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Examining Charter School Policy and Public School District Resource Allocation in Ohio

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Abstract: This project focuses on the competitive pressure, or the threat of competitive pressure, generated by charter school policy. This paper uses longitudinal district-level data and multiple quasi-experimental designs to examine the relationship between two Ohio charter school policies and changes in public school district instructional resource allocation. Some believe that the competitive pressure created by charter schools will improve efficiency in district-run public schools; however, the findings from this study do not reliably demonstrate that charter school policy will induce a public school district to increase the level of instructional resource allocation. The findings do provide evidence that some charter policies are linked to changes in resource allocation at certain school districts. This study suggests that additional, multiple method investigations are needed to study how public school districts respond to competition and policies designed to change the levels of competition in the public school system.
Keywords: charter school policy; resource allocation; quasi-experimental designs

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Evaluando la acción política de las escuelas charter y la asignación de recursos en el Distrito Escolar de Ohio
Resumen: Este proyecto se centra en las presiones competitivas, o la amenaza de presiones competitivas, generada por las políticas de las escuelas charter. Este trabajo utiliza datos longitudinales a nivel de distrito y diseños múltiples cuasi-experimentales para examinar la relación entre las dos políticas y los cambios de las escuelas chárter de Ohio en la asignación de recursos de instrucción para el distrito escolar público. Algunos creen que las presiones competitivas, creada por las escuelas charter mejorarán la eficiencia en las escuelas públicas administradas por el distrito; Sin embargo, los resultados de este estudio no demuestran fehacientemente que las políticas de las escuelas chárter inducirán un distrito escolar público para aumentar el nivel de asignación de recursos de instrucción. Los hallazgos proporcionan evidencia de que algunas cambios en la asignación de recursos en ciertos distritos escolares están vinculados a las escuelas charter. Este estudio sugiere que se necesitan investigaciones adicionales, con métodos múltiples para estudiar cómo los distritos escolares públicos responden a la competencia y las políticas diseñadas para cambiar los niveles de competitividad en el sistema de educación pública.
Palabras clave: políticas escuelas charter; asignación de recursos; diseños cuasi-experimentales

Avaliando a ação política das escolas charter e a alocação de recursos no Distrito Escolar de Ohio
Resumo: Este projeto centra-se em pressões de concorrência, ou a ameaça de pressões de concorrência, geradas por políticas das escolas charter . Este trabalho usa dados longitudinais a nível distrital e um modelo quase-experimental para examinar a relação entre as duas políticas e as mudanças nas escolas charter em a alocação de recursos de instrução para o distrito de escolas públicas em Ohio. Alguns acreditam que as pressões de concorrência criadas por escolas charter melhorariam a eficiência das escolas públicas operadas pelo distrito; No entanto, os resultados deste estudo não mostram conclusivamente que as políticas das escolas charter induziram os distritos escolares públicos para aumentar o nível de recursos alocados a instrução. No entanto ha evidências de que algumas mudanças na alocação de recursos em determinados distritos escolares estão ligados a escolas charter. Este estudo sugere que é necessária mais investigação, com métodos mistos para estudar como distritos escolares públicos respondem à concorrência e políticas destinadas a alterar os níveis de concorrência no sistema de ensino público.
Palavras-chave: escolas charter Políticos; alocação de recursos; modelos quase-experimentais

Examining Charter School Policy and Public School District Resource Allocation in Ohio

In the United States, educational reform policies have continued to blur the distinction between public and private schooling by introducing a variety of market-based educational reforms such as charter schools, private school vouchers, open-enrollment schemes, and tuition tax credits. Advocates of choice-based reforms claim that such policies, in addition to offering alternative options, will improve the performance and efficiency of district-run public schools by exposing them to competitive pressure (Chubb & Moe, 1990; Friedman, 1955). Competition from charter schools is expected to open additional educational options for students and families and, through competitive effects, improve the efficiency of district-run public schools[1]. However, district leaders are sensitive to various inputs, and the threat of competition, inherent in charter school policies, may alone be sufficient to drive change in school district efficiency.

Much of the research on charter schools has focused on comparing charter schools to district-run public schools. Research into the effects of charter schools on district-run public schools, has returned mixed results (Arsen & Ni, 2012; Bettinger, 2005; Bifulco & Ladd, 2006; Booker et al., 2008; Hoxby, 2003; Sass, 2006). While these studies speak to the effect of charter school competition, they do not directly measure the effect of the threat of competition inherent in charter school policies.

Very little is known about the effects of charter school policy on district-run public schools, and understanding how existing publicly-run school districts may respond to these policies is important. Policies generating competition in public education, such as charter school policies, have been sold to the public as a rising "tide that lifts all boats" (Hoxby, 2003, p. 1), but evidence to support these claims are lacking, conflicted, or highly contextualized (Arsen & Ni, 2012; Bettinger, 2005; Bifulco & Ladd, 2006; Booker et al., 2008; Hoxby, 2003; Ni & Arsen, 2010; Sass, 2006). Additionally, these studies examine the effects of charter school competition, though do not directly examine the impact of charter school policy, which generates the threat of competition. Current research discussed below offers conflicting evidence on the impact of competition on public school district efficiency (Arsen & Ni, 2012; Chakrabarti & Roy, 2012). Seeing as Chakrabarti and Roy found that policies that decrease competition led to decreased efficiency, and Arsen and Ni found that increased competition led to decreased efficiency, there is clearly a need for greater understanding of the roles that competition and policy play in shaping public school district behavior and efficiency. This study proposes to examine aspects of the assertion that increasing competition for public school districts will lead to greater efficiency in said districts. However, this study, rather than looking at the direct effect of competition on efficiency, examines the potential for policy, policy designed to increase competition, to impact public school district resource allocation.

Resource Allocation and Policies as a Proxy for Efficiency

If we accept the contention, as made famous by Friedman (1955), that increasing competition in the educational marketplace leads to greater efficiency, then the expected changes in efficiency should generate from the central district office where most resource allocation decisions are made. However, there is a finite amount of resources available to public school districts, typically determined through a combination of local, state, and federal contributions. These resources can be divided into different expenditure types including personnel, instruction, activities, infrastructure, transportation, and food service (Thompson, Wood, & Crampton, 2008).

The finite level of resources and the needs of the district constrain a district's ability to become more efficient. In order to become more efficient, districts may focus on increasing achievement, and restrict themselves to spending money in areas that are most connected to student performance, namely instruction (Arsen & Ni, 2012). There is a growing literature that relies on the assertion that instructional expenditures are more productive, in terms of contribution to student achievement, than administrative expenditures. As such, an increase in the proportion of a budget directed towards instruction can be interpreted as an attempted increase in efficiency (Arsen & Ni,

[1] While charter schools are publicly funded, I am drawing a distinction between charter schools and public school districts or publicly-run school districts. Public school districts, in this case, are typically referred to in the literature as "traditional public school districts."

2012; Chakrabarti & Roy, 2012). Arsen and Ni (2012) examined the role of charter penetration — the market share of students that attend charter schools within a district — in public school district resource allocation. They found that though there were no immediate effects, public school districts exposed to high levels of competition for long periods of time shifted resources away from instruction and into administrative expenditures. These findings indicate that high levels of competition, resulted in decreased efficiency — a finding that contradicts economic theory (Friedman, 1955). Whereas, Chakrabarti and Roy (2012) found that Michigan's Proposal A, a 1994 policy that centralized Michigan educational spending, resulted in decreased instructional expenditures. As local budgetary control is viewed as a generator of Tiebout competition in which residents seek out their preferred tax-service package, Proposal A can be viewed as a policy that decreased competition in Michigan. While Arsen and Ni (2012) found that increased competition led to decreased instructional expenditures, Chakrabarti and Roy (2012) found that decreased competition also led to decreased instructional expenditures. This indicates that competition, as measured by the activation of Policy A or charter school penetration, resulted in conflicting findings when using instructional resource expenditures as a proxy for efficiency. However, the use of resource allocation as a proxy for school district efficiency and the use of state policy as a proxy for competition (Chakrabarti & Roy, 2012) establish a useful theoretical framework for the study of competition and efficiency through the use of charter school policy and public school district resource allocation. Incorporating these most recent studies into the economic theory of competition as a driving force for improved efficiency (Chubb & Moe, 1990; Friedman, 1955), a district responding to potential or actual charter school competition by attempting to become more efficient may shift resource allocation out of non-instructional expenditures and into instructional expenditures. Following this framework, this study tests whether charter policies impact resource allocation changes at public school districts, and answers the following research question: what are the size and direction of the changes in public school district instructional resource allocation associated with changes in state charter school policy?

Research Context and Data Sources

The expansion of charter schools throughout the country provides different opportunities to support research of charter schools as a market-based reform, but the educational and legislative context in Ohio is particularly well-suited for this research. Ohio is a hotbed for market-based reform, even having been referred to as the "Wild, Wild West" of charter schools (O'Donnell, 2014). Ohio has instituted multiple market-based reforms including charter schools and vouchers[2]. In addition, charter school legislation has existed in Ohio for over 15 years. While this context is exciting for examining outcomes associated with charter school policies, this study only examines changes immediately following the initial charter school policies in Ohio, Senate Bill 55 and House Bill 282, rather than examining changes over time, as I rely on the exogenous shock of policy activation to examine the immediate changes in resource allocation associated with the policies.

