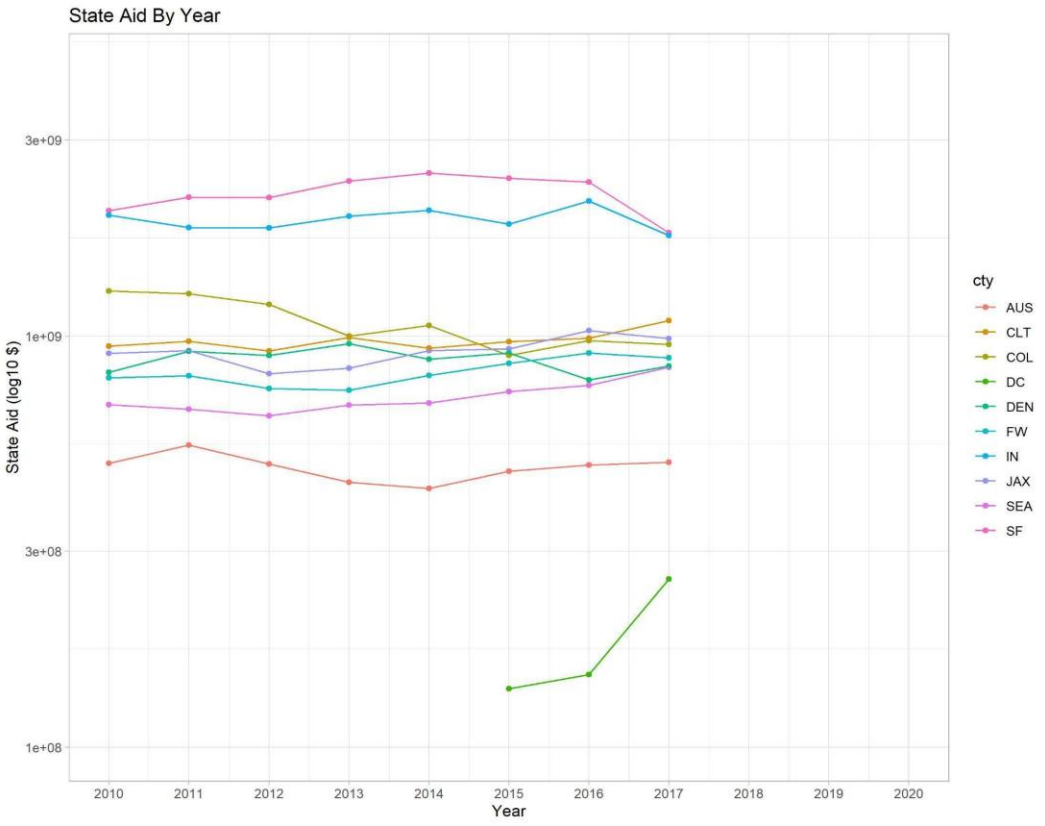


Figure B.14

State Aid by Year Group 3

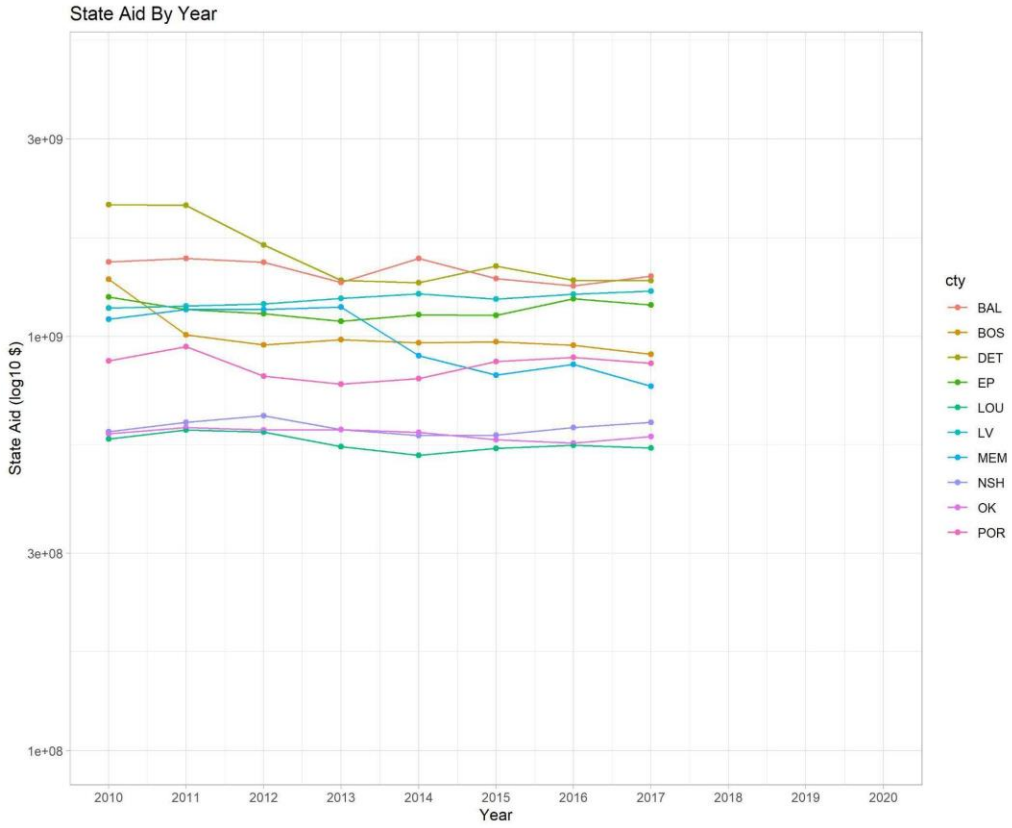


Figure B.15

State Aid by Year Group 4

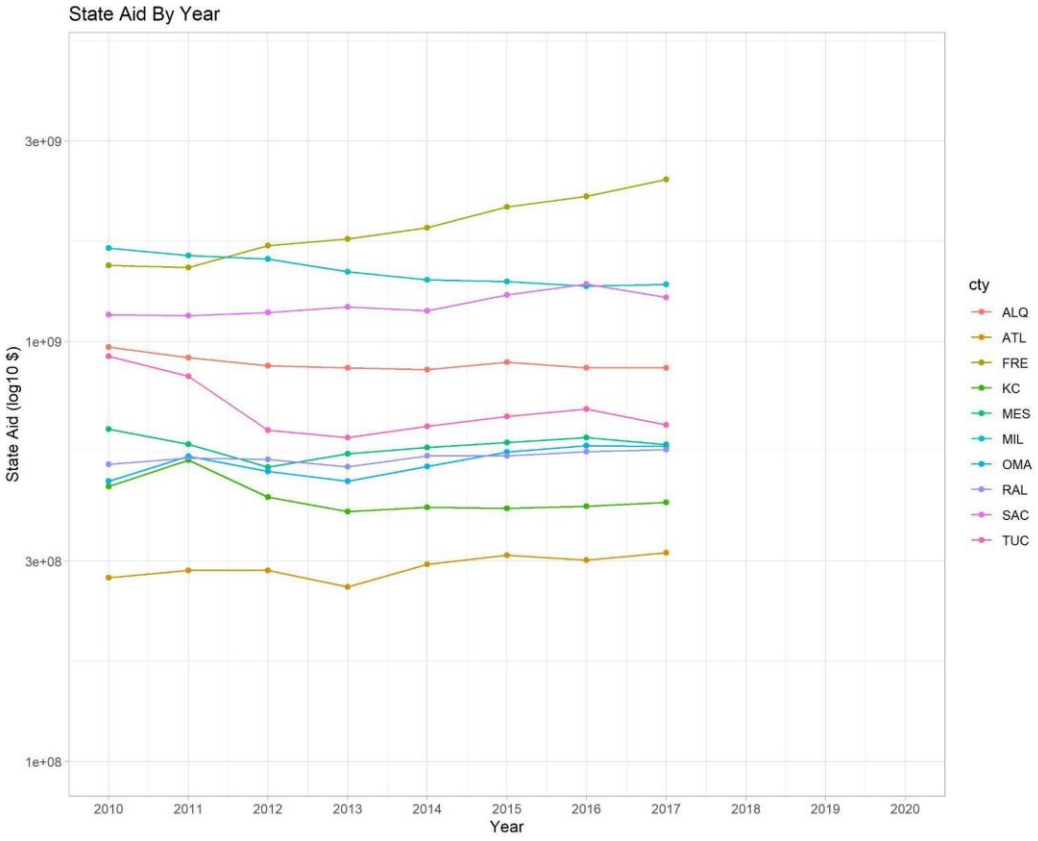


