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ROBIN HOOD AND HIS NOT-SO-MERRY PLAN: CAPITALIZATION AND THE SELF-DESTRUCTION OF TEXAS' SCHOOL FINANCE EQUALIZATION PLAN

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In this paper, we show how Texas' "Robin Hood" school finance scheme derailed itself in less than a decade. The Robin Hood system is approaching collapse: it has exhausted its own capacity, has run up against its own constraints, and is likely to abandoned in 2004. We show that the nature of this collapse was predictable because Robin Hood has features that maximize inefficiency, given the amount of redistribution performed. Robin Hood's parameters caused substantial capitalization, shrinking its own tax base rapidly. Robin Hood is not an odd system: many other states' systems share its features and consequences to some degree. These problems are not inevitable: greater familiarity and understanding of school finance among economists may produce systems of school finance that are much more efficient and, thus, more stable, equalizing, and supportive of school spending.

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I. Introduction

School finance is one of the most important public policies in the United States. It can determine whether cities or suburbs grow; it can create or destroy investment in education. School finance programs govern the allocation of approximately 370 billion dollars a year in the United States. Despite their importance, these programs are poorly understood by economists. Every good public economist knows the income tax code and knows how social security earnings taxes and benefits work. But, he probably knows little about school finance. Even more worrisome is the fact that the creators of school finance formulas often lack economic expertise. They sometimes set up systems that *maximize* the deadweight loss created, given the tax revenue collected. They rarely foresee the consequences of capitalization (the response of property prices to the fiscal burdens and rewards created by the formula). Often, they do not foresee that school districts may respond to perverse incentives that the formula creates. For instance, a formula might create a strong incentive for districts to minimize reported property values or maximize the number of children who are classified as disabled.

In this paper, we show how a school finance program derailed itself. We examine Texas' so-called "Robin Hood" formula, first implemented in the 1994-95 school year. Robin Hood is not an odd system: most other states share its features to some degree. However, we focus on Robin Hood because it *strongly* exhibits all of the problems listed above. In less than a decade, the system is approaching collapse: it has exhausted its own capacity and has run up against its own constraints. We show that the nature of this collapse was predictable. States with muted versions of Texas' provisions experience the same effects to a lesser degree.

These problems are not inevitable: a few states use systems of school finance that are significantly more efficient, judged on tax efficiency grounds. We describe more efficient systems at a few points in the paper. Empirical evidence on the diverse impact of diverse school finance systems is the subject of Hoxby (2001).

II. A Useful Analogy

Before entering the world of school finance, it may be useful to illustrate some of the issues in the more familiar world of firms. Because we are going to draw an analogy between firms and school districts, suppose that firms cannot pay out income in dividends (though shareholders can benefit from capital gains and firms can repurchase shares).

Suppose that government wanted to redistribute income among firms for some reason. A straightforward scheme might take income from firms with high net return on capital and transfer it to firms with low net return on capital. This system of redistribution would naturally generate some dead weight loss, as firms were discouraged from engaging in business activities that generated returns. However, in its essential character, this tax would be no different from other taxes on income.

Instead of the tax scheme just described, the government might implement a peculiar scheme: it could take income from firms with high market capitalization per unit of book capital and transfer it to firms with low market capitalization per unit of book capital. What would this scheme do? First, like redistribution based on return to capital, the scheme would discourage business activities that generated returns. Increased return on capital raises market capitalization and would thus trigger higher taxes (smaller transfers).

Second, the present value of a firm's expected tax burden would be capitalized into its share price, so that firms with initially high market capitalization would see their share prices and market capitalization fall. Thus, if the government initially picked a tax rate that would raise the desired revenue given the initial distribution of firms' market capitalization, it would find itself unable to raise that revenue with that tax rate because the tax base would shrink not just as businesses cut back on real activity but in order to capitalize the tax burden itself. The government would probably raise the tax rate in hopes of getting the level of revenue it initially desired. But, this would merely set off another round of share price changes, as new expectations were capitalized. (Note well that the negative capitalization

among the initially high market capitalization firms would not fully offset by positive capitalization among the initially low market capitalization firms. This is because the cash is less valued by the recipient firms.) In short, a redistribution scheme based on market capitalization per unit of book capital is likely to be unstable and to generate a series of increases in the tax rate.

A third consequence of the peculiar scheme would be firms' altering their accounting and other practices to maximize the value of *book* capital relative to true productive capital. The higher a firm's book capital, the lower its tax. Firms might also issue more debt than they otherwise would in order to minimize their market capitalization and, thus, their tax.

Suppose that the peculiar scheme has a refinement: the government not only taxes firms according to their market capitalization-per-dollar-of-book-capital but actually confiscates 100 percent of their market-capitalization-per-dollar–of-book-capital above some threshold. This refinement would give some firms *negligible* incentive to be productive with their marginal investments since all returns would be taxed away. That is, by setting the marginal tax rate at 100 percent while setting the average tax rate lower, the government would have maximized the deadweight loss associated with the tax scheme. The "refinement" would also heighten the incentives to distort accounting and debt issuance practices.

In summary, the government's peculiar redistribution scheme would not only generate the usual deadweight loss associated with discouraging income-producing business activity (as redistribution based on return to capital would), it would also be (i) an unstable scheme with rising tax rates, (ii) a scheme that generated rising ratios of book to true productive capital, (iii) a scheme that induced rising ratios of debt to equity, (iv) a scheme that maximized deadweight loss owing to its reliance on high marginal tax rates.

III. Understanding Robin Hood

The scheme just described sounds so problematic as to be unlikely. Yet, such schemes account

for much of the $370 billion that is redistributed among school districts each year. The "peculiar scheme" is somewhat analogous to many American school finance systems, and it is a strict analogy of Texas' Robin Hood scheme. Most school finance systems in the United States (including Robin Hood) do the equivalent of redistributing on the basis of market capitalization, rather than return on capital. A good many school finance systems (including Robin Hood) do the equivalent of redistributing based on book values that can be manipulated. Robin Hood (alone) uses a confiscation system that maximizes deadweight loss.

In reading the description of Robin Hood below, keep the following parallels in mind. A district's public school spending is analogous to the firm's investment. A districts' property tax base is analogous to a firm's market capitalization. The relationship between weighted and actual students is analogous to the relationship between book capital and true productive capital.[1] (To take the analogy all the way, it might help to think that the primary reason for redistribution is that residents of some districts are wealthier and give their districts access to "cheaper capital." Thus, the goal of the redistribution is to undo differences among "shareholders" created by their initial, unequal access to wealth.)

A. The Origins of Robin Hood

Texas' Robin Hood formula came about in a fairly typical way. A 1984, a group of school districts sued the state, charging that the then-current system of school finance was unconstitutional. The Supreme Court of Texas found the system to be unconstitutional in 1989, and the Texas legislature then proceeded to enact new systems of school finance. The first two systems took effect in the 1990-91 and 1992-93 school years, respectively, and were also found to be unconstitutional. The third system was Robin Hood. It was implemented in the1994-1995 school year and found to be constitutional by the

[1] More accurately, the relationship between weighted students and true student educational needs is analogous to the relationship between book capital and true productive capital.