Research Context

In 1997, Ohio passed Senate Bill 55 (SB55) which permitted conversion charter schools throughout the state, but only permitted start-ups in Lucas County and the 'urban eight'[3] city districts. In 1999, Ohio passed House Bill 282 (HB282), a similar bill that impacted an additional 13

[2] Also known as the "EdChoice Scholarship Plan."

[3] Akron, Canton, Cincinnati, Cleveland, Columbus, Dayton, Toledo, and Youngstown.

districts: Cleveland Heights, East Cleveland, Elyria, Euclid, Hamilton, Lima, Lorain, Mansfield, Middletown, Parma, South-Western, Springfield, and Warren (*Legislation for Community Schools*, n.d.).

Following SB55, community schools could be established as start-ups or conversion schools. Start-up community schools are new schools sponsored by external authorizers, while conversion community schools are sponsored by the local public school district. As conversion charters, authorized by the local school district, generate less competitive pressure, I focus on charter school policies related to start-ups, authorized by an outside entity. Previous research indicates that public school districts are more threatened or motivated to respond to charter school competition when the charter school is sponsored by an external agency (Hess et al., 2001; Ni & Arsen, 2010). Since Ohio policy specifically allows for start-up charter schools under different circumstances than district sponsored charter schools, the inclusion of this distinction better informs this study of the nature of competitive responses in educational markets. For these reasons, I focus specifically on the 8 districts in which non-district sponsored start-up community schools could be opened following SB55 and the 13 districts in which non-district sponsored start-up community schools could be opened following HB282.

Data Sources

The data for this analysis were collected from the National Center for Education Statistics (NCES) Common Core of Data. The financial data, including total expenditures, instructional expenditures, and support expenditures were organized by type, year, and district. The collected data ranges from 1995 to 2004. According to the NCES, instructional expenditures include teachers' salaries and benefits, as well as instructional supplies and services[4]. In addition to financial data, data related to district student demographics, district organization, and district size were also collected (National Center for Education Statistics, n.d.).

Analytic Samples, Plausibility of Inferences, and Models

There are over 600 publicly-run school districts in Ohio, of which SB55 impacted 8 and HB282 impacted 13. Despite the low number of affected districts, since the policies targeted the largest districts in Ohio, a significant proportion of students were impacted by these policies. Though only a total of 21 districts were directly affected by these policies, SB55 impacted 316,327 Ohio students (17.47% of Ohio students) in 1998, and HB282 impacted 118,983 Ohio students (6.67% of Ohio students) in 2000. In 2000, after the implementation of HB282, over 400,000 students attended a district that had been targeted by either SB55 or HB282.

Analytic Samples

District characteristics, including finance characteristics, number of students, grades of students, student demographics, Free Lunch Eligibility (FLE), and student Individualized Education Plan (IEP) status, are listed in Table 1. Student race, FLE, IEP status, and grade level are all reported as a proportion of the total district population. Unfortunately, these data were not collected for every school district and therefore the full analytical sample only contains the 230 Ohio school districts from which reported data on these characteristics were collected. As NCES only collected

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[4] Current instruction expenditures include expenditures for activities related to the interaction between teachers and students, including salaries and benefits for teachers and teacher aides, textbooks, supplies, and purchased services. These expenditures also include expenditures relating to extracurricular and co-curricular activities. For further information, NCES provides definitions of all financial data terms in publication reports, such as http://nces.ed.gov/pubs2014/2014303.pdf.

complete data for 230 school districts in Ohio, the analyses are restricted to those districts. It is not clear that there are specific district characteristics that led to missing data in the NCES CCD, if districts are not randomly missing data (and therefore removed from the analyses) this could impede the generalizability of any findings from this study. Lucas County school districts which, according to the Ohio Department of Education, were impacted by charter school legislation earlier than other SB55 school districts are removed from the dataset. Lucas County was the subject of the community school pilot and was subject to the potential influences of community school competition prior to the implementation of SB55. Due to the nature of the analytic models, those districts participating in the pilot prior to SB55 must be removed from the analyses. Further, because treatment status (i.e. being targeted by charter school policy) is inherently associated with certain characteristics such as district size, an additional comparison group was created to test the robustness of the findings. The smaller dataset, referred to as the "restricted dataset," only includes comparison districts that had

Table 1.
Mean District Characteristics by Treatment Status (1995-2004)

	SB55 Districts (n=8)	HB282 Districts (n=13)	Comparison Districts (n=209)	Restricted Comparison (n=27)
%Instruction	57.44 (4.00)	58.06 (3.19)	60.48 (3.05)	60.33 (3.28)
%Support	38.52 (3.61)	38.01 (3.81)	35.85 (3.25)	36.77 (3.43)
Total Expenditures (in millions)	313.42 (190.45)	69.15 (28.02)	22.94 (17.22)	54.26 (12.32)
Instructional Expenditures (in millions)	180.98 (111.05)	40.13 (16.18)	13.79 (10.27)	32.47 (6.40)
Property Tax Revenue (in millions)	129.49 (92.49)	30.96 (19.78)	13.36 (13.75)	37.15 (12.72)
Total Students	37402.99 (21504.98)	9178.30 (3808.58)	3333.68 (2180.40)	7636.00 (551.12)
%Primary	48.56 (2.87)	47.11 (2.89)	43.97 (2.90)	42.61 (2.96)
%Middle	22.44 (1.19)	22.84 (1.11)	23.23 (1.30)	22.63 (1.40)
%Secondary	25.54 (2.17)	27.82 (2.74)	31.00 (2.48)	31.71 (0.75)
%IEP	13.89 (5.30)	12.98 (4.94)	11.08 (4.65)	10.90 (3.53)
%Free-Lunch Eligible	54.03 (14.20)	37.89 (15.66)	16.29 (11.83)	6.04 (2.73)
%Black	57.15 (12.93)	35.15 (26.70)	6.49 (13.66)	2.53 (1.44)
%Latino	3.23 (3.08)	3.21 (7.00)	1.32 (2.44)	1.06 (0.27)
%Asian	0.92 (0.73)	0.69 (0.59)	1.18 (1.50)	2.49 (2.03)
%Native American	0.16 (0.12)	0.13 (0.11)	0.11 (0.12)	0.14 (0.06)
%White	36.50 (13.59)	58.98 (26.44)	89.92 (14.67)	92.71 (3.62)

total expenditures or total enrollment greater than the smallest HB282 targeted district in 1995. This is in no way a matched sample, but offers some insight into the robustness of the findings. District characteristics, based on treatment status, are reported in Table 1. The restricted dataset does not offer more or less rigorous findings than the full dataset; however, looking across the analyses and datasets allows an examination of the robustness of the findings.

There were obvious differences between SB55 districts, HB282 districts, and the comparison non-targeted school districts, as seen in Table 1. These differences were implicit in the policies themselves, as SB55 targeted the eight largest school districts in Ohio and HB282 targeted the next 13 populous districts. For example, SB55 districts had a much larger total student population and budget. HB282 districts also, though to a lesser extent, had larger student populations and budgets than the comparison districts. Other differences found between the policy targeted districts and comparison districts are typically associated with urban school districts such as higher proportions of minority students, FLE students, and IEP students. SB55 districts, and HB282 districts, allocated a larger proportion of their budgets to support expenditures. Support expenditures include maintenance and operations, transportation, school district administration, business expenses, and other administrative or support expenditures (Common Core of Data, "N.D."). This was expected as larger urban districts typically have a larger, more expensive infrastructure; an additional possible explanation for this difference was the higher proportion of students receiving services associated with FLE or IEPs in the more densely populated districts. This is not problematic for measuring the impact of SB55 and HB282 as the models account for these differences; of greater concern are pre-policy trends in instructional resource allocation. In fact, a key strength of the analytic models is that the comparison groups do not need to have similar background characteristics. As long as the pre-treatment trends in the outcome variable are similar, the similarity of the treatment and comparison groups is not essential. This issue is discussed in greater detail in the following section.

Plausibility of Inferences

In this study, I examined two charter school policies passed in Ohio through the use of difference-in-difference (DID), regression discontinuity (RD), and difference-in-regression-discontinuity (DRD) models, all considered quasi-experimental designs. Quasi-experimental designs allow researchers to make limited causal inferences provided certain assumptions are met (Murnane & Willett, 2011; Shadish & Cook, 2009); in addition, designs such as DID, RD, and DRD are appropriate for estimating the changes in instructional allocation associated with the introduction of charter school policies.