Figure B.16

State Aid by Year Group 5

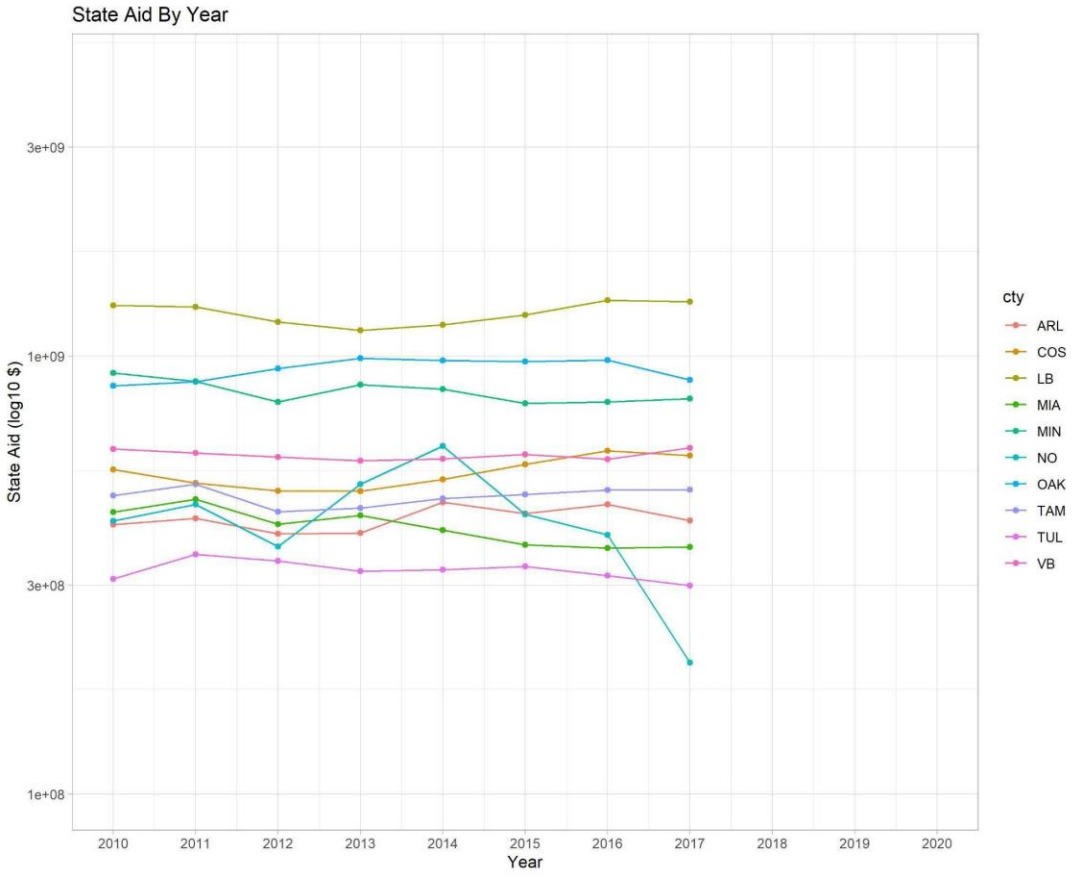


Figure B.17

State Aid by Wage Gap

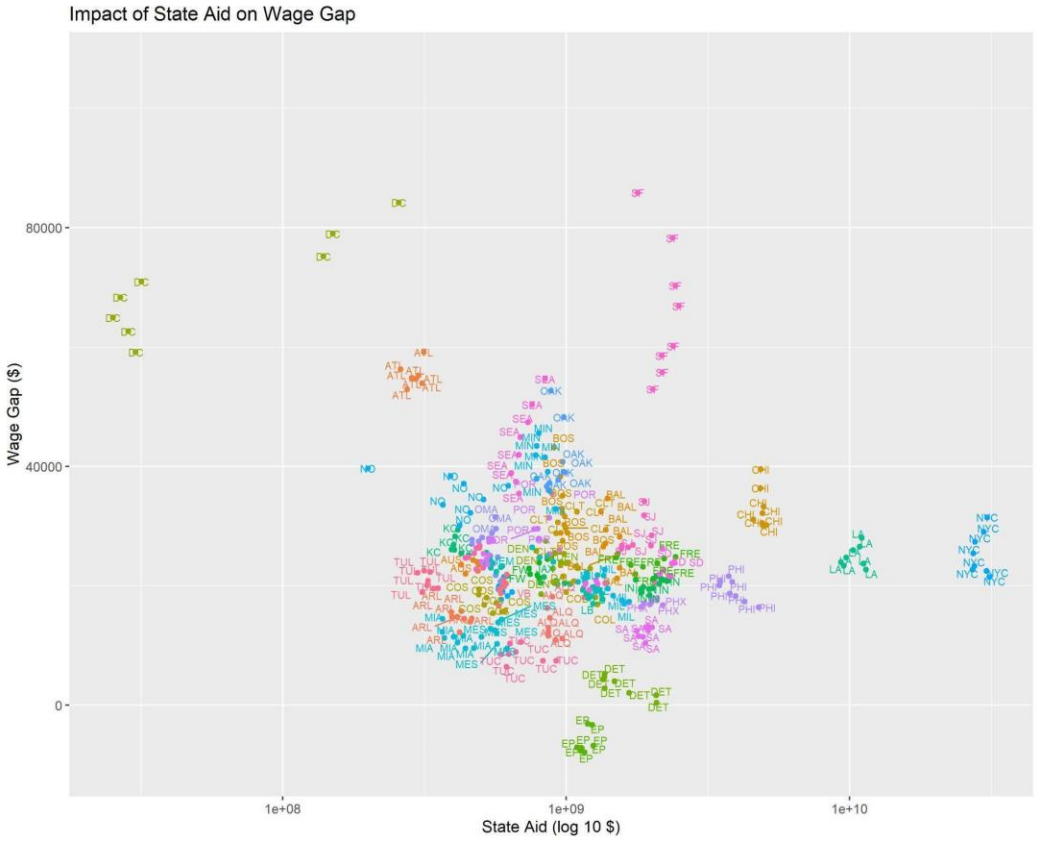


Figure B.18

Cash Assistance vs Wage Gap