Supreme Court of Texas. Such back and forth between courts and legislatures is not unusual.[2]

Robin Hood's structure is fairly common. Like all states, Texas' underlying school finance system is based on local property taxes, which are paid to school districts and generate local spending. On top of this base are layered three "tiers:" a foundation aid system, a guaranteed revenue system, and a confiscation system. All three tiers are based on a district's property value per "weighted pupil." A weighted pupil is not an actual pupil. Students' disabilities, limited English proficiency, need for compensatory education, and other conditions are converted into weights, so that a student may count as multiple students. A district with a high property value per weighted pupil is commonly described as "property-rich;" a district with low property value per weighted pupil is "property-poor." Keep in mind that a district can be property-poor either through a low property tax base per actual pupil or through a high ratio of weighted pupils to actual pupils. Hereafter, we use the word "pupil" to refer to an actual pupil, and we use the abbreviation WADA (weighted pupil in average daily attendance) to refer to a weighted pupil.[3]

B. The Confiscation System

In describing Texas' system, it is best to start with the confiscation system.[4] Under this system, a district's property tax base per weighted pupil is divided into two pieces: that below and that above the confiscation threshold. The threshold was initially set at $280,000 per WADA in 1994. When a district enacts a property tax rate, the taxes paid on the below-threshold part go into the district's own coffers. The taxes paid on the above-threshold part go into the state's coffers and use then used to fund aid to other districts. In effect, the state has confiscated the property tax base above the threshold, although the

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[2] In some states, however, dramatic changes in the laws are made purely through legislature effort, with no court rulings (see Hoxby 2001).

[3] Specifically, a pupil is a student in average daily attendance.

[4] The confiscation system is also called "recapture" and Chapter 41, after its place in the Texas Code.

district continues to be able to set the property tax rate (up to limit, as we shall see).[5]

Figure 1 illustrates the budget constraint and spending choice for a property-rich district that is operating under purely local school finance. It is a standard figure, displayed simply to acquaint the reader with its elements. On the horizontal axis in the right-hand quadrant is school spending per pupil *(g)*. On the horizontal axis in the left-hand quadrant is units of fully-taxed property in the district *(H)*.[6] On the vertical axis is the price per unit of property (P_H) and the gross-of-tax cost of a unit of property ($P=P_H(1+\tau)$). The difference between P_H and P is the tax paid per unit of property τP_H –put another way, it is a measure of the *loss* in non-housing consumption that a person experiences when he pays property taxes. For the purposes of the graph, the property tax rate τ is defined in such a way that it generates *per pupil* revenue from tax payments. Note that the property tax rate can be deduced from the figure by examining the ratio of the length of the segment labeled "tax per unit of housing" to the length of the segment from the origin to P_H^0. The line labeled BC^0 is the district's per-pupil budget constraint, given by the equation:

$$g = \tau P_H H \quad or \quad P = P_H + \frac{g}{H}.$$

The slope of the budget constraint is the marginal tax price of a dollar of per-pupil spending. For graphical exposition, we treat the amount of property consumed under pure local finance (H^0) as one unit. This makes the budget constraint have a 45 degree slope under local finance, which should help to remind us that the marginal tax price of a dollar of per-pupil spending is one under local finance.

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[5] The confiscation of wealth program is written in a peculiar way that is designed to skirt issues of unconstitutionality in Texas. See below for more on this.

[6] Typically, the supply of fully taxed property is assumed to have some elasticity even though jurisdictions' boundaries do not change. The idea is that there is usually some undeveloped property or low grade commercial property that can be developed as, say, residential property and made thereby to generate more tax revenue.

Because marginal tax prices can be infinite, it is often convenient to use the inverted marginal tax price, which is the amount that a district gets to spend if it raises an additional dollar. Finally, note that the scales used in the figure are not realistic: they are designed to allow readers to see the differences among curves.

Figure 1 illustrates an initial equilibrium. The indifference curve of the deterministic voter in the district is tangent to the budget constraint at a point such that the district spends g^0 per pupil and each household pay taxes of $\tau^0 P_H^0$ per unit of housing it consumes. The price of a unit of property, P_H, generates a supply of housing equal to H^0; and the gross-of-tax cost of a unit of property, P, generates a demand for housing equal to H^0.

Figure 2 shows what the state projects the property-rich district will do after the confiscation system is enacted. State projections assume that property-rich districts do not cut their local spending in response to increases in the marginal tax price, do not cut their consumption of housing in response to an increase in its gross-of-tax cost; and do not see the tax burden capitalized into their property prices. That is, the state projects that property-rich districts will simply raise their tax rate to keep their spending the same in the face of confiscation and that nothing else will change. In Figure 2, this "hoped-for" response is shown by the budget constraint labeled "$BC^{hoped\ for}$" and labeled, hoped-for tax payments to the local district and state. Of course, what the state projects is not an equilibrium. The indifference curve of the deterministic voter is not tangent to $BC^{hoped\ for}$ at the initial level of school spending, g^0, and the supply of housing in the district outstrips the demand, which has fallen because of the higher gross-of-tax cost of housing in the district. Observe that the slope of $BC^{hoped\ for}$ will be steeper the higher is the marginal tax price or, equivalently, the larger is the share of property tax wealth that is confiscated. This is because, with confiscation, the district pays a dollar of property taxes, but only get to spend a fraction of that dollar, so its marginal tax price is ratio of the district's property wealth per pupil *(v)* to the confiscation threshold per pupil *(l)*. Finally, note that $BC^{hoped\ for}$ turns vertical at some point: this is caused by the

limit on the property tax *rate* that was imposed in coordination with the confiscation scheme. We will have more to say about the limit later.

Figure 2 has already shown that property prices must fall in the property-rich district: its existing residents want to consume less property than is supplied at current prices. This response is akin to the usual response of consumption when it is taxed. But, property prices will also capitalize the tax burden because of the new equilibrium *among* districts. That is, people will be deterred from residing in the property-rich district at all, and property prices will fall commensurately. Figure 3 shows how this happens.

Figure 3 shows the pre-confiscation and hoped-for tax and spending choices of the property-rich district. It also shows the choices of an intermediate district that is insufficiently property-rich to experience confiscation but is also insufficiently property-poor to get state aid. An initial inter-district equilibrium is defined by the existence of an equilibrium within each district (as shown in Figure 1) and "boundary" individuals like the one whose indifference curve is illustrated in Figure 3. Initially, the boundary individual is just indifferent between living in the property-rich district, where he will experience more school spending and pay more tax than he would most prefer, and living in the intermediate district, where he will experience lower school spending than pay less tax than he would most prefer. After the confiscation scheme is enacted, the boundary individual is no longer indifferent: he strictly prefers the intermediate district. Indeed, the figure is drawn in such a way that the intermediate district is strictly preferred by all of the residents of the property-rich district who preferred school spending less than its former deterministic voter. (To see that the initial deterministic voter would become the new boundary individual if the hoped-for budget constraint prevailed in the property-rich district, mentally extend his top indifference curve –which is tangent to $BC^{hoped\ for}$– and see that it runs right through the choice of the intermediate district.)