In this case, the shift in charter school policies, which altered the eligibility of certain districts to compete with externally sponsored charter schools, provides an opportunity to examine the impact of these policies on the policy targeted districts through the use of DID and DRD designs. These analyses rely on the assumption that the comparison school districts' differences are a reasonable proxy for the differences that would have been experienced by the targeted school districts, had the policy not existed. I address this assumption by examining the similarity in trends, not similarity in levels, between targeted and comparison districts prior to the implementation of the policy—these concerns are addressed in Figure 1, which charts the trends of proportion of budgets dedicated to instructional expenditures by treatment type. Figure 1 shows pre-policy trends in HB282 districts are nearly identical to pre-policy trends in comparison districts. On the other hand, pre-policy trends in the SB55 districts are not identical to comparison districts, and if these differences are due to omitted variable bias, it jeopardizes the models' validity for making reliable inferences.

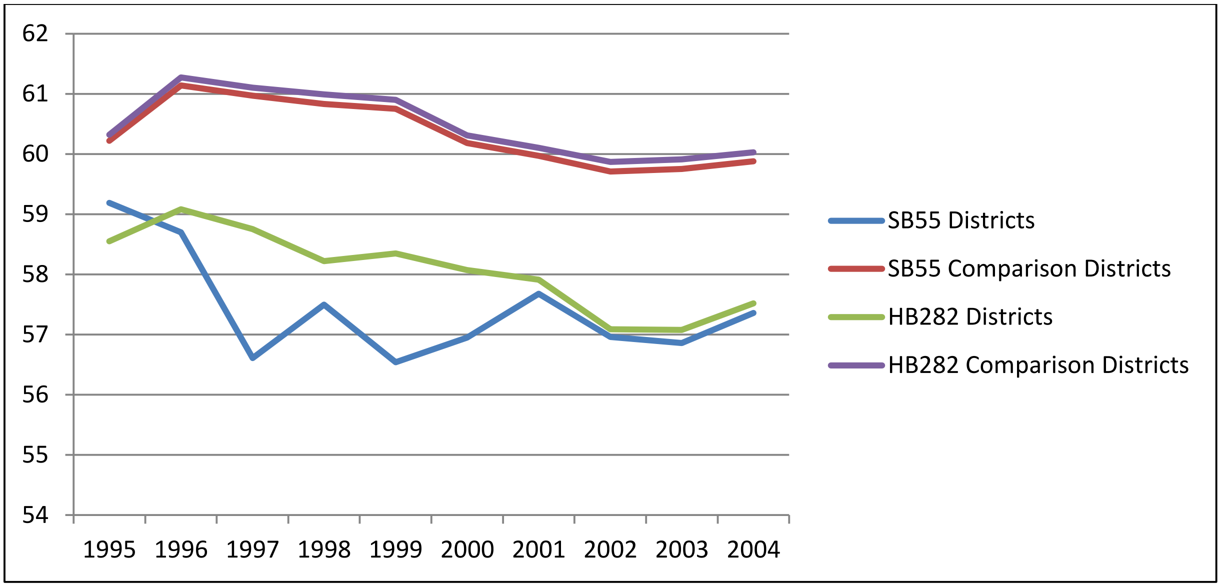

Figure 1: Percent of budget dedicated to instruction by treatment status

It is possible that the differences between SB55 districts and comparison districts are due to district characteristics such as district size or student demographics. If that is the case, by accounting for those characteristics in the model, I have addressed any concerns related to pre-policy trends. The largest concern is the drastic drop in instructional resource allocation the year before the activation of SB55 in districts targeted by the policy. Examining each district's change from 1996 to 1997, it seems most districts spent less in 1997 than in 1996. However, Cleveland spent 7.3% less in 1997 and Youngstown spent 5.4% less, decreases much larger than the average 1.7% in other districts with a decrease in instructional resource allocation. It is possible that pre-policy trends at Cleveland and Youngstown bias estimates related to SB55. For this reason, estimates related to SB55 may provide plausible estimates related to changes in resource allocation associated with charter school policies, however, estimates based on HB282 are more reliable.

A further concern of the DID analysis is that it is only able to include observations from the year immediately before and immediately after the implementation of the treatment. I test the robustness the findings from the DID analyses, and address the weakness of limited time frames, by also conducting RD and DRD analyses. Through the RD model, I establish a relationship between a continuous measure of time and the proportion of the resources allocated towards a district. This produces estimates of the change in resource allocation associated with the policy, because the relationship is disrupted at the cut point, activation of the charter school policy. The RD analyses measure targeted districts' instructional resource allocations over time, and estimate trends in resource allocation, which allows an examination of how those trends change at the cut-point. These changes in the trend represent the effect of the policy on resource allocation the year the policy occurred. However, the RD analyses only contain the school districts targeted by the policy, therefore, the model is unable to absorb state-wide secular trends in resource allocation, an advantage of the DID and DRD models.

The DRD model incorporates the longer time frame used by the RD models while still accounting for the state-wide secular trends provided by the comparison group in the DID model. The DID estimates are based on the interaction of dichotomous indicators of whether the district was targeted by the policy and whether the policy was activated, but requires the time frame included in the dataset to be limited to one year before and one year after the policy's activation. The RD model estimates the effects of the policies based on the interaction of a dichotomous indicator of whether the observation occurred after policy implementation and a continuous indicator of time, but only policy targeted districts are included in the analyses. Using the DRD model, I estimate the changes in instructional resource allocation associated with the policies based on the interaction of dichotomous indicators of whether the district was targeted by the policy and whether the policy was implemented; however, because the dataset contains multiple years of data, the model also includes a continuous indicator for year. Through the use of several interaction terms and the year term, I estimate the changes in resource allocation in targeted districts associated with the activation of the policy immediately following the activation of the policy. The DRD exploits the strengths of the DID and the RD by comparing districts targeted by the policy after policy activation to districts targeted by the policy before policy activation while accounting for trends in districts not targeted by the policy, and including observations for multiple years before and after policy activation.

Models

The datasets contain annual observations nested within districts. In order to account for the within district variation of instructional expenditures over multiple years, I utilize hierarchical linear modeling (HLM) to cluster annual observations for each district, and compare the post-policy instructional expenditures to pre-policy instructional expenditures. HLM is appropriate for such analyses of longitudinal data (Snijders & Bosker, 1999).

According to Arsen and Ni (2012), there are several factors identified in the literature associated with school district resource allocation. I include the same factors as Arsen and Ni in these analyses: total district enrollment in logarithmic form, total district expenditures in logarithmic form, property tax revenue per student in logarithmic form, and the percentage of district FLE students[5]. Arsen and Ni also included measurements of student characteristics such as the percentage of students that receive special education services and indicators of racial characteristics, such measures are also included in these analyses.

The models are constructed beginning with policy related covariates, which differ based on model construction. Next, covariates related to district size are added, such as total number of students. Next, covariates related to district organization are added, which include the proportion of the district students in primary grades (kindergarten through fifth grade), middle grades (sixth through eighth grade), and secondary grades (ninth through twelfth grade). Next, covariates related to the characteristics of the student body are added, which include the proportion of the students that are identified as African-American, Latino, Asian-American, Native-American, and Caucasian, as well as FLE students or students eligible for IEP services. Finally, covariates related to district finances are added such as district expenditures and revenues. The dependent variable, instructional resource allocation, is calculated as the proportion of the total school district budget dedicated to instructional expenditures in a given school district (j) for a given year (i): $Y_{ij} = instruction_{ij}/total_{ij}$. I use the DID, RD, and DRD models to examine if SB55 and HB282 are associated with changes in instructional resource allocation in targeted school districts.

In the DID models, the variables for each year are nested within a district, comprising the level one observations ($n_{iSB55} = 460, n_{iHB282} = 444$). Thus, the school districts are the clustered

[5] Arsen and Ni (2012) include the percentage of students eligible for free and reduced lunch, but due to data constraints only measurements for free lunch are available and included in these analyses.

variable and comprise the level two observations ($n_{jSB55} = 230, n_{jHB282} = 222$)[6]. Level one covariates, observations pertaining to a single year, are included, however, the only level two covariate included is district treatment status, a dichotomous indicator of whether or not the district was targeted by charter school policy. In this manner, the HLM serves to cluster the standard errors of the school districts over time in the analyses. Level two covariates, such as district level means, and district centered measurements were examined, but not found to improve model fit.

According to Meyer (1995), traditional DID designs are sensitive to variations in the functional form, meaning small changes in a single equation component may lead to skewed reporting of treatment effects. The use of HLM allows additional covariates and other tests of model fit. The independent variables in the DID models include a dichotomous indicator of whether the district was targeted by a policy ($SB55_j, HB282_j$), a dichotomous indicator of whether the observation occurred before or after the activation of the policy ($policy1_i, policy2_i$), and an interaction term indicating whether the district was targeted by the policy and the policy was activated [($SB55_j * policy1_i$), ($HB282_j * policy2_i$)]. By estimating the change in instructional resource allocation for districts targeted by the policy when the policy was activated, these models estimate the degree to which charter school policies are associated with changes in resource allocation in policy targeted districts. The models are displayed in equation 1 and equation 2.