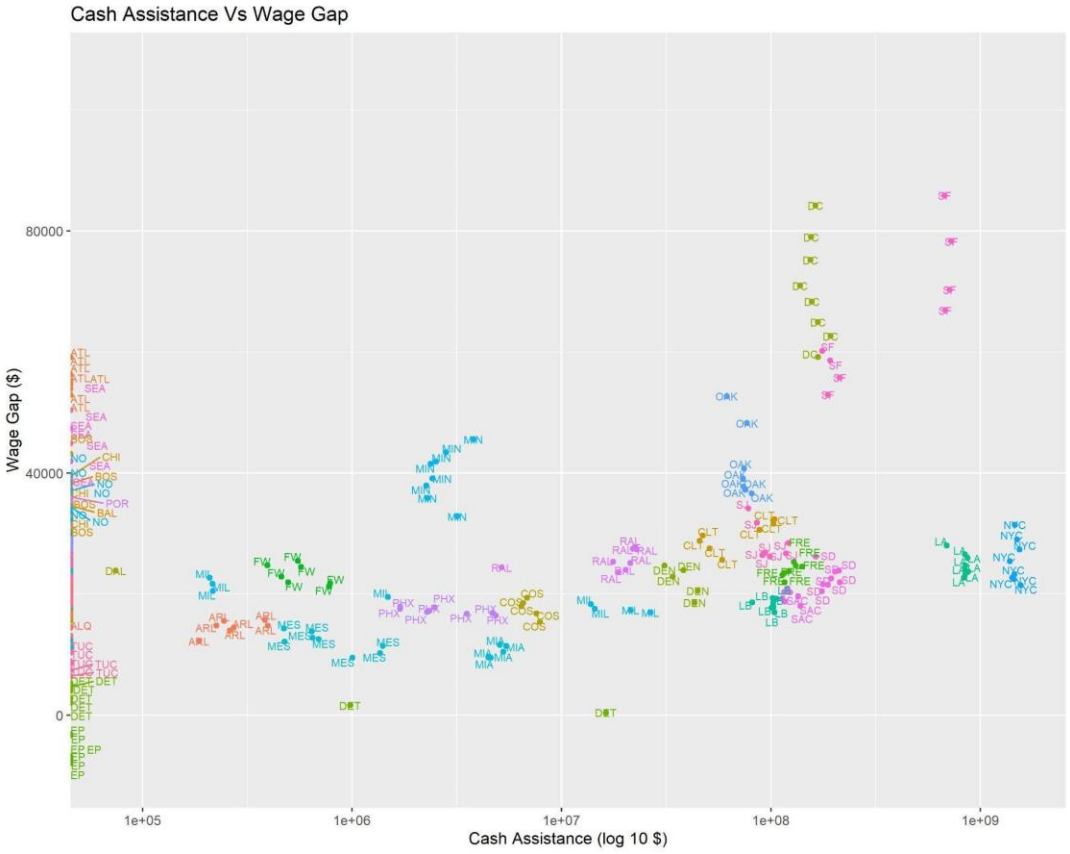


Figure B.19

Elementary and Secondary Education vs Wage Gap

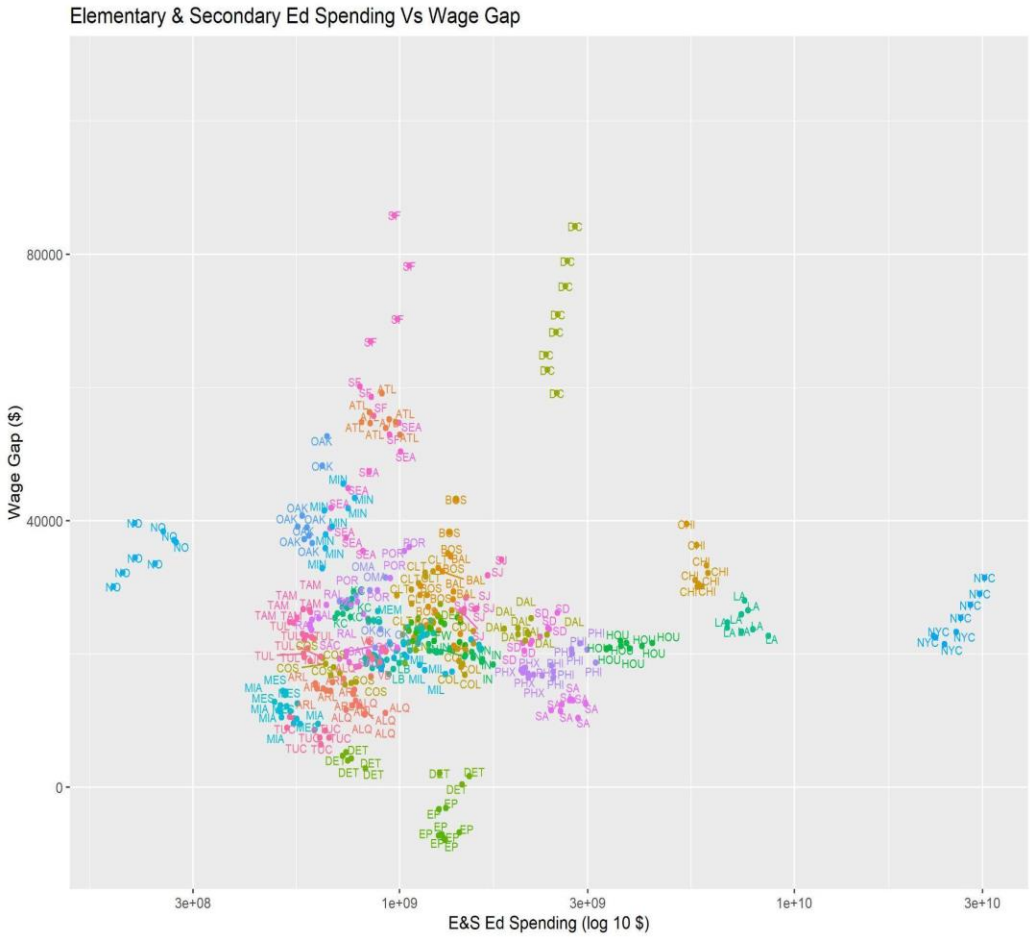


Figure B.20

Higher Education vs Wage Gap