The point of Figure 3 is that property prices fall in the property-rich district, not just because

property consumption is taxed but also because of capitalization. The result is that the hoped-for budget constraint and choices do not prevail. Instead, there is a new equilibrium like that shown in Figure 4. In Figure 4, the property-rich district has lower property prices, which have re-equilibriated the housing market and limited the outflow of residents to the intermediate district. With lower property prices, the district has less property confiscated, faces a lower marginal tax price, and has a budget constraint with a lower intercept and slope (BC^1). At the new equilibrium, the district is spending a little less per-pupil than it did at the initial equilibrium, owing to standard income and substitution effects of a rise in the price of school spending. The dramatic difference is, however, between what the state hoped to collect in tax payments and what it does collect (see labeled lengths in figure). The reason that these amounts are so different is that, under a confiscation system, the property wealth that is lost through capitalization affects only the part of district's property tax base that now effectively belongs to the state.

Going forward, keep in mind the shortfall between the state's hoped-for revenue and its actual revenue from the property-rich district.

C. The Foundation Aid System

Foundation aid systems are easiest to understand them if we think of the state as having converted some local property taxes into a state property tax, which it collects and uses to make a lump-sum grant to each district. The part of the local property tax rate that is converted into a state property tax is known as the foundation tax rate. For instance, in Texas, the foundation tax rate is the first 8.6 mils of each district's property tax rate.[7] In return for paying 8.6 mils to the state, each district receives a

[7] The foundation system is called "Tier 1" in Texas. For convenience, property tax rates are usually expressed in mils or thousandths. Thus, a 10 mil rate is a 1 percent tax on property. In Texas, property tax rates are usually expressed as cents per hundred dollars of property value (8.6 mils equals 86 cents per hundred). To make the Texas system easy to compare with those of other states, we express everything in mils in this paper.

lump sum grant per WADA, called the foundation grant.[8] A foundation aid system can redistribute a good deal of revenue because districts that are property-poor on a weighted pupil basis will contribute far less than they get in grants. In many states, the foundation aid tax rate is set so that the system is self-supporting: the property-rich districts' payments fund all of the aid to the property-poor districts.

In Texas, the foundation aid system cannot be self-supporting because the property-rich districts that would ordinarily be net contributors to the foundation system are already contributing much of their property tax revenue through the confiscation system. In other words, the state cannot take 8.6 mils of their property tax revenue because it has already confiscated 100 percent of the property tax revenue associated with the base that makes property-rich districts rich. The amount confiscated from a property-rich district is, in practice, larger than the amount it would have contributed under a self-supporting foundation aid system.

There is a always a self-supporting foundation aid system that raises the same funds as a confiscation system –the foundation tax rate must simply be adjusted. We shall see (below) that a self-supporting foundation aid system is more efficient than a confiscation system plus a partial foundation aid system. So, why does Texas use the peculiar combined confiscation plus foundation aid system?

The answer is that Texas has a constitutional ban on statewide property taxes. A self-supporting foundation aid system would too obviously impose a statewide property tax.

If one looks only at the letter and not the spirit of the law, the confiscation of wealth system appears to be constitutional because it rests on a bizarre fiction. Legally, a property-rich district does not *have* to allow its above-threshold revenue to be confiscated. It is simply the case that, if it refuses to "voluntarily" contribute this revenue, the state will redraw districts until the property-rich district has property wealth

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[8] Districts do not actually send checks to the state and then receive checks in return. The state computes the district's net receipt or payment and only that amount is transferred. Below, we shall that, in Texas, the foundation aid system has a peculiar limit on net payments, owing to the interaction between foundation aid and the confiscation of wealth system.

below the threshold. Districts can be redrawn without regard to geographic contiguity so that a poor inner-city neighborhood could, in theory, become part of an affluent suburban district halfway across the state. Similarly, part of an property-rich district could, in theory, be detached and re-attached to a poor district hundreds of miles away. Naturally, to avoid the serious management problems that haphazard district boundaries would generate, property-rich districts "voluntarily" contribute revenue. Many people find Texas' pseudo-voluntary scheme confusing, and this is not surprising because it was *designed* to disguise the effective imposition of a statewide property tax.

Figure 5 shows a property-poor district under purely local finance. Compared to the property-rich district under local finance (Figure 1), the property-poor district has less pricey property and spends less on schools. Its budget constraint, BC^0, is such that if the district raises one dollar of property tax revenue, it spends one dollar on its local schools.

Figure 6 shows the property-poor district with a foundation aid system (and a guaranteed revenue system, which we have not yet described). In order to focus on the foundation aid system, notice the length labeled "foundation grant from the state" and connect it visually to the dashed line: this is the budget constraint that would prevail under a foundation system if property prices stayed the same when the system was enacted. The property-poor district's initial budget constraint (BC^0) has its bottom end lopped off because the district's per-property unit contribution to the foundation aid system is given by the foundation tax rate (τ_F) times its property price (P_H). In return, the district receives the foundation grant per pupil (F). Because the foundation grant is larger than what the property-poor district has paid in foundation taxes, the with-foundation-aid budget constraint is shifted out relative to the purely local budget constraint. Nevertheless, over much of its length, the with-foundation-aid budget constraint has the same slope as the no-state-intervention budget constraint. Thus, at least at first glance, foundation aid systems do not distort a district's marginal incentives to spend on schools. (This is not quite true, owing to the fact that a positive foundation grant will raise the demand for housing in the district. However, it

is a reasonable first approximation.) By a parallel logic, a property-rich district does not have marginal incentives that are much distorted, under a self-supporting foundation system. This is shown in Appendix 1. In general, foundation systems are significantly closer to being lump sum and have substantially smaller deadweight loss than confiscation of wealth systems.

D. The Guaranteed Revenue System

Like many other states, Texas has a guaranteed revenue system that lies on top of its foundation system. Beyond the 8.6 mils that districts contribute to the foundation system, districts may choose another property tax rate (called the "Tier II rate"). Each mil of a district's Tier II property tax rate is *guaranteed* to produce at least a certain revenue per weighted pupil, regardless of the district's own property tax base. The state fulfils this guarantee by contributing revenue when a district's own property tax base would generate insufficient revenue. If a district's property tax base generates as much or more revenue than the guaranteed level, it is left alone in Tier II, neither contributing to nor receiving aid. (Keep in mind that property-rich districts do not get all the revenue associated with their Tier II rates because the part associated with their above-threshold property wealth is confiscated.)

Under a guaranteed revenue system, a property-poor might only have to pay five cents in property taxes for every dollar of revenue it receives. This is such an attractive price for school spending that property-poor districts might be tempted to spend with abandon because nearly all of the money is coming from the state's or other districts' coffers. To prevent such overspending, every guaranteed revenue system has an upper limit on the property tax rate for which state will fulfil the guarantee. In Texas, a district's Tier II rate is capped at 6.4 mils and its total property tax rate is capped at 15 mils (8.6 mils for the foundation system and up to 6.4 mils for Tier II). Although it is necessary to have a cap on the rate that is guaranteed, an overall cap is unnecessary –most states simply make a district revert to pure local finance once it gets over the guaranteed rate. Texas' overall 15 mil cap is politically

motivated.[9]

Figure 6 illustrates how the guaranteed revenue system fits on top of the foundation system. The budget constraint labeled "$BC^{\text{if property prices stay same}}$" shows that the property-poor district first receives its foundation grant and then faces a marginal tax price for school spending that is well below one. Specifically, the slope of the with-guaranteed-revenue budget constraint is given by the ratio of the per-WADA revenue guarantee to the district's per-WADA property tax base times one mil:

$$\frac{r}{\left(\frac{1}{1000}\right) P_H H}.$$

(The one mil in the denominator is there because the guarantee is defined on a per mil basis. The budget constraint turns vertical where the district reaches the property tax rate cap.