Equation 1.
$$Y_{ij} = \gamma_{01}SB55_j + \gamma_{10}policy1_{ij} + \gamma_{20}\left(SB55_j * policy1_{ij}\right) + \gamma_{3j}\boldsymbol{X}_{ij} + U_{0j} + R_{ij}$$

Equation 2.
$$Y_{ij} = \gamma_{01}HB282_j + \gamma_{10}policy2_{ij} + \gamma_{20}\left(HB282_j * policy2_{ij}\right) + \gamma_{3j}\boldsymbol{X}_{ij} + U_{0j} + R_{ij}$$

Wherein Y_{ij} measures the proportion of a school district's budget dedicated to instructional expenditures, $\boldsymbol{X}_{ij}$ is a matrix of district covariates, U_{0j} measures the level two residual, and R_{ij} measures the level one residual. The interaction variable,($SB55_j * policy1_{ij}$) or$\left(HB282_j * policy2_{ij}\right)$, reports the size and significance of the changes in instructional resource allocation associated with the charter school policies. In order to examine these changes, these models only include the years immediately before and after the policies were activated[7].

The RD models include multiple years of observations before and policy activation. This accounts for pre- and post-policy trends in the targeted school districts; however, the RD datasets analyses only include policy targeted districts. In order to estimate changes in resource allocation associated with the charter school policies, I place the cut point along the X axis at the time of policy activation. By only including districts targeted by the policy, fewer level one observations are nested within the district (n_{iSB55}= 48, n_{iHB282}= 130). Without the inclusion of comparison school districts, the level two observations are also fewer in number (n_{jSB55}= 8, n_{jHB282}= 13). I estimate changes in the proportion of district budget allocated for instruction based on an interaction of a continuous measure of time and a dichotomous indicator of time of policy activation [($year_{ij} * after97_{ij}$), ($year_{ij} * after99_{ij}$)]. Since only districts targeted by the policy are included in the

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[6] Here I have reported n_i and n_j for the larger dataset, the restricted dataset contains fewer observations. The number of observations in the restricted dataset for each model is reported in Table 2 and Table 3.

[7] The model examining SB55 includes 1997 and 1998, and the model examining HB282 includes 1999 and 2000, thereby including the year immediately before and the year immediately after policy activation.

analysis, there is no need for an indicator of whether the district was targeted by the policy. However, a dichotomous indicator of whether the observation occurred after policy activation ($after97_{ij}, after99_{ij}$) and a continuous indicator for year ($year_{ij}$) are included. By estimating the change in instructional resource allocation for districts targeted by the policy when the policy was activated, but still accounting for trends occurring in the surrounding years, I attempt to measure the change in resource allocation at public school districts associated with charter school policies. These models are reflected in equation 3 and equation 4.

Equation 3.

$$Y_{ij} = \gamma_{10}after97_{ij} + \gamma_{20}year_{ij} + \gamma_{30}(year_{ij} * after97_{ij}) + \gamma_{4j}\boldsymbol{X}_{ij} + U_{0j} + R_{ij}$$

Equation 4.

$$Y_{ij} = \gamma_{10}after99_{ij} + \gamma_{20}year_{ij} + \gamma_{30}(year_{ij} * after99_{ij}) + \gamma_{4j}\boldsymbol{X}_{ij} + U_{0j} + R_{ij}$$

Wherein Y_{ij} measures the proportion of a school district's budget dedicated to instructional expenditures, $\boldsymbol{X}_{ij}$ is a matrix of district covariates, U_{0j} measures the level two residual, and R_{ij} measures the level one residual. The interaction term [$(year_{ij} * after97_{ij})$,$(year_{ij} * after99_{ij})$] allows me to report the size and significance of changes in resource allocation associated with the charter school policies. An equal number of years before and after the implementation of the policies are included in both analyses[8].

The DRD models include multiple years before and after implementation, as well as a comparison group of non-targeted districts, but statistically isolate only the changes associated with the policies on the policy-targeted districts immediately following the activation of the policies. I estimate changes in resource allocation associated with the charter school policies at the time the policy was activated, while still accounting for any secular trends in instructional resource allocation. This is done by accounting for trends in time related measures and policy targeted districts, as well as interactions of these measures, and by placing the cut point along the X axis at the time of policy activation. In the DRD models, a comparison group is included as well as multiple years of analysis leading to a larger number of level one observations ($n_{iSB55} = 1380, n_{iHB282} = 2220$)[9], and the same number of level two observations, as seen in the DID models ($n_{jSB55} = 230, n_{jHB282} = 222$). Estimating the changes in the proportion of district budgets allocated to instruction associated with the activation of the policy is measured as a dichotomous indicator of whether the district was targeted by the policy and whether the observation occurred after the policy activated [$(SB55_j * after97_{ij}), (HB282_j * after99_{ij})$]. These estimates are only reliable after accounting for additional measures, including: a dichotomous indicator of whether the district was targeted by a policy ($SB55_j, HB282_j$), a dichotomous indicator of whether the observation occurred after policy activation ($after97_{ij}, after99_{ij}$), a continuous indicator for year ($year_{ij}$), an indicator for year and whether the observation occurred after policy activation [$(year_{ij} * after97_{ij}), (year_{ij} * after99_{ij})$], an indicator for year and whether the district was targeted by the policy [$(SB55_j *$

[8] The RD and DRD models examining SB55 include 1995 through 2000, three years before and after policy activation because the earliest available data is 1995. The RD and DRD models examining HB282 include 1995 through 2004, including five years before and five years after policy activation.

[9] As in the RD model, the SB55 analysis includes 6 years of observations and the HB282 analysis includes 10 years of data. For this reason, despite there being more level two observations in the SB55 analysis, there are more level one observations in the HB282 analysis.

$year_{ij}), (HB282_j * year_{ij})$], and an indicator for year, whether the district was targeted by the policy, and whether the observation occurred after policy activation [$(SB55_j * year_{ij} * after97_{ij}), (HB282_j * year_{ij} * after99_{ij})$]. These models are reflected in equation 5 and equation 6.

Equation 5.

$$Y_{ij} = \gamma_{01}SB55_j + \gamma_{10}after97_{ij} + \gamma_{20}year_{ij} + \gamma_{3j}\left(SB55_j * after97_{ij}\right) + \gamma_{4j}\left(SB55_j * year_{ij}\right) + \gamma_{50}\left(year_{ij} * after97_{ij}\right) + \gamma_{6j}\left(SB55_j * after97_{ij} * year_{ij}\right) + \gamma_{7j}\boldsymbol{X}_{ij} + U_{0j} + R_{ij}$$

Equation 6.

$$Y_{ij} = \gamma_{01}HB28255_j + \gamma_{10}after99_{ij} + \gamma_{20}year_{ij} + \gamma_{3j}\left(HB282_j * after99_{ij}\right) + \gamma_{4j}\left(HB282_j * year_{ij}\right) + \gamma_{50}\left(year_{ij} * after99_{ij}\right) + \gamma_{6j}\left(HB282_j * after99_{ij} * year_{ij}\right) + \gamma_{7j}\boldsymbol{X}_{ij} + U_{0j} + R_{ij}$$

Wherein Y_{ij} measures the proportion of a school district's budget dedicated to instructional expenditures, $\boldsymbol{X}_{ij}$ is a matrix of district covariates, U_{0j} measures the level two residual, and R_{ij} measures the level one residual. The interaction variable [$(SB55_j * after97_{ij})$,$\left(HB282_j * after99_{ij}\right)$] measures the change in district instructional resource allocation associated with the policy. The DRD models, like the RD models, include an equal number of years before and after the activation of the policies.

Results

In order to examine the impact of SB55 and HB282 on public school district resource allocation from multiple analytic angles, three methods were used to examine each policy. Tables 2 and 3 report the findings from these analyses. Additional tables containing parameter estimates for the entire models are located in Appendix A. For each policy a nested DID and DRD analysis is reported examining the change in instructional resource allocation associated with the charter school policy using both datasets. The RD analyses, unlike the DID and DRD analyses, are already restricted to only policy-targeted districts and therefore, only one dataset is used to examine the outcomes associated with these analyses; as such, RD results are not reported for the restricted sample. The restricted sample comparison group more closely resembles SB55 and HB282 districts than the larger comparison group in terms of total expenditures, property tax revenue, and total students—three measures important to resource allocation (Arsen & Ni, 2012).

SB55 Outcomes

As seen in Table 2, I found in the DID analyses that the change in instructional resource allocation associated with SB55 in the districts targeted by SB55 ranged from 0.99% to 1.30%, depending on the sample and model characteristics. Additionally, the standard errors of this estimate remained stable and slightly diminished with the introduction of additional covariates in models two, three, four, and five. The estimates of the changes associated with the policy were similar between both samples, despite the diminished degrees of freedom in the restricted dataset. The estimates are significant across all models and both datasets ($p<0.05$). As seen in model five of both datasets, the activation of SB55 resulted in an increase in the proportion of the budget dedicated to instructional expenditures between 0.99% and 1.30% after accounting for district and student characteristics. Districts targeted by SB55 spent between 0.99% and 1.30% more on instruction than they would have, had such a policy not existed.