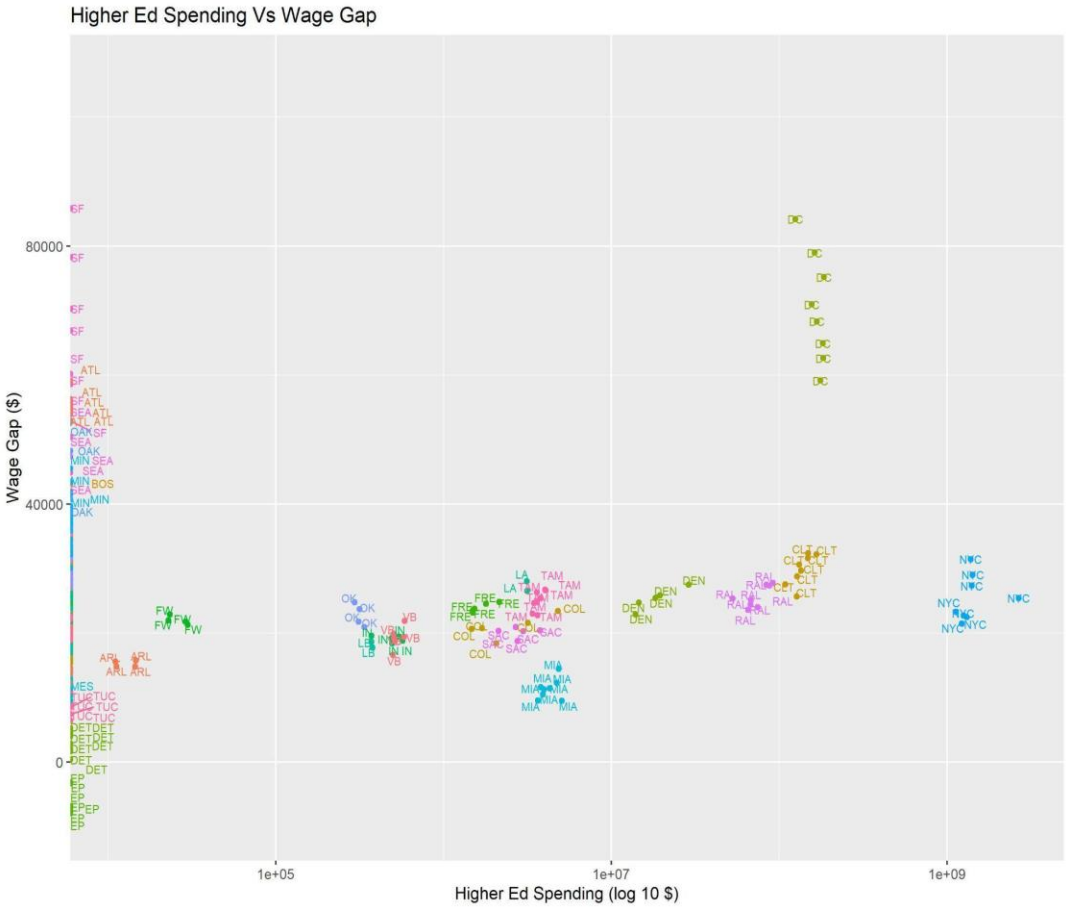


Figure B.21

Housing and Community Development vs Wage Gap

Figure B.22

Local Authority vs Wage Gap

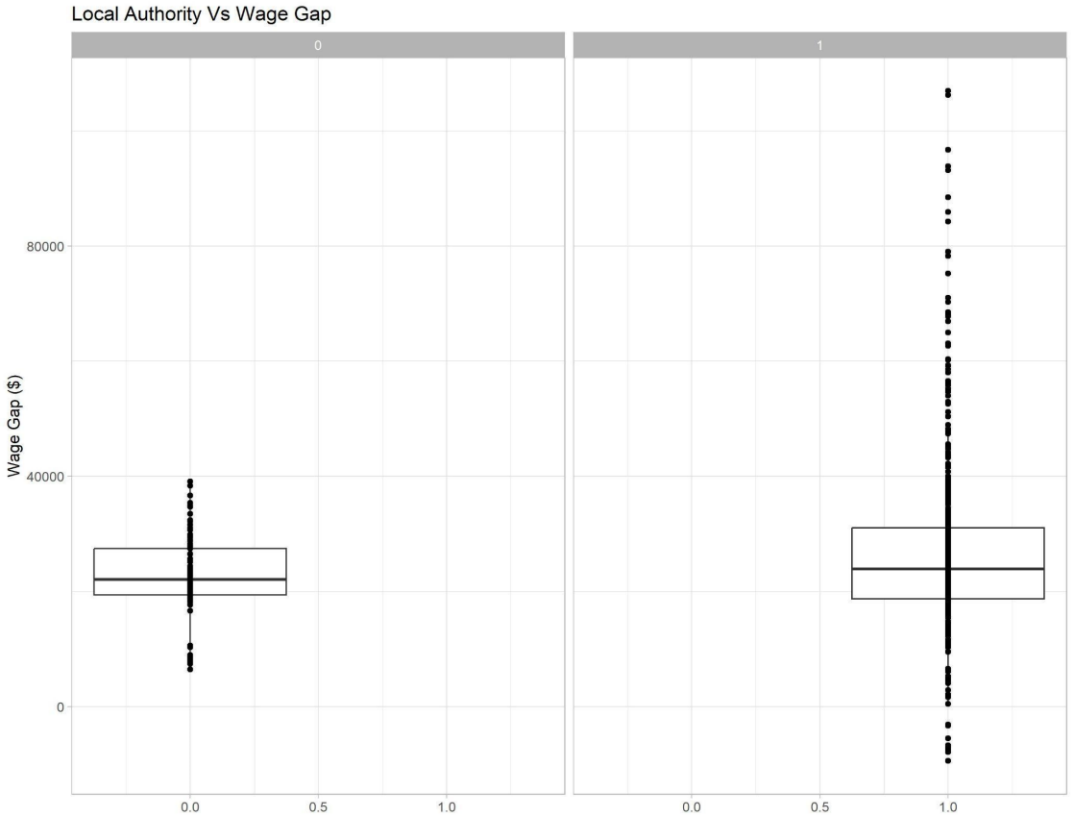


Figure B.23

Libraries Spending vs Wage Gap