Figure 6 illustrates what the state would like to have happen to a poor district getting foundation and guaranteed revenue aid. The district is paying just a bit more property tax than it was paying under purely local finance, yet its schools are spending much more per pupil. The district is getting no only the foundation grant but also guaranteed revenue payments from the state (see labeled length). Figure 6 assumes, however, that the district's property prices do not change when it receives such aid. This is

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[9] The overall 15 mil cap appeals to the property-poor districts because they not only desire sufficient school spending themselves but also want to ensure that property-rich districts cannot spend much more than they can. This want appears to be poorly thought-out. The property-poor districts no more interest in preventing rich families from spending their own money on unnecessary luxuries in school, such as fancy insignia clothing or gourmet lunches, than they have in preventing rich families from buying jewelry or fancy furniture. Also, the property-poor districts should not try to prevent property-rich districts from spending their own money on marginal inputs that they think are educationally productive, such as new technology. If the property-poor districts want to make a case for some input being so necessary that it must be included in the foundation grant, they need to have evidence that property-rich districts are buying it uniformly with their own money.

unlikely.

Figure 7 shows why property prices change. The figures compares the property-poor district with district that is more intermediate (less poor, but still poor enough to receive some state aid). Initially, both districts are in internal equilibrium under local finance, and the indifference of their "boundary" individuals shows that they are also in inter-district equilibrium. With the new state aid programs, there will be a new boundary individual. Looking closely, it will be seen that the new boundary individual has a greater preference for school spending than the old boundary individual (the indifference curve is less flat). Put another way, the property-poor district can now attract an individual with more taste for school spending because the district gets to spend more per pupil. If the property-poor district is more attractive, it must be the case that its property prices rise to re-equilibriate the housing market –that is, to capitalize the fiscal benefit it has received. Realistically, however, such price increases will be limited by the fact that the property-poor district is mainly drawing residents from other districts that have *also* been given state aid (though a smaller amount).

Figure 8 shows the property-poor district's equilibrium with state aid, taking into account the rise in its property prices. Because its property prices have risen to capitalize the aid, the district makes greater tax payments than the state expected, it gets less guaranteed revenue aid than the state expected, and it spends less on schools than the state expected. However, the differences between the state's expectations and what actually occurs is likely to be rather small. Finally, notice how easy it would be for the district to locate at the kink where the budget constraint (BC^1) turns vertical –even a small change in the slope of the deterministic voter's indifference curve would put the district at the kink. That is, property-poor districts are likely to set their property tax rate at or near the cap, owing to their strong incentives to spend on schools (they pay only a small fraction of the marginal dollar).

E. The WADA (Weighted Average Daily Attendance) System

The parts of the Texas' school finance system described so far are all based on WADA, not

actual pupils. There are, of course, many details to the construction of the pupil weights. For the purposes of this paper, however, we can focus on two aspects of the system.

First, districts can face very strong incentives to increase their ratio of WADA to actual pupils. By raising WADA/pupils, property-rich districts that face confiscation can reduce their measured wealth, and thereby reduce confiscation. Property-poor districts can increase both their foundation and guaranteed revenue aid by raising WADA/pupils. Intermediate districts can increase the probability that they receive foundation or guaranteed revenue aid and decrease the probability that they experience confiscation. Essentially, every child who gets a weight makes a district appear to be more property-poor.

Second, although some weights are for conditions that require little or no local judgement (blindness, deafness), other weights are for conditions that do require local judgement. In practice, these are conditions in which there is a spectrum of difficulty, where a low level of difficulty is considered to be part of the normal variation among children and a high level of difficulty is considered to be a disability that requires special treatment: limited English proficiency, speech impairment, learning disability, emotional disturbance. The procedures for classifying students into these disabilities make it clear that much local discretion is used.[10] In addition, the judgement-sensitive disabilities receive non-trivial weights. One full-time equivalent pupil in speech therapy is 5 WADAs. One full-time equivalent resource room pupil is 3 WADAS (resource rooms are typically assigned to learning disabled students). In Dallas, more than 98 percent of the students who have weights greater than one are students in judgement-sensitive categories. Students in judgement-sensitive categories account for 95 percent of the difference between WADA and pupils.[11] Cullen (2003) shows that these percentages are typical for Texas.

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[10] See Texas Education Agency, Division of Special Education (2002).

[11] Authors' calculations using *Summary of Finances*, 2003.

In short, the easiest way for a district to increase its revenue is to get the maximum out of the WADA system, given the schooling it means to give students. The weights are designed to help cover the costs of the *average* student who is in a category. Therefore, a district will gain if it can put students into categories where they are *marginal* candidates for classification. Because classification requires local judgement, it may be quite possible for districts to gain via such accounting practices. Indeed, there are now established WADA consultants, whom districts employ to help them get the most out of the system.

WADA accounting may make few people happy. Parents with infra-marginal disabled children may feel that the disability staff devote too much effort to classifying marginal children and too little effort to serving seriously disabled students. Parents with children who are just at the margin of being classified may worry that their child is overclassified and would be better off in a regular classroom or without a label. Parents with children who have no disability or near disability may feel that the school administration is unduly concerned with disability-related paperwork and too little concerned with educating "regular" students.

IV. Robin Hood *in Toto*: Unrealized Expectations and Instability

We have shown that, under the Robin Hood system, property-rich districts experience confiscation, are likely to experience falling property prices and reduced consumption of housing, and are likely to contribute less revenue to the aid system than the state hoped they would. Property-poor districts receive aid, are likely to experience a small rise in property prices and a small increase in housing consumption, are likely to pay more local taxes than the state expected they would, and are likely to set their tax rate near or at the cap. Both property-rich and property-poor districts are likely to raised their WADA relative to their number of actual pupils. We have focused on districts at the two extremes because they are most interesting, but of course there are intermediate districts like those we showed in

Figures 3 and 7.

Our summary cannot stop here, however, because the system we have outlined is not stable. Because of capitalization, the state is getting significantly less revenue than it expected, yet it still has to make the promised foundation grants and fulfil its revenue guarantees. What can the state do? An apparently attractive option is lowering the threshold at which confiscation occurs. (In practice, the state can do this by not raising the threshold at the rate of inflation. The threshold will therefore fall in real terms). The lower threshold will confiscate more of the property of the formerly property-rich and it will also redefine as property-rich some intermediate districts that previously had too little property wealth per pupil to experience confiscation. Lowering the confiscation threshold *sounds* like a good solution, but we now know that lowering the threshold will set off another round of capitalization, so that the state will get some extra revenues, but is again likely to be disappointed. Notice, as well, that every time the state lowers the confiscation threshold, the property-rich districts will raise their tax rates, just as they did in Figure 4. Thus, they will gradually but inevitably move toward the property rate cap.