Table 2
SB55 Outcomes

	Model 1:	Model 2: Model 1 + District Size	Model 3: Model 2 + Student Levels	Model 4: Model 3 + Student Characteristics	Model 5: Model 4 + District Expenditures
Full sample					
DID ($n_j = 230$)					
RD ($n_j = 8$)					
DRD ($n_j = 230$)					
DID ($n_i = 460$)	1.02* (0.51)	1.02* (0.51)	1.03* (0.51)	1.01* (0.51)	0.99* (0.50)
RD ($\boldsymbol{n_i = 48}$)	1.01~ (0.56)	1.04~ (0.57)	1.00 (0.62)	0.04 (0.87)	0.11 (0.93)
DRD ($n_i = 1380$)	2.29** (0.86)	2.29** (0.85)	2.32** (0.86)	2.46** (0.86)	2.39** (0.83)
Restricted sample					
DID($n_j = 48$)					
DRD($n_j = 48$)					
DID ($n_i = 96$)	1.14* (0.56)	1.13* (0.56)	1.18* (0.58)	1.27* (0.56)	1.30* (0.51)
DRD ($n_i = 288$)	2.18* (0.93)	2.16* (0.93)	2.54** (0.94)	2.80** (0.96)	2.85** (0.93)

~, p<0.10, *p<0.05, **p<0.01, ***p<0.001

I found in the RD models of SB55 that the estimates were not statistically significant. Due to the low number of level one and level two observations, I was unable to determine if the undetectable change in instructional resource allocation was due to restricted degrees of freedom or the more developed model specificity. An assumption of RD designs is that observations at or near the cut point are randomly distributed on either side of the cut point, and therefore, the addition of covariates should not affect the variables of interest (Lee & Lemieux, 2010). However, considering that I examined the same districts over time, this assumption required a shorter leap, as I assumed that a given district is not inherently different in 1997 than it was in 1998, a less daunting assumption than assuming two different subjects with similar scores are inherently similar. The addition of the district covariates ensured that if a district changed in a significant way between the two years that were measured by the covariate, it was included in the analysis and part of the model. It is unclear if the drastic changes in parameter estimates seen between model 3 and model 4 reflect a violation of Lee and Lemieux's assumption, or if those changes were simply due to the constrained number of degrees of freedom. Examining the changes associated with SB55 through a third quasi-experimental lens, provided additional considerations.

I found that the DRD analyses of SB55 supported the findings of the DID analyses. In fact, the results found in the DRD analyses suggest that the changes associated with the policy were much larger in magnitude than those found in the DID analyses. I found in the DRD analyses that the changes in instructional resource allocation associated with SB55 were significant across all models and both datasets. As seen in the DID analyses, the estimates from the restricted dataset were slightly larger than those found in the full dataset. The estimates are robust to changes in sample and model specification. Districts targeted by SB55 spent between 2.39% and 2.85% more on instruction than they would have, had such a policy not existed. Such increases in instruction were equivalent to between $6,785,078.55 and $8,090,993.25. Also, effect size ranged from 0.87 for the full sample to 0.84 for the restricted sample. The significance of these estimates persisted across DRD models ($p<0.01$). Even though SB55 districts tended to allocate less towards instruction than comparison districts, the estimates from the DID and DRD suggest that these districts allocated more towards instruction than would have been allocated in the absence of this policy.

These estimates do not suggest that more money was spent as a result of these policies, only that more of the available resources were allocated towards instruction. Additionally, a concern about the reliability of the analysis of SB55 is the difference between pre-policy trends of policy-targeted districts and the comparison group, as seen in Figure 1. As discussed above, Cleveland and Youngstown school districts were largely responsible for the large, pre-policy drop in average instructional resource allocation for SB55 districts. The significance of the finding is not robust to removing either Cleveland ($p=0.20$) or Youngstown ($p=0.16$) in the DID model. In the DRD model, the main finding is robust to removing Cleveland ($p=0.01$), however the main finding is only marginally significant if Youngstown is removed ($p=0.06$). Also, if both Cleveland and Youngstown are removed, the main finding becomes insignificant ($p=0.15$). Despite the consistency of the DID analyses and the significance of the DRD analyses, since the pre-policy trends in the treatment group do not match those of the comparison groups for the SB55 analyses, HB282 provides more reliable analyses for measuring the impact these policies on public school district resource allocation.

HB282 Outcomes

As seen in Table 3, changes in instructional resource allocation associated with being a district targeted by HB282 in the year HB282 was activated were not statistically significant in any model or dataset. The standard errors of the treatment effect remained stable despite the introduction of additional variables in models two, three, four, and five. There is no conclusive evidence supporting the findings from the analyses of SB55.

Unlike the findings in the analyses of SB55, the analyses of HB282 do not offer compelling evidence of a relationship between charter school policies and changes in instructional resource allocation. The lack of significance in the findings may suggest that there is something particular about SB55, or unobserved variable bias in the model, that resulted in the significant findings which are not generalizable to other policies or analyses. Considering the difference between pre-policy trends in SB55 districts and the comparison districts, the analyses of HB282 provide more reliable and generalizable estimates of how changes in charter school policy were associated with changes in instructional resource allocation. The most reliable estimates suggest that the threat of charter school policies were not associated with a significant change public school district resource allocation; however the findings from the SB55 suggest the need for further investigation.

Table 3.
HB282 Outcomes

	Model 1:	Model 2: Model 1 + District Size	Model 3: Model 2 + Student Levels	Model 4: Model 3 + Student Characteristics	Model 5: Model 4 + District Expenditures
Full sample					
DID ($n_j = 222$)					
RD ($n_j = 13$)					
DRD ($n_j = 222$)					
DID ($n_i = 444$)	0.30 (0.38)	0.30 (0.38)	0.30 (0.38)	0.31 (0.38)	0.42 (0.38)
RD ($\boldsymbol{n_i = 130}$)	-0.07 (0.17)	-0.06 (0.17)	-0.16 (0.20)	0.01 (0.30)	-0.04 (0.28)
DRD ($n_i = 2220$)	0.69 (0.56)	0.69 (0.56)	0.69 (0.56)	0.66 (0.56)	0.78 (0.55)
Restricted sample					
DID($n_j = 40$)					
DRD($n_j = 40$)					
DID ($n_i = 80$)	0.17 (0.52)	0.20 (0.52)	0.20 (0.54)	0.20 (0.54)	0.40 (0.43)
DRD ($n_i = 400$)	0.53 (0.60)	0.54 (0.60)	0.40 (0.60)	0.27 (0.60)	0.39 (0.60)

*p<0.05, **p<0.01, ***p<0.001

Significance

Amidst shrinking budgets, increased accountability, and a national push to improve the efficiency of district-run public schools, over the last 20 years there has also been an influx of charter school policies (Lubienski & Weitzel, 2010). According to economic theory, such competition-based reforms should improve the effectiveness and efficiency of district-run schools (Chubb & Moe, 1990; Friedman, 1955; Hoxby, 2000). However, what we know about the effects of charter school competition on district-run public school efficiency is extremely limited. We do not know if charter school competition consistently has a statistically measurable, causal effect on district-run public school efficiency and leadership behavior, and have little statistical evidence outside of certain, specific contexts. Recently, the literature has supported the use of instructional resource allocation as a proxy for measuring the efficiency of a district (Arsen & Ni, 2012; Chakrabarti & Roy, 2012), and the use of policies designed to increase, or decrease, competition as a proxy for measuring competition (Chakrabarti & Roy, 2012).

With no regard for violated methodological assumptions, and full acceptance that a policy threat of competition is an accurate proxy for competition and that instructional resource allocation is an accurate proxy for efficiency, the findings from this study still could not be taken as acceptable evidence supporting Friedman's (1955) assertion that increased competition results in increased efficiency. These results provide possible, but not reliable evidence of a relationship between certain charter school policies and resource allocation in some public school districts. This study builds on a growing literature, and tests the hypothesis that competition improves efficiency by examining the impact of policies designed to increase competition on public school district resource allocation.

Though policies and resource allocation serve as proxies for competition and efficiency, it is not clear that such proxies are equivalent to such measures, or need they be. While this investigation can provide some insight to competition and efficiency, it explicitly measures the impact, or lack thereof, of charter policy on public school district behavior, an important investigation on its own merits.

These analyses provide important guidance for future research. First, I found that SB55 led to increased proportions of school district budgets being allocated towards instruction; however, the reliability of these findings is confounded by differences in pre-policy trends. Second, I found in my analysis of HB282 no significant changes in instructional resource allocation associated with the activation of the policy. While the analysis of HB282 provides more reliable insight into the impact of charter policy on school district resource allocation, the difference in outcomes seen between the two sets of analyses, certainly lead to additional questions such as: if the findings from the SB55 analyses are reliable, what are the elements of the policy, or the targeted districts, that led to a change in behavior for those 8 districts but not the 13 districts targeted by HB282?