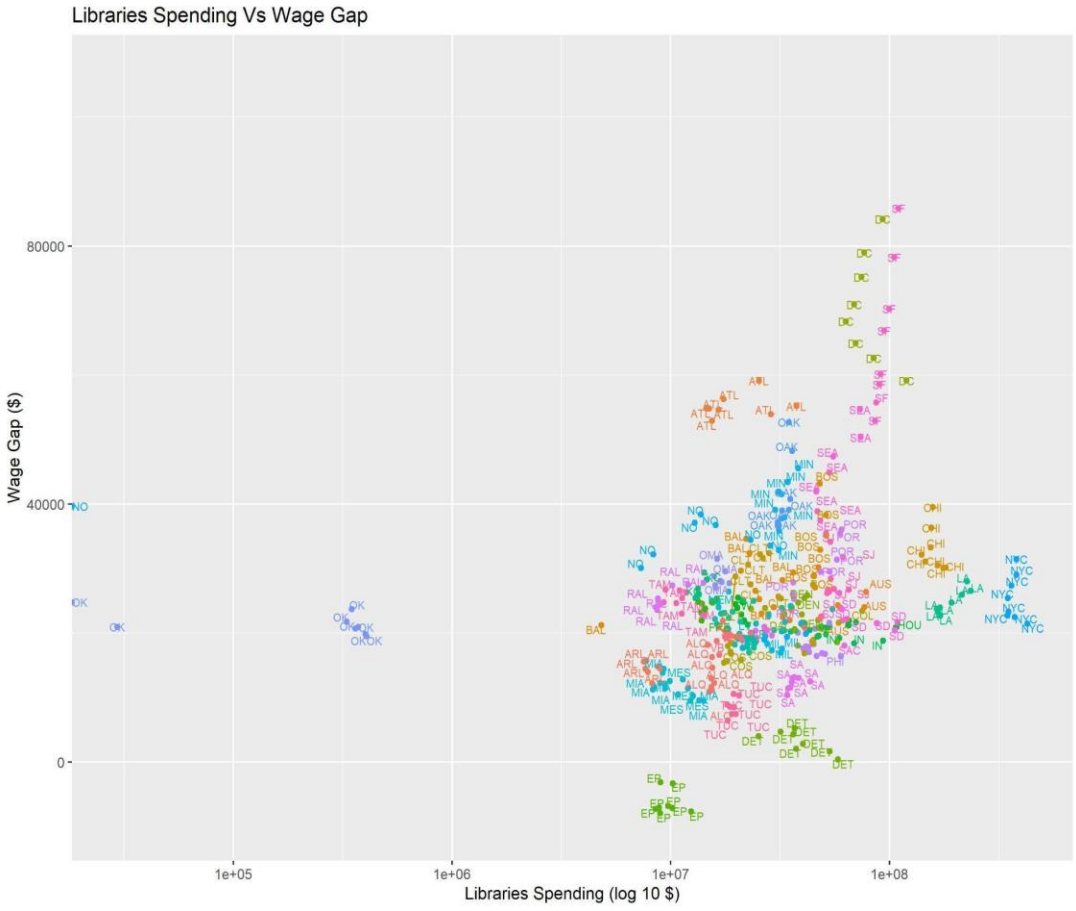


Figure B.24

Other Public Welfare Spending vs Wage Gap

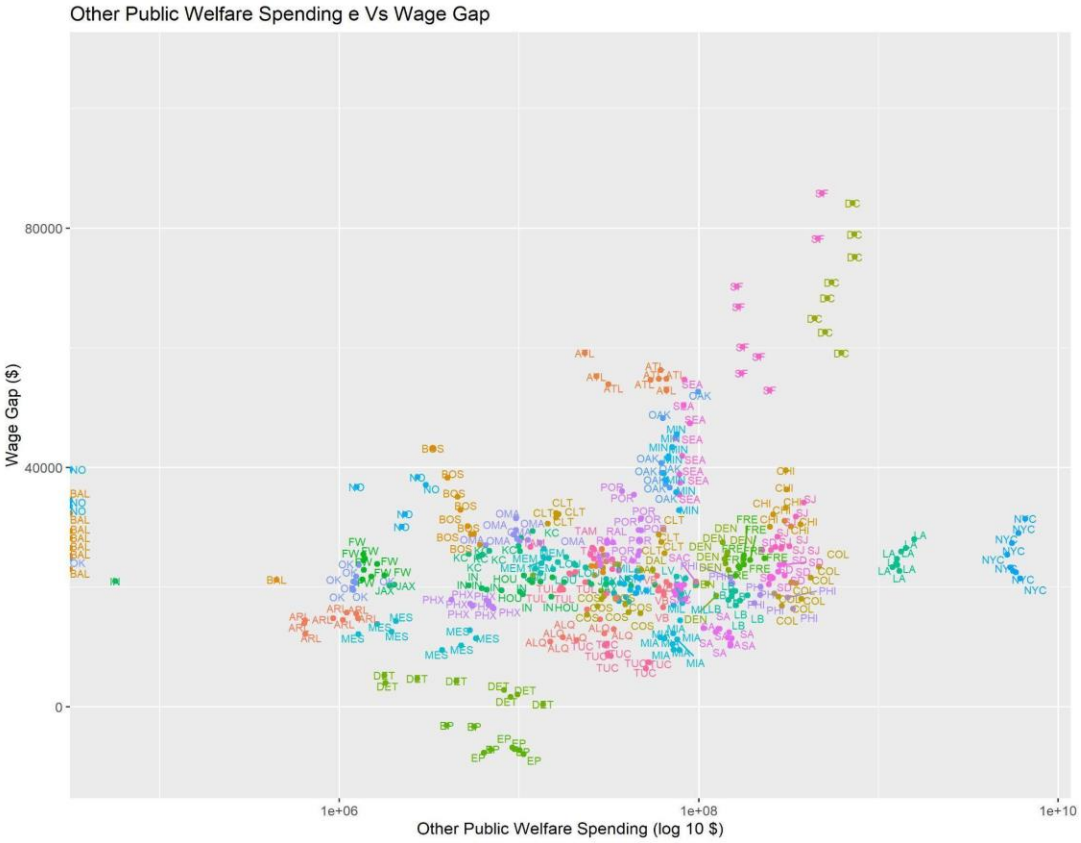


Figure B.25

Consolidation vs Wage Gap