In short, what is the experience of the Robin Hood system likely to be, over several years? From the state's point of view, the system is always disappointingly short of funds and requires greater infusions from the state's general revenue than it expected to need. From the point of view of a resident of a property-rich district, the system is not only burdensome (he has lost property wealth and is sending taxes outside his district) but the system mysteriously grows more burdensome with each passing year. Moreover, if he has children in schools, he is increasingly worried about the fact that his district is gradually losing all its discretion as it approaches the property rate cap. From the point of view of the resident of an intermediate district, the system probably seemed harmless enough at its inception. But, he may have been surprised to find that, after several years, he has been declared to be property-rich and subject to confiscation. From point of view of a childless (elderly, say) resident of a property-poor district, the system is problematic: although his house is worth more according to the assessor, his

housing consumption is unchanged and he now owes more property tax, both because his house is worth more and because his district has increased its property tax rate to be near or at the cap. A resident of a property-poor district who has school-aged children probably has the rosiest view: he does pay more property tax but his children also attend a school that spends substantially more. Yet, he is likely to be anxious: his district is at or near the property tax rate cap so it has almost no discretion: it depends entirely on the foundation grant and guaranteed revenue level, which are set by the state. Yet, the state perennially complains that it is short on funding for the system. He (the resident of property-poor district with school-aged children) probably feels that he needs to fight a continuing battle at the state capitol to ensure that the system does not wither away. Many parents are likely to be dissatisfied with the WADA system because it may produce decisions that are more oriented toward maximizing revenues than giving proper treatment to the disabled and near-disabled.

In short, after several years, a system like Robin Hood is unlikely to enjoy the widespread popularity enjoyed by the man after whom it is named. Many people will feel that property taxes are rising too fast; school superintendents and parents of school-aged children are likely to feel unduly constrained; state legislators are likely to be tired of the perennial problems. Indeed, to the best of our knowledge, Texas is the only state that has been sued over its school finance system by the property-rich and property-poor at the same time.

A curious feature of the Texas Supreme Court opinion in favor of the Robin Hood system is that the Court explained how the system could become unconstitutional. The Court stated that if all districts were to reach the 15 cap, it would be obvious that districts had no discretion and that the 15 mil tax was a statewide tax.[12] The Court's statement has created a widely-recognized automatic trigger for the system's

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[12] This is a curious standard from an economist's point of view because it is evident that the combination of the foundation aid system and confiscation of wealth system already constitute a statewide property tax (mentally assign the first 8.6 mils of confiscated revenue to the foundation aid system and there you are). Nevertheless, this is the standard set by the Court.

demise. Currently, more than 80 percent of Texas pupils are in districts that are at the cap or within half a mil of the cap.[13] The system is about to become unconstitutional and few people seem motivated to resuscitate it in anything like its current form.

We wish to reemphasize that these problems are not an inevitable result of redistributive school finance. In our conclusion, we will return to the question of how Texas might have achieved and how some states achieve redistribution with fewer problems.

V. An Empirical Strategy for Testing Hypotheses about Robin Hood

We hypothesize that Robin Hood's structure has brought about its own near extinction. Specifically, we hypothesize that:

(i) Capitalization of Robin Hood drove down property prices in districts that faced confiscation. (Of course, the decrease in property prices would be *relative* to what prices would have otherwise been, given income and population growth in Texas.)

(ii) Owing to capitalization, the revenues contributed by property-rich districts to the Robin Hood system were insufficient to fund the intended aid. As a result, the state reduced the confiscation threshold in real terms and could not allow the foundation grant or the guaranteed revenue level grow with the demand for school spending.

(iii) As a result of the confiscation threshold falling in real terms, an increasing number of districts were subjected to confiscation.

(iv) As a result of capitalization, districts that faced confiscation could not keep up with the demand for school spending without raising their property tax rates. Such districts were gradually pushed toward the 15 mil cap on property taxes.

(v) The property tax burden on the average household in a property-poor district grew, primarily

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[13] The source is Texas Education Agency, Summary of Finances 2003-04.

because Robin Hood induced districts to set property tax rates at or near the cap.

(vi) Districts will have increased their WADA/ADA ratio depending on their financial incentives to do so (a function of where they are in the school finance system) and on the density of students in the district who are marginal candidates for classification into a weighted category.

A. Parameters that Describe the School Finance System

Most systems of school finance can be described by a few parameters:

(i) the marginal tax price facing a district –that is, the slope of its budget constraint;

(ii) the foundation tax –that is, the difference between the vertical intercept of pure local finance budget constraint and the vertical intercept of the with-foundation-aid budget constraint;

(iii) the foundation grant;

(iv) the property tax rate cap;

(v) the effect of a change in WADA/pupil on its revenue;

(vi) the effect of a district's property prices on its spending, holding its tax rate constant;.

Parameters (i) through (v) affect a district's internal equilibrium. Parameter (vi) affects the equilibrium *among* districts –that is, it determines the extent of capitalization. Observe that, for econometric estimation, the net effect of the foundation tax and grant can be summarized by a virtual lump-sum tax–that is, the projection of the relevant segment of the budget constraint onto the vertical axis.

B. Our Empirical Strategy

Our empirical strategy is straightforward because, at heart, we are analyzing one big policy change in school finance. Of course, the Robin Hood formula affected different districts differently, but the differences are not random but related to districts' prior positions. Therefore, it is best to think of the timing of Robin Hood as the main source of exogenous variation: we will look for districts to deviate from their prior behavior with timing that makes it appear that they are reacting to Robin Hood. Because

we want the Robin Hood parameters that a district faces to reflect only the impact of the law, not the district's endogenous response to it, we use simulated parameters. That is, for each year, we take each district's before values of property value and so on, inflate them, and run them through the contemporary school finance laws to determine what marginal tax price, foundation tax, *et cetera* would have been with Robin Hood but no other change.[14] Because we predict that some responses will play out over time, we graphically show districts' responses for the years after the law change, up to the 2001-02 school year. We treat several variables as simultaneously determined dependent variables: property prices, property tax rates, school spending, and the WADA/pupil ratio.

We will also show how the school finance parameters evolved from the beginning of Robin Hood to the present. In particular, we are interested in whether capitalization decreasing the pool of available property tax revenues is likely to have caused the confiscation threshold to fall in real terms.

C. Obstacles for Our Empirical Strategy

As in most studies of tax reforms, the primary empirical obstacle is determining what would have happened in the absence of the reform. That is, what is the correct counterfactual? This issue is much

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[14] Actually, we do not merely inflate property values, but predict them. See below. The technique we use may be familiar to some as simulated instrumental variables although we actually estimate the reduced-form equation. The remainder of this is note is for those unfamiliar with simulated instruments. We are concerned about differentiating between changes in the parameters that are exogenous (caused purely by the law change) and endogenous to the districts' reactions to the law changes. We could address this problem by instrumenting for each actual parameter with the simulated parameter that the district would face if the law had changed but its own behavior had not. This now-standard technique is usually called simulated instrumental variables estimation.