While I do not provide evidence suggesting that charter school policies lead to higher levels of instructional resource allocation, it is plausible to infer that SB55 was at least associated with higher instructional allocation in the SB55 districts; however, this quantitative analysis only goes so far and does not speak to how the specifics of school district behavior did or did not change in the face of charter school policy. Qualitative analyses can provide insight into whether the aggregate changes resource allocation were in relation to reducing administrative expenditures, restructuring instructional expenditures, or a purposeful reallocation based on charter policy. This study demonstrates the need for continued investigation using multiple methods to better understand changes in public school districts in response to changes in policy or measured levels of competition, and what those changes might look like.

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Appendix

Table A1.
The DID Effects of SB55 on Instructional Resource Allocation

$n_j = 230, n_{ij} = 460$	Null Model	Model 1:	Model 2: Model 1 + District Size	Model 3: Model 2 + Student Levels	Model 4: Model 3 + Student Characteristics	Model 5: Model 4 + District Expenditures
Intercept:		57.50*** (1.07)	61.07*** (3.33)	60.46*** (4.65)	56.83*** (4.80)	11.39 (10.94)
%Change in Ins. Resource Allocation		1.02* (0.51)	1.02* (0.51)	1.03* (0.51)	1.01* (0.51)	0.99* (0.50)
SB55		-4.35*** (1.09)	-3.53** (1.31)	-3.31* (1.34)	-1.88 (1.35)	-1.32 (1.28)
After Policy		-0.13 (0.09)	-0.13 (0.09)	-0.11 (0.10)	-0.05 (0.11)	0.35** (0.12)
Total Students[a]			-0.34 (0.30)	-0.29 (0.31)	0.25 (0.32)	8.31*** (1.40)
%Primary				-0.50 (5.08)	13.19~ (7.46)	7.49 (7.26)
%Middle				-5.82 (8.23)	3.40 (10.01)	1.67 (9.65)
%Secondary				6.52 (5.87)	13.78~ (8.25)	11.86 (7.97)
%IEP Students					7.59 (6.26)	12.95* (6.05)
%Free Lunch					-0.31 (1.97)	-1.43 (2.15)
%Black					-16.48** (6.23)	-9.76 (6.11)
%Latino					3.46 (8.92)	7.01 (8.52)
%Asian					-33.62* (16.55)	13.62 (17.51)
%Native					-147.15 (117.71)	-116.73 (112.69)
%White					-9.83 (6.15)	-6.55 (5.98)
Total Expenditures[b]						-8.16*** (1.42)
Property Tax PPR[c]						0.50 (0.54)
Level One Error Variance	1.02*** (0.10)	1.00*** (0.09)	1.00*** (0.09)	1.00*** (0.09)	0.98*** (0.09)	0.93*** (0.09)
Level Two Error Variance	8.65*** (0.86)	8.17*** (0.81)	8.13*** (0.81)	8.13*** (0.81)	6.81*** (0.69)	6.00*** (0.61)

a. $\log(total\ students)$
b. $\log(total\ expenditures)$
c. log(*property tax per pupil revenue*)
*p<0.05, **p<0.01, ***p<0.001

Table A2.
The RD Effects of SB55 on Instructional Resource Allocation

$n_j = 8, n_{ij} = 48$	Null Model	Model 1:	Model 2: Model 1 + District Size	Model 3: Model 2 + Student Levels	Model 4: Model 3 + Student Characteristics	Model 5: Model 4 + District Expenditures
Intercept:		57.27*** (1.33)	47.75* (19.70)	34.53 (22.83)	20.30 (38.93)	26.00 (67.84)
%Change in Ins. Resource Allocation		1.01~ (0.56)	1.04~ (0.57)	1.00 (0.62)	0.04 (0.87)	0.11 (0.93)
Year		-1.29** (0.40)	-1.29** (0.40)	-1.30** (0.39)	-0.28 (0.77)	-0.29 (0.81)
After Policy		1.68 (1.00)	1.67 (1.01)	2.36* (1.05)	1.88 (1.11)	1.98~ (1.15)
Total Students[a]			0.91 (1.89)	0.53 (2.05)	2.12 (3.49)	3.88 (7.02)
%Primary				20.83 (17.07)	71.71~ (35.92)	74.06~ (37.11)
%Middle				0.59 (53.52)	71.51 (65.43)	66.90 (66.46)
%Secondary				28.62 (35.30)	83.47 (57.75)	86.12 (58.09)
%IEP Students					-18.27 (11.57)	-18.89 (11.79)
%Free Lunch					0.89 (1.76)	0.67 (1.84)
%Black					-52.50 (36.19)	-52.84 (36.27)
%Latino					-102.76 (78.04)	-96.58 (80.56)
%Asian					-208.69 (281.54)	-218.04 (280.97)
%Native					-1349.46 (877.58)	-1326.69 (881.11)
%White					-45.61 (37.17)	-46.07 (37.20)
Total Expenditures[b]						-1.40 (6.12)
Property Tax PPR[c]						1.10 (3.42)
Level One Error Variance	3.65*** (0.82)	2.54*** (0.57)	2.55*** (0.57)	2.36*** (0.53)	1.94*** (0.46)	1.94*** (0.47)
Level Two Error Variance	11.94* (6.28)	12.12* (6.27)	11.51* (6.00)	12.10* (6.35)	16.25 (10.78)	15.93 (11.28)

a. $\log(total\ students)$
b. $\log(total\ expenditures)$
c. log(*property tax per pupil revenue*)
*p<0.05, **p<0.01, ***p<0.001

Table A3.
The DRD Effects of SB55 on Instructional Resource Allocation

$n_j = 230, n_{ij} = 1380$	Null Model	Model 1:	Model 2: Model 1 + District Size	Model 3: Model 2 + Student Levels	Model 4: Model 3 + Student Characteristics	Model 5: Model 4 + District Expenditures
Intercept:		57.27*** (1.04)	62.16*** (3.04)	60.73*** (3.67)	58.12*** (3.79)	122.92*** (7.41)
%Change in Ins. Resource Allocation		2.29** (0.86)	2.29** (0.85)	2.32** (0.86)	2.46** (0.86)	2.39** (0.83)
SB55		-5.93*** (1.21)	-4.81*** (1.38)	-4.71*** (1.39)	-3.98** (1.41)	-3.43* (1.35)
Year		0.37*** (0.06)	0.38*** (0.06)	0.36*** (0.06)	0.68*** (0.10)	0.75*** (0.10)
After Policy		-0.61*** (0.16)	-0.61*** (0.16)	-0.57*** (0.16)	-0.75*** (0.17)	-0.39* (0.17)
SB55*Year		-1.66*** (0.34)	-1.66*** (0.34)	-1.65*** (0.34)	-1.72*** (0.35)	-1.79*** (0.34)
After Policy*Year		-0.70*** (0.09)	-0.70*** (0.09)	-0.69*** (0.09)	-0.96*** (0.11)	-0.55*** (0.12)
SB55*Year*After		1.71 (0.48)	1.70*** (0.48)	1.72*** (0.48)	1.82*** (0.49)	1.98*** (0.47)
Total Students[a]			-0.47~ (0.27)	-0.45 (0.28)	-0.01 (0.28)	8.01*** (0.86)
%Primary				2,17 (3.14)	0.44 (4.93)	1.10 (4.76)
%Middle				-6.51 (4.41)	-9.22 (5.84)	-6.09 (5.65)
%Secondary				6.22~ (3.45)	2.22 (5.19)	3.41 (5.01)
%IEP Students					-7.71*** (1.91)	-4.63* (1.87)
%Free Lunch					1.43~ (0.83)	0.83 (0.82)
%Black					-1.43 (4.49)	0.68 (4.34)
%Latino					14.16~ (7.17)	13.18~ (6.90)
%Asian					-19.63 (12.23)	3.75 (12.45)
%Native					-21.57 (58.52)	-12.23 (56.53)
%White					3.91 (4.40)	3.05 (4.25)
Total Expenditures[b]						-8.15*** (0.84)
Property Tax PPR[c]						0.78* (0.35)
Level One Error Variance	1.93*** (0.08)	1.78*** (0.07)	1.78*** (0.07)	1.77*** (0.07)	1.75*** (0.07)	1.63*** (0.07)
Level Two Error Variance	7.48*** (0.73)	7.18*** (0.70)	7.14*** (0.69)	7.12*** (0.07)	6.21*** (0.61)	5.65*** (0.56)

a. $\log(total\ students)$
b. $\log(total\ expenditures)$
c. log(*property tax per pupil revenue*), *p<0.05, **p<0.01, ***p<0.001

Table A4.
The DID Effects of SB55 on Instructional Resource Allocation (Comparison)