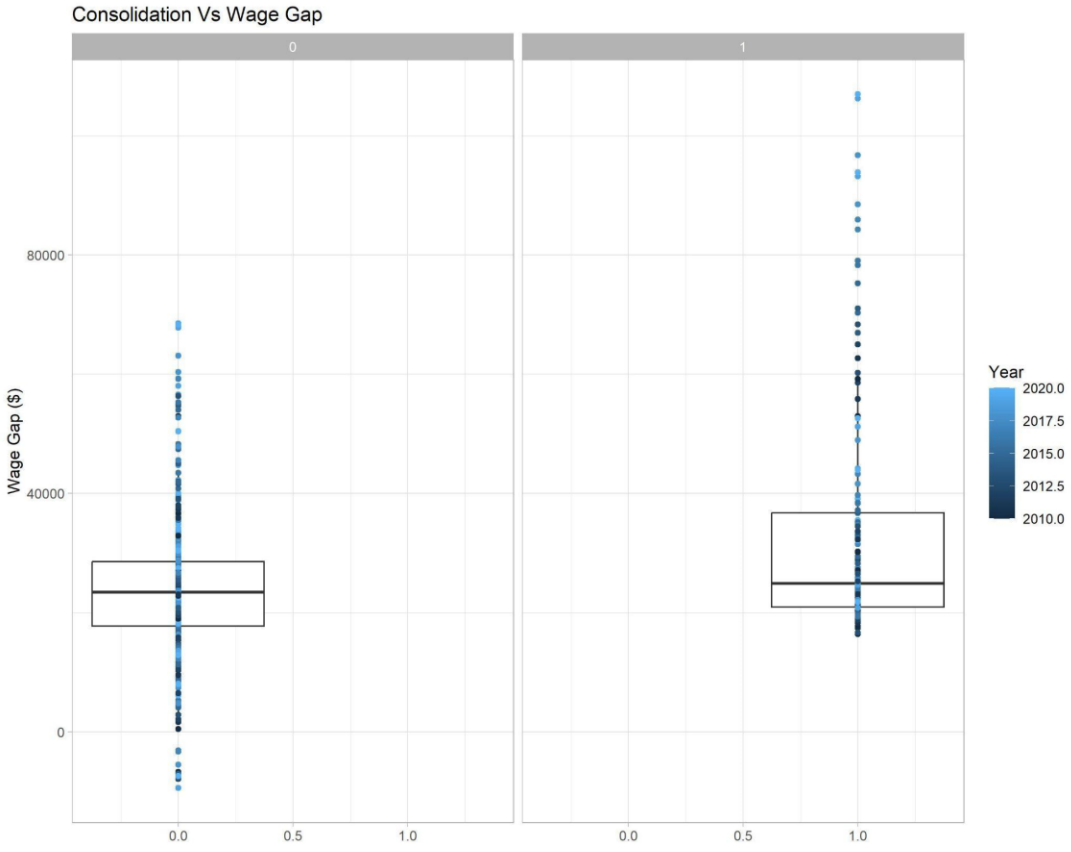


Figure B.26

Black Population vs Wage Gap

Figure B.27

Degree of Segregation vs Wage Gap

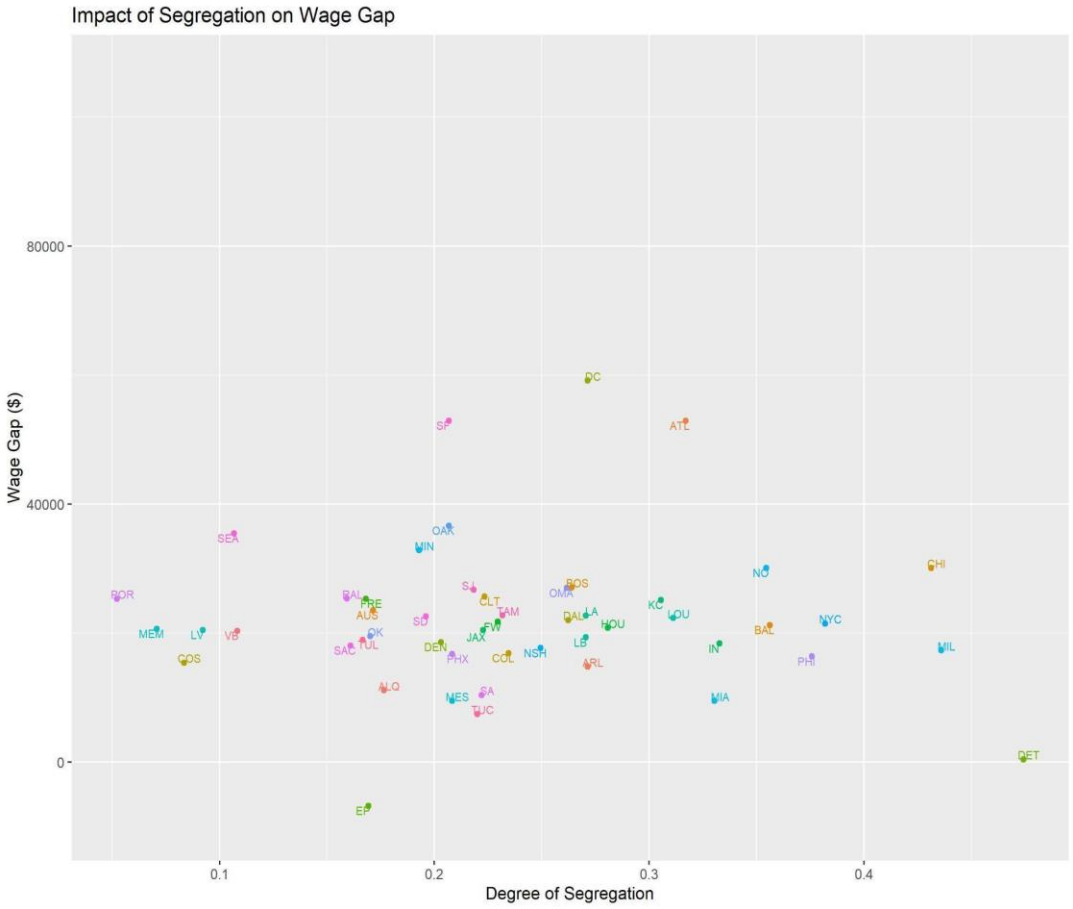
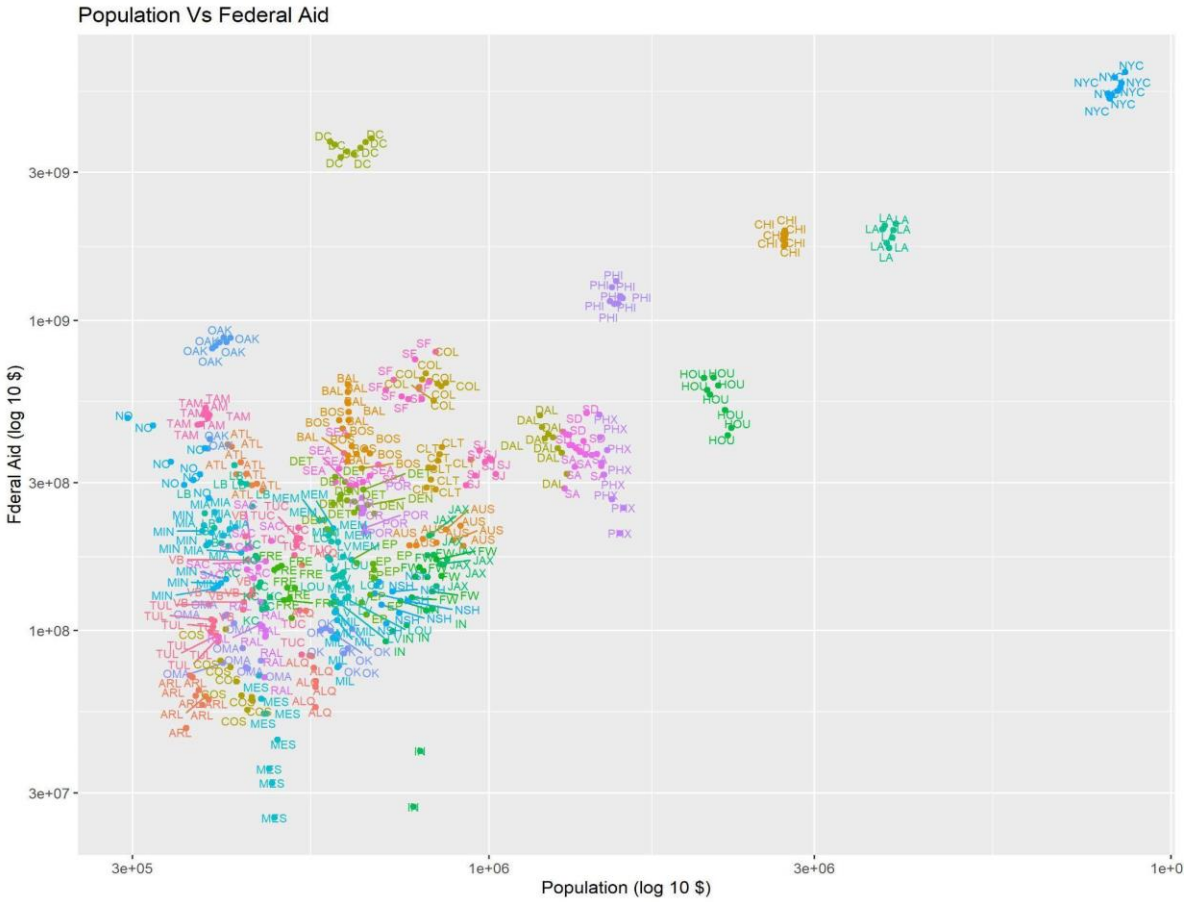


Figure B.28

Population vs Federal Aid



Appendix E: Economic Mobility Catalog

Name: Economic Mobility Catalog

File Type: Microsoft Excel Worksheet

Size: 71 KB

Required Application Software: Microsoft Excel

Appendix F: Multi-Objective Optimization Model

Name: MOO Min Change in Wage Gap and Wage Gap v3

File Type: Microsoft Excel Worksheet

Size: 305 KB

Required Application Software: Microsoft Excel