We actually estimate the reduced-form equation, substituting the simulated parameters for the parameters of the school finance law that actually apply. Because each simulated parameter has exactly the same structure as the parameter it mimics, the interpretation of the reduced form equation is straightforward. Simulated instruments do not share some of the features of typical instrumental variables estimation. For instance, with simulated instruments, it is obvious where the variation in the instruments comes from: the law change. Also, the case for the instruments fulfilling the second instrumental variables condition (lack of correlation between the instruments and unobserved determinants of the dependent variable) is straightforward: the instruments are *constructed* to fulfil this condition as much as possible.

discussed in studies of income tax reforms, but less discussed for school finance.[15]

Overall, we believe that constructing a counterfactual is less problematic for Texas school finance than it typically is for an analysis of an income tax reform. First, we believe that the timing of the reform was more arbitrary than is a typical income tax reform. Income tax reforms typically begin in the legislature (presumably sensitive to the business cycle) while the timing of school finance reforms is dictated by an erratic interaction of plaintiffs, courts, and legislatures. Even if the initiation of the Edgewood case (1984) were endogenous to the business cycle, the school finance system was not affected at all until 1989 and Robin Hood was not implemented until 1994. Second, in tax reform analysis, it is often difficult to follow individuals. We do not have this problem: a district is a district and the data form a complete panel. Third, unlike individuals who have many idiosyncracies in their lives that are unobserved by the econometrician, districts' actions are relatively public and deliberate. Fourth, there were no other major school or tax reforms in Texas over the same period that are likely to confound our results. Texas implemented an accountability program for schools in the 1990s that included statewide testing, but the financial consequences of the program were negligible, given the scale of revenues and spending that we will examine.[16]

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[15] See, for instance, Feldstein (1995) on the importance of using panel data and Goolsbee (2000) on the difficulty in constructing a counterfactual for high income people. Gordon (forthcoming) discusses this issue when constructing counterfactual for a major change in federal Title I spending on schools.

[16] Texas increased its aid for the building school facilities in property poor districts in 1997 and for all districts in 2001. We therefore look at the property tax and school spending that is *not* for facilities: the "maintenance and operations tax" and "maintenance and operations spending." Maintenance and operations taxes and spending are more than 95 percent of the total in Texas, but we acknowledge that focusing on them is not a perfect solution. The reason is that some districts face more advantageous parameters for facilities taxes and spending than for maintenance and operations taxes and spending (or *vice versa*). Districts may therefore alter the description of certain spending to make it fit in the more advantageous system. Opportunities to do this are limited, however: spending on the refurbishment of a computer lab might be called either facilities or maintenance and operations spending; a teacher's salary cannot be called facilities spending and bonds for constructing a new building cannot be part of the maintenance and operations budget.

Nevertheless, we see a few difficulties for constructing a counterfactual for Texas property tax bases in the absence of Robin Hood. First, Texas' economy in general and the prices of its oil and gas property in particular are sensitive to the price of oil, which varied during the 1980s and 1990s. Second, Texas experienced significant income growth in the 1990s, some of which was associated with high-technology and finance.[17] Finally, immigration from Mexico is an important demographic phenomenon in Texas. Immigrants, and perhaps especially Mexican immigrants (who form a critical mass in some areas) may have brought their own attitudes to taxes and school spending, in addition to having an effect on local property prices. Note that we have to be careful about "controlling" for demographics since the not all changes in demographics were exogenous. Robin Hood probably made some districts more or less attractive to migrants.

D. Constructing a Counterfactual

There are two reasons we need to construct a counterfactual. We need to construct the simulated parameters for each district in each year. Also, when we estimate the effect of Robin Hood, we need to control for what would likely have happened in its absence. Let us consider the simulated parameters first.

We hold constant each district's ratio of WADA/pupils at its 1991 value because this was the first year in each WADA was measured and districts would have had little time to react to the law by reclassifying students. We use data from 1980 to 1990 to estimate how district's property tax base is affected by natural and oil prices, the growth of personal income in its metropolitan area (or county, for non-metropolitan districts), and various types of population growth in its metropolitan area (county): overall population growth, foreign immigrant population growth, and Mexican immigrant population growth. To be clear, we estimate a regression for all districts with most variables at the county or metropolitan area level in order that the covariates be strong predictors of property values but also be

[17] Austin is the home of Dell computer; Dallas has headquarters of telecom firms; and so on.

plausibly exogenous to the conduct of the individual school district.[18] The only right-hand side variables that are specific to each district are its indicator (for a fixed effect), its typical share of property tax base from oil and gas land interacted with natural gas and oil prices, and its typical share of tax base from residential property interacted with metropolitan/county total personal income. The typical shares are evaluated using 1987, a year of typical oil and house prices for the 1980s. [19] The equation is:

$$\ln(P_{ijt}^{H} H_{ijt}) = \alpha_0 + \boldsymbol{I}_i^{district}\alpha_1 + \boldsymbol{X}_{jt}\alpha_2 + Share_i^{oil\ gas} \cdot \boldsymbol{Price}_t^{oil\ gas}\alpha_3 + Share_i^{residential} \cdot \boldsymbol{PersonalIncome}_{jt}\alpha_4 + \epsilon_{ijt}$$

where *i* indexes districts, *j* indexes the metropolitan area or county, and *t* indexes time. We use a similar equation to predict each district's number of pupils for 1991 through 2001.[20] We then apply the district's initial WADA/pupil ratio to its predicted number of pupils to get a predicted WADA for each district. This is all the information that we need to feed into the school finance formula to construct the simulated parameters.

We are deliberately not using a district's own values for most variables. This is because it is plausible that a metropolitan area's socio-demographics change in a way that is exogenous to a district's own conduct and circumstances, but it is not plausible that a district's socio-demographics are exogenous to its conduct and circumstances (especially, for our exercise, the impact of Robin Hood itself).

E. The Estimating Equations

For our equations that estimate the effect of Robin Hood, we not only use simulated parameters to eliminate endogeneity of the school finance parameters, we also control directly for our prediction of

[18] We have performed all of the analysis using only state level variables and get similar but attenuated results, as we would expect.

[19] In 1987, the average price of a barrel of oil was $18.1.

[20] Unsurprisingly, only the population variables matter in the pupil prediction regression.

the property tax base. We also try allowing the variables used in our prediction equations to enter the equation directly.

VI. Data

All of our data are either administrative or census data. Most data are from the Texas Education Agency's Summary of Finances files (Texas Education Agency, Division of State Funding, 2003). These are the data used to generate each district's actual aid. The files contain all the information we use on assessed property values, pupils, WADA, property tax rates, foundation grants, revenue confiscation, and so on. The only administrative data that are not from the Summary of Finances are districts' expenditures, which are from the Academic Excellence Indicator System files (Texas Education Agency, Division of Performance Reporting, 2004). We also use the Texas Comptroller's annual Property Value Study to verify that assessed property values remain highly correlated with market values over the period in question (Texas Comptroller of Public Accounts, various years). We are in the process of acquiring data on a very large sample of house price transactions. We will use it to confirm that assessed values reflect market values and use it to see whether house consumption reacts in predictable ways (are people less likely to build onto a house in a district that faces confiscation, for instance?).

On the whole, data are not an issue in this study. The administrative data are comprehensive, and errors in the data are unlikely because they would have been costly to some party. In any case, because we are using the actual data that were used to generate aid, it is likely that the state and districts would have responded to erroneous data as though they were correct.

V. Districts' Budget Constraints: Before and After Robin Hood

In this section, we show the before-after differences in Texas' school finance parameters for two exemplary districts and districts categorized by their property-richness. Texas has 1031 conventional

school districts –too many to show individually. The ideal "before" year is the 1988-89 school year because it precedes any attempt by the state to respond to the Edgewood case.. It does not matter much whether we choose 1994-95, 1995-96, 1996-97, or 1997-98 as an "after" year. 1994-95 was the first year in which Robin Hood was fully implemented–in particular, it is the first year in which the confiscation system operated. In the years intervening between 1988-89 and 1994-95, the structure of the foundation grant and guaranteed revenue level were in effect, but they were considerably lower than they were after confiscation began.[21] We often show 1991-92 as a "partial before" year before it is the first year we use in our regressions.