$n_j = 48, n_{ij} = 96$	Null Model	Model 1:	Model 2: Model 1 + District Size	Model 3: Model 2 + Student Levels	Model 4: Model 3 + Student Characteristics	Model 5: Model 4 + District Expenditures
Intercept:		57.50*** (1.31)	36.58* (14.08)	27.87~ (15.35)	42.85** (13.29)	158.32*** (31.07)
%Change in Ins. Resource Allocation		1.14* (0.56)	1.13* (0.56)	1.18* (0.58)	1.27* (0.56)	1.30* (0.51)
SB55		-3.42* (1.43)	-6.32* (2.40)	-5.36* (2.44)	-1.30 (2.22)	-0.13 (2.11)
After Policy		-0.25 (0.23)	-0.25 (0.23)	-0.26 (0.24)	-0.17 (0.24)	0.36 (0.26)
Total Students[a]			2.01 (1.35)	2.17 (1.38)	0.83 (1.15)	13.37*** (3.30)
%Primary				-6.18 (12.61)	16.24 (15.17)	6.58 (14.14)
%Middle				36.32 (26.79)	32.35 (28.51)	19.12 (26.28)
%Secondary				9.46 (14.00)	6.54 (16.20)	7.08 (15.14)
%IEP Students					11.55 (16.91)	12.58 (15.75)
%Free Lunch					1.34 (4.52)	-1.19 (4.78)
%Black					-18.86* (8.44)	-9.06 (8.12)
%Latino					12.50 (14.94)	23.86 (14.14)
%Asian					-8.72 (29.35)	21.70 (29.99)
%Native					125.05 (293.16)	74.15 (275.81)
%White					-7.48 (8.29)	-3.53 (7.64)
Total Expenditures[b]						-13.62*** (3.47)
Property Tax PPR[c]						2.07 (1.50)
Level One Error Variance	1.14*** (0.23)	1.05*** (0.21)	1.05*** (0.21)	1.01*** (0.21)	0.91*** (0.19)	0.75*** (0.16)
Level Two Error Variance	13.70*** (2.91)	12.62*** (2.68)	12.03*** (2.57)	11.70*** (2.50)	6.97*** (1.54)	6.16*** (1.36)

a. $\log(total\ students)$
b. $\log(total\ expenditures)$
c. log(*property tax per pupil revenue*)
*p<0.05, **p<0.01, ***p<0.001

Table A5.
The DRD Effects of SB55 on Instructional Resource Allocation (comparison)

$n_j = 48, n_{ij} = 288$	Null Model	Model 1:	Model 2: Model 1 + District Size	Model 3: Model 2 + Student Levels	Model 4: Model 3 + Student Characteristics	Model 5: Model 4 + District Expenditures
Intercept:		57.27*** (1.24)	36.82** (12.32)	28.88* (12.41)	39.02*** (10.76)	121.17*** (18.69)
%Change in Ins. Resource Allocation		2.18* (0.93)	2.16* (0.93)	2.54** (0.94)	2.80** (0.96)	2.85** (0.93)
SB55		-4.77** (1.51)	-7.60*** (2.26)	-6.95** (2.28)	-3.61~ (2.10)	-2.61 (1.96)
Year		0.20 (0.15)	0.20 (0.15)	0.21 (0.15)	0.62** (0.24)	0.73** (0.23)
After Policy		-0.50 (0.38)	-0.50 (0.37)	-0.42 (0.38)	-0.74~ (0.40)	-0.38 (0.40)
SB55*Year		-1.49*** (0.37)	-1.48*** (0.37)	-1.51*** (0.37)	-1.61*** (0.40)	-1.71*** (0.39)
After Policy*Year		-0.36~ (0.21)	-0.35 (0.21)	-0.31 (0.21)	-0.65* (0.27)	-0.17 (0.27)
SB55*Year*After		1.37** (0.52)	1.41** (0.52)	1.31* (0.52)	1.40* (0.55)	1.56** (0.53)
Total Students[a]			1.96~ (1.18)	1.58 (1.17)	0.77 (0.98)	8.98*** (1.91)
%Primary				13.67~ (7.28)	8.51 (10.67)	12.47 (10.35)
%Middle				8.69 (14.34)	4.79 (16.22)	2.55 (15.65)
%Secondary				14.30~ (8.40)	0.90 (11.80)	9.34 (11.43)
%IEP Students					-8.82* (4.40)	-5.74 (4.29)
%Free Lunch					1.44 (1.32)	1.02 (1.27)
%Black					1.46 (8.18)	3.02 (7.87)
%Latino					23.74~ (12.94)	26.11* (12.20)
%Asian					-4.89 (21.97)	15.35 (22.21)
%Native					73.51 (180.63)	50.71 (172.64)
%White					10.18 (8.10)	8.25 (7.81)
Total Expenditures[b]						-9.11*** (1.87)
Property Tax PPR[c]						0.47 (0.88)
Level One Error Variance	2.06*** (0.19)	1.84*** (0.17)	1.83*** (0.17)	1.78*** (0.16)	1.78*** (0.16)	1.67*** (0.15)
Level Two Error Variance	11.50*** (2.42)	10.84*** (2.28)	10.58*** (2.23)	10.13*** (2.13)	6.28*** (1.38)	5.26*** (1.15)

a. $\log(total\ students)$
b. $\log(total\ expenditures)$
c. log(*property tax per pupil revenue*)
*p<0.05, **p<0.01, ***p<0.001

Table A6.
The DID Effects of HB282 on Instructional Resource Allocation

$n_j = 222, n_{ij} = 444$	Null Model	Model 1:	Model 2: Model 1 + District Size	Model 3: Model 2 + Student Levels	Model 4: Model 3 + Student Characteristics	Model 5: Model 4 + District Expenditures
Intercept:		58.07*** (0.83)	59.15*** (3.13)	59.28*** (4.34)	55.44*** (4.60)	98.29*** (12.09)
%Change in Ins. Resource Allocation		0.30 (0.38)	0.30 (0.38)	0.30 (0.38)	0.31 (0.38)	0.42 (0.38)
HB282		-2.54** (0.85)	-2.41* (0.94)	-2.59** (0.96)	-2.27* (0.98)	-1.72~ (0.95)
After Policy		-0.59*** (0.09)	-0.59*** (0.09)	-0.58*** (0.09)	-0.58*** (0.09)	-0.27* (0.12)
Total Students[a]			-0.12 (0.33)	-0.14 (0.34)	0.39 (0.35)	4.86** (1.45)
%Primary				2.77 (5.04)	11.07 (7.39)	10.16 (7.25)
%Middle				-2.19 (7.89)	9.01 (9.58)	14.22 (9.52)
%Secondary				-2.73 (5.35)	5.46 (7.75)	10.18 (7.67)
%IEP Students					2.80 (5.92)	7.95 (5.90)
%Free Lunch					0.69 (2.01)	-1.47 (2.16)
%Black					-14.00* (6.40)	-11.96~ (6.33)
%Latino					6.99 (8.88)	6.39 (8.63)
%Asian					-44.06** (15.76)	-8.71 (17.07)
%Native					-142.01 (113.98)	-141.25 (112.49)
%White					-8.61 (6.26)	-9.16 (6.18)
Total Expenditures[b]						-4.46** (1.47)
Property Tax PPR[c]						-0.69 (0.55)
Level One Error Variance	1.05*** (0.10)	0.89*** (0.08)	0.89*** (0.08)	0.88*** (0.08)	0.88*** (0.08)	0.87*** (0.08)
Level Two Error Variance	8.29*** (0.84)	8.06*** (0.81)	8.05*** (0.81)	8.08*** (0.81)	6.92*** (0.71)	6.33*** (0.66)

a. $\log(total\ students)$
b. $\log(total\ expenditures)$
c. log(*property tax per pupil revenue*)
*p<0.05, **p<0.01, ***p<0.001

Table A7.
The RD Effects of HB282 on Instructional Resource Allocation

$n_j = 13, n_{ij} = 130$	Null Model	Model 1:	Model 2: Model 1 + District Size	Model 3: Model 2 + Student Levels	Model 4: Model 3 + Student Characteristics	Model 5: Model 4 + District Expenditures
Intercept:		57.92*** (0.83)	53.50** (14.43)	31.71~ (16.82)	48.14** (14.92)	105.09** (31.64)
%Change in Ins. Resource Allocation		-0.07 (0.17)	-0.06 (0.17)	-0.16 (0.20)	0.01 (0.30)	-0.04 (0.28)
Year		-0.13 (0.12)	-0.12 (0.12)	-0.04 (0.13)	-0.05 (0.24)	0.19 (0.26)
After Policy		-0.30 (0.50)	-0.29 (0.50)	-0.46 (0.50)	-0.56 (0.57)	-0.43 (0.56)
Total Students[a]			0.49 (1.59)	1.24 (1.58)	-0.15 (1.36)	-0.37 (2.64)
%Primary				18.20~ (10.13)	-4.19 (14.96)	-4.21 (14.32)
%Middle				14.68 (17.44)	9.15 (18.56)	14.00 (17.82)
%Secondary				11.12 (12.12)	-3.44 (15.24)	0.77 (14.65)
%IEP Students					-0.26 (6.18)	-1.63 (5.92)
%Free Lunch					-2.27 (3.40)	-4.85 (3.33)
%Black					10.35 (8.17)	11.11 (7.79)
%Latino					42.54 (10.06)	44.02*** (9.52)
%Asian					-201.26* (90.03)	-53.38 (94.45)
%Native					-27.84 (235.65)	21.22 (224.83)
%White					15.56~ (8.40)	15.93 (8.07)
Total Expenditures[b]						-1.84 (2.81)
Property Tax PPR[c]						-3.04** (1.00)
Level One Error Variance	2.26*** (0.30)	1.89*** (0.25)	1.89*** (0.25)	1.84*** (0.24)	1.80*** (0.24)	1.65*** (0.23)
Level Two Error Variance	7.83** (3.16)	7.87** (3.16)	7.63** (3.14)	6.85** (2.85)	1.09* (0.64)	0.87~ (0.55)

a. $\log(total\ students)$
b. $\log(total\ expenditures)$
c. log(*property tax per pupil revenue*)
*p<0.05, **p<0.01, ***p<0.001