First consider Edgewood Independent School District and Alamo Heights Independent School District in Bexar County. They are geographically close districts. The former was property-poor (bottom 5 percent of property wealth per pupil) and the latter was property-rich (top 5 percent of property wealth per pupil). Also, as shown in Table 1, Alamo Heights households had significantly higher income ($252,288 in 1989) than Edgewood households ($33,065 in 1989). In 1991, the two districts coincidentally had the same property tax rate of 11.7 mils. In 1997, their property tax rates were also the same, but substantially higher: 15 mils. The remainder of the table shows the parameters of the system, before and after Robin Hood (from 1988 to 1997). Edgewood's inverted marginal tax price rose from 2.49 in 1988-89 to 7.67 in 1991-92 to 9.07 in 1997-98 (that is, the district could spend $9.07 for every dollar of taxes paid). Alamo Heights's inverted marginal tax price fell from 1 in 1988-89 and 1991-92 to 0.72 in 1997-98 (being able to spend 73 cents for every dollar of taxes paid). However, both district's inverted marginal tax prices only applied "in theory" by 1997-98 because the districts were at the 15 mil

[21] During the 1992-93 and 1993-94 school years, a peculiar formula was used that was quickly found unconstitutional. The formula involved grouping Texas school districts in County Education Districts and redistributing some funds within the groups. From our point of view, this formula is an unnecessary detour between the old formula and the Robin Hood formula. Robin Hood is an adaptation of the old formula, not the County Education District formula, which was wholly discarded after its short "life." Because the County Education District formula was found to be unconstitutional quite quickly, it would not have changed expectations much or generated much capitalization.

cap and could not raise their tax rates. Edgewood's spending could benefit from higher property values only in a limited way, even before Robin Hood: it faced an inverted marginal tax price of 0.33 in 1988-89. This fell to 0 after Robin Hood. However, before Robin Hood, Alamo Heights could spend one dollar for every extra tax dollar from property value increases. After Robin Hood's full implementation in 1994, it could spend zero of every extra tax dollar from property value increases. The middle columns show the districts' net foundation grants, writing the confiscation from Alamo Heights as though it were a negative net foundation grant.

Having looked at two specific districts, we now show, in Table 2, mean parameters of the school finance system for 20 property-wealth-per-WADA quantiles. Everything in Table 2 is pupil weighted. The most noteworthy changes in budget constraints occur at the two ends of the property wealth spectrum. The bottom quantiles experience positive changes in their net foundation grants and inverted marginal tax prices. The top quantiles experience large negative changes in their inverted marginal tax prices and from confiscation (written in Table 2 as though it were a negative foundation grant). We can see that Edgewood and Alamo Heights are fairly typical of, respectively, the bottom and top quantiles.

Table 3 shows how the confiscation threshold fell over time in real terms, from $280,000 to $251,256 in 1994 dollars. Because the threshold fell, more districts were swept into the confiscation group. In 1994, confiscation districts accounted for only 4.7 percent of students. By 2002, 10.3% of students were enrolled in confiscation districts, and the predicted enrollment numbers suggest that about a quarter of all Texas students would now be in confiscation districts if they had not been deterred from living in them by the Robin Hood scheme. Put another way, Table 3 shows that Texas has been changing the parameters of the system in an apparent effort to fill a perennial shortage of revenue. Below, we show that capitalization did likely cause such a revenue shortage.

VII. Capitalization and Other Consequences of Robin Hood

We now turn to capitalization and other direct consequences of the Robin Hood scheme, using figures to illustrate the evidence before presenting regression results.

A. Capitalization of Robin Hood into Property Values

Figure 9 shows the predicted and actual property tax bases for the property-poorest districts in Texas (bottom 5 percent). In these districts, the actual property tax base roughly keeps pace with the predicted base, suggesting that little or no capitalization occurred. Figure 10 shows that intermediate districts like those between the 50th and 55th percentiles (quantile 11) experienced some negative capitalization after Robin Hood. The negative capitalization begins in about 1990, which makes sense because parts of the system that affected intermediate districts started at this time. It appears that most or all of the negative capitalization has occurred for these districts by 1997. (This conclusion can only be approximate because the new homestead exemption starting in 1998 makes it difficult to get the 1998 to 2000 numbers precisely right).

Finally, Figure 11 shows that property-rich districts like those between the 95th and 100th percentiles (quantile 20) experienced very substantial negative capitalization, beginning in 1993-94 when confiscation started but the constitutionality of Robin Hood was still in doubt. The negative capitalization continued to grow thereafter and, in 2000, shows no signs of slowing down. This negative capitalization has serious consequences for the stability of Robin Hood because (recalling Table 2), these districts are responsible for most of the revenues flowing into the system. It is no wonder that, with their property tax bases falling in response to Robin Hood, these districts would find themselves perennially short of revenue and the state would find itself perennially disappointed about the revenue confiscated from these districts.

B. The Consequences of Robin Hood for Property Tax Rates

As predicted above, Robin Hood also had consequences for property tax *rates*. The property-

poor districts had incentives to raise their tax rates because each dollar they raised allowed them to spend multiple dollars. Indeed, their tax rates did rise, as shown in Figure 12. In it, we see that the property-poorest districts (the bottom 5 percent) raised their tax rates abruptly from about 12 miles to 14 mils following the full implementation of Robin Hood in 1994-95. Their tax rates have since crept up and are now about 14.3 mils. This gradual increase is probably because the parameters of the system have gradually become less generous to property-poor–in particular, the guaranteed revenue level is not keeping up with inflation (Table 3). The falling generosity is probably due to the system's perennial revenue shortages.

Figure 13 shows that intermediate districts (between the 50th and 55th percentiles) also experienced rising property tax rates. Recall that, with Robin Hood, these districts experience some negative capitalization. The predictable consequence is that they choose ever higher property tax rates. In 1991, their average tax rate was 12.6 mils. By 2002, it was 14.7 mils.

However, it is the property-rich districts that experienced the steepest rise in property tax rates. Figure 14 shows that, immediately after the confiscation system started, their tax rates rose from 12.5 mils to 14 mils. However, because negative capitalization steady got worse for them from 1994 onwards, their rates simply kept rising. They are now at or extremely close to the 15 mil cap. Indeed, Figure 14 gives us reason to believe that their rates would still be rising if they had not hit the cap. These districts literally cannot spend *anything* more –they cannot raise rates and additional tax payments from rising property values would generate no additional spending because all marginal revenue from that source is confiscated. (Note, however, that these districts have a strong incentive to raise their WADA/pupil ratios: raising WADA is their sole means of obtaining additional spending.)