Table A8.
The DRD Effects of HB282 on Instructional Resource Allocation

$n_j = 222, n_{ij} = 2220$	Null Model	Model 1:	Model 2: Model 1 + District Size	Model 3: Model 2 + Student Levels	Model 4: Model 3 + Student Characteristics	Model 5: Model 4 + District Expenditures
Intercept:		57.92*** (0.80)	62.95*** (2.58)	60.73*** (3.26)	57.75*** (3.37)	113.49*** (6.22)
%Change in Ins. Resource Allocation		0.69 (0.56)	0.69 (0.56)	0.69 (0.56)	0.66 (0.56)	0.78 (0.55)
HB282		-2.97*** (0.88)	-2.34* (0.93)	-2.16* (0.93)	-1.49 (0.94)	-0.59 (0.92)
Year		0.09** (0.03)	0.09** (0.03)	0.09** (0.03)	0.16** (0.05)	0.40*** (0.06)
After Policy		-0.99*** (0.14)	-0.99*** (0.14)	-0.99*** (0.14)	1.09*** (0.15)	-0.76*** (0.15)
HB282*Year		-0.21 (0.14)	-0.22 (0.14)	-0.19 (0.14)	-0.18 (0.14)	-0.17 (0.13)
After Policy*Year		-0.16*** (0.05)	-0.17*** (0.05)	-0.17*** (0.05)	-0.24*** (0.06)	-0.17** (0.06)
HB282*Year*After		0.10 (0.19)	0.10 (0.19)	0.06 (0.19)	0.03 (0.19)	0.08 (0.19)
Total Students[a]			-0.56* (0.27)	-0.53~ (0.27)	-0.15 (0.28)	6.20*** (0.67)
%Primary				2.40 (2.21)	2.39 (2.93)	2.76 (2.86)
%Middle				-6.08~ (3.44)	-5.67 (3.86)	-3.64 (3.78)
%Secondary				8.22** (2.90)	7.79* (3.48)	8.44* (3.41)
%IEP Students					-2.53 (1.62)	-0.77 (1.59)
%Free Lunch					1.27 (0.87)	1.14 (0.87)
%Black					-4.57* (2.28)	-2.49 (2.24)
%Latino					15.82** (5.22)	14.75** (5.11)
%Asian					-13.72 (8.60)	-4.24 (8.62)
%Native					13.72 (44.83)	23.47 (43.73)
%White					1.11 (2.03)	1.49 (1.98)
Total Expenditures[b]						-6.72*** (0.65)
Property Tax PPR[c]						0.74* (0.30)
Level One Error Variance	2.53*** (0.08)	2.30*** (0.07)	2.29*** (0.07)	2.27*** (0.07)	2.26*** (0.07)	2.15*** (0.07)
Level Two Error Variance	7.15*** (0.70)	6.85*** (0.67)	6.92*** (0.68)	6.90*** (0.68)	5.89*** (0.59)	5.65*** (0.58)

a. $\log(total\ students)$
b. $\log(total\ expenditures)$
c. log(*property tax per pupil revenue*), *p<0.05, **p<0.01, ***p<0.001

Table 12. The DID Effects of HB282 on Instructional Resource Allocation (comparison)

$n_j = 40, n_{ij} = 80$	Null Model	Model 1:	Model 2: Model 1 + District Size	Model 3: Model 2 + Student Levels	Model 4: Model 3 + Student Characteristics	Model 5: Model 4 + District Finances
Intercept:		58.07*** (0.98)	38.22* (16.17)	31.34~ (16.48)	60.09** (18.78)	251.54*** (37.48)
%Change in Ins. Resource Allocation		0.17 (0.52)	0.20 (0.52)	0.20 (0.54)	0.20 (0.54)	0.40 (0.43)
HB282		-2.23~ (0.85)	-2.62* (1.22)	-3.53* (1.33)	-1.84 (1.78)	-0.75 (1.63)
After Policy		-0.45 (0.30)	-0.44 (0.30)	-0.27 (0.32)	-0.46 (0.32)	1.02** (0.36)
Total Students[a]			2.19 (1.78)	1.82 (1.71)	-0.97 (1.85)	18.32*** (3.72)
%Primary				29.56~ (15.02)	78.04* (29.55)	43.77 (28.53)
%Middle				-23.08 (36.39)	86.10~ (47.40)	59.21 (40.58)
%Secondary				5.60 (17.06)	56.70 (35.13)	45.45 (31.58)
%IEP Students					6.73 (18.11)	19.53 (15.48)
%Free Lunch					3.73 (5.83)	-1.67 (5.70)
%Black					-74.86* (30.00)	-34.36 (28.37)
%Latino					-34.30 (31.77)	7.97 (30.15)
%Asian					-78.15~ (39.42)	8.21 (40.47)
%Native					-555.77 (409.02)	-669.76~ (367.34)
%White					-64.58* (30.14)	-35.50 (27.97)
Total Expenditures[b]						-21.34*** (3.79)
Property Tax PPR[c]						1.32 (1.42)
Level One Error Variance	1.27*** (0.28)	1.18*** (0.26)	1.18*** (0.26)	1.22*** (0.28)	1.17*** (0.27)	0.69*** (0.17)
Level Two Error Variance	12.22*** (2.88)	11.25*** (2.65)	10.89*** (2.57)	9.51*** (2.34)	5.30*** (1.36)	4.76*** (1.26)

a. $\log(total\ students)$
b. $\log(total\ expenditures)$
c. log(*property tax per pupil revenue*)
*p<0.05, **p<0.01, ***p<0.001

Table A9.
The DRD Effects of HB282 on Instructional Resource Allocation

$n_j = 40, n_{ij} = 400$	Null Model	Model 1:	Model 2: Model 1 + District Size	Model 3: Model 2 + Student Levels	Model 4: Model 3 + Student Characteristics	Model 5: Model 4 + District Expenditures
Intercept		57.92*** (0.88)	45.88*** (9.39)	34.13** (10.58)	33.61** (10.57)	113.82*** (18.35)
%Change in Ins. Resource Allocation		0.53 (0.60)	0.54 (0.60)	0.40 (0.60)	0.27 (0.60)	0.39 (0.60)
HB282		-2.52* (1.12)	-2.74* (1.11)	-2.51* (1.14)	-2.90* (1.20)	-2.31* (1.08)
Year		0.07 (0.08)	0.06 (0.08)	0.08 (0.09)	0.08 (0.13)	0.38** (0.14)
After Policy		-0.83* (0.34)	-0.81* (0.34)	-0.76* (0.34)	0.77* (0.37)	-0.46 (0.37)
HB282*Year		-0.19 (0.15)	-0.18 (0.15)	-0.12 (0.15)	-0.12 (0.15)	-0.09 (0.15)
After Policy*Year		-0.18 (0.12)	-0.18 (0.12)	-0.21~ (0.12)	-0.19 (0.15)	-0.19 (0.15)
HB282*Year*After		0.12 (0.21)	0.13 (0.21)	0.06 (0.21)	0.02 (0.22)	0.06 (0.22)
Total Students[a]			1.33 (1.03)	1.57 (1.03)	1.48 (1.01)	6.02*** (1.54)
%Primary				10.96~ (5.85)	1.53 (8.04)	2.72 (7.85)
%Middle				3.30 (8.50)	-2.59 (10.05)	-2.27 (9.85)
%Secondary				13.41~ (7.35)	6.78 (9.47)	11.63 (9.29)
%IEP Students					-0.83 (3.87)	-0.74 (3.80)
%Free Lunch					4.45* (2.18)	2.92 (2.10)
%Black					3.83 (5.70)	4.12 (5.53)
%Latino					26.64** (9.51)	30.05*** (8.07)
%Asian					-4.89 (15.64)	14.02 (14.98)
%Native					78.57 (123.41)	81.91 (120.82)
%White					8.61 (5.45)	7.90 (5.33)
Total Expenditures[b]						-6.40*** (1.54)
Property Tax PPR[c]						-0.90 (0.71)
Level One Error Variance	2.13*** (0.16)	1.86*** (0.14)	1.86*** (0.14)	1.84*** (0.14)	1.83*** (0.14)	1.78*** (0.13)
Level Two Error Variance	9.93*** (2.27)	9.05*** (2.07)	8.56*** (1.97)	8.26*** (1.93)	5.50*** (1.39)	3.72*** (0.94)

a. $\log(total\ students)$
b. $\log(total\ expenditures)$
c. log(*property tax per pupil revenue*)
*p<0.05, **p<0.01, ***p<0.001

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