C. The Consequences of Robin Hood for Disability and Other Student Classification

The Robin Hood system is based on property wealth per WADA. Thus, *every* district has an incentive to raise its ratio of WADA to pupils to minimize its "book" wealth. However, property-poor

and property-rich districts have stronger incentives to raise WADA than do intermediate districts. As just seen, raising WADA is property-rich districts' sole means of raising spending. A property-poor district also has strong incentives: raising WADA makes the guaranteed revenue level more generous. An intermediate district likely has weak incentives to raise WADA: it can obtain a somewhat higher foundation grant but it is otherwise unaffected.[22]

Figures 15 through 17 show that, as predicted, property-rich districts raised their WADA/pupil ratios the most, from 1.26 to 1.34, between 1991 and 2001. Property-poor districts raised their WADA/pupil ratios the next most, from 1.30 to 1.36. The WADA/pupil ratios of intermediate did not change much over the period: they rose from just over 1.26 in 1991 to just over 1.27 in 2001. (The striking decrease and recovery of intermediate districts' WADA/pupil ratios between 1997 and 2000 was the result of a "WADA crackdown," in which the state conducted WADA audits and disallowed many students' classifications. This auditing regime was short-lived, however.[23])

The sharpest change in a district's incentives to maximize WADA occurs as it gets in the neighborhood of the confiscation threshold. In this neighborhood, we should see districts struggling to raise the WADA/pupil ratios in order to stay out of confiscation and be able to keep some spending benefits of increases in their property values. Because a district cannot know exactly how the assessor will certify its property values, it cannot be sure that a given increase in WADA will keep it out of the confiscation group, but all districts in the neighborhood of the threshold can substantially raise their probability of being below the threshold by maximizing WADA. Note also that very property-rich districts also have an incentive to raise WADA –it is their only means of gaining additional revenue. However, we do not expect very property-rich districts' efforts would actually get them below the

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[22] Raising WADA raises a district's foundation grant because the same pupil classifications that raise WADA also raise multipliers that generate a district's foundation grant. This indirect link is rather complicated. We do not discuss it further here because it does not affect our point.

[23] See Blair (2004)

confiscation threshold.

These predictions are borne out by Figures 18 through 20, which show the WADA/pupil ratios of districts in the neighborhood of the confiscation threshold. Figure 18 shows 1994-95, when the confiscation system is in place but districts have not had time to respond by reclassifying students. WADA/pupil ratios in these affluent districts hover around 1.20.[24] Figure 19 shows the same affluent districts in 1997, by which time their WADA/pupil ratios have risen to about 1.29 in the immediate neighborhood of the threshold. Notice as well that the WADA/pupil ratio is still about 1.20 for the districts that are between $20,000 and $40,000 above the threshold: presumably these districts have little hope of getting below the threshold but yet are not property-rich enough to have a strong incentive to maximize WADA in order to raise their inverted marginal tax prices with respect to the tax rate. Figure 20 shows 2001 with its new cutoff at $300,000. WADA/pupil ratios in the immediate neighborhood of the cut-off now range between 1.325 and 1.375. There are *no* districts in the wealth range just to the right of the neighborhood, suggesting that all districts with any probability of moving themselves below the threshold are aggressively reduced their "book" property wealth.

We think that Figures 15 to 20 are our clearest evidence that Robin Hood has caused districts' to reclassify marginal students in an attempt to raise WADA and minimize their "book" property wealth. However, in Table 4, we show the results of a regression of districts' WADA/pupil ratios on a district indicator and their inverted marginal tax prices with respect to property values. Recall that this inverted marginal tax price is key because it is zero for both property-rich and property-poor districts, giving them strong incentives to raise WADA so they can some spending benefit from higher property values. The Table 4 coefficient suggests that a district's WADA/pupil ratio will rise by 0.041 if it goes from being able to spend one dollar to being able to spend zero for every dollar it pays in taxes (from increased

[24] The very high WADA/pupil ratios of a few districts in the $340,000-360,000 range are due to their being very sparsely populated districts. Pupil classification happens not to be the major issue for these districts.

property values).

D. The Effects of Robin Hood on the Equality of Per-Pupil Spending

Figures 21 and 22 show, respectively, nominal and real per-pupil spending in Texas schools by property wealth quantiles, from 1986 to 2001. We show these mainly to demonstrate that there has been narrowing of the spending gap, especially among the first through the 95th percentiles of the property wealth distribution. The coefficient of variation in per-pupil spending has fallen from 0.22 to 0.12, a point to which we will return. The spending gap between the lowest and highest spending property-wealth quartiles has narrowed from about $2,200 to about $1,800. Note that the property-poorest quartile typically does *not* spend the least per pupil in Texas: the lowest spending district tend to have per-pupil property wealth between the 25th and 50th percentile.

Looking at the real per-pupil spending results, it appears that Robin Hood is at best a very mild "leveling-up" school finance program. Average per-pupil spending in Texas has risen by 2.95 percent in CPI-adjusted terms since 1986, but most of the increase is in the mid to late 1990s, and it is possible that spending growth is due mainly to income growth in that period, which substantially outstripped inflation. Another way to make this point is to note that if we were to inflate per-pupil spending by per-capita income in Texas rather than the CPI, we would find that average per-pupil spending had fallen by 11.70 percent since 1986. The true effect of Robin Hood on leveling-up or down is between these two bounds, but it would be hard to make a strong case for leveling up.

E. Regression Results on Capitalization

Table 5 is our attempt to quantify the capitalization consequences of Robin Hood. We regress the natural log of districts' property tax bases on district indicators, their predicted property tax bases, and the simulated parameters of the school finance system. Keep in mind that the big change in the parameters comes from the implementation of Robin Hood and that they are simulated to avoid endogeneity. The predicted property tax base is a reasonably sufficient statistic for many factors that

systemically affect a district's tax base. Therefore, our preferred specification is the one in the left-hand column. From the coefficients, we see that property values rise by about 4.3 percent if a district experiences a one unit increase in its inverted marginal tax price with respect to its tax rate. Property values rise by about 4.4 percent if a district experiences a one unit increase in its inverted marginal tax price with respect to its tax base. The virtual lump sum grant has a statistically significantly but unimportant effect on property values: a 100 percent increase in the virtual lump sum grant raises property values by about 0.2 percent. This result confirms evidence in Hoxby (2001) that school finance schemes that mimic lump-sum redistribution do not have much effect on property prices (are not much capitalized).

The only difference between the left-hand column and the second column is that the second column does not attempt to adjust for a $10,000 increase in the homestead exemption that affects the 1998-99 through 2000-01 data.[25] The signs of all of the coefficients are the same as those cited above, but the coefficients are at least twice as large. We believe that it is appropriate to adjust for the homestead exemption, so we offer these coefficients merely as evidence that capitalization still occurs as expected if we use unadjusted data. The next two columns take out, respectively, a linear time trend and a quadratic time trend. The linear time trend has little effect on the estimates. Property values rise by about 3.5 percent if a district experiences a one unit increase in its inverted marginal tax price with respect to its tax rate. Property values rise by about 5.3 percent if a district experiences a one unit increase in its inverted marginal tax price with respect to its tax base. A 100 percent increase in the virtual lump sum grant raises property values by about 0.2 percent. We believe that the quadratic time trend is "over-controlling" because we only have one major event (the full implementation of Robin

[25] The amount of each owner-occupied house's value that was exempted from property taxation (the "homestead exemption") rose from $5,000 to $15,000 with timing so it affects the 1998-99 data first. The increased exemption mechanically reduced each district's "book" property tax base and raised its state aid. These changes were capitalized. In all the columns of Table 5 except the second to the left, we attempt to control for the capitalization caused by the new exemption.

Hood), and the quadratic time trend is surely picking up some of its true consequences. Notice, however, that the coefficients simply drop in magnitude: they do not change sign and most are still statistically significantly different from zero. In the final column, we add the natural log of several covariates, at the metropolitan area level (or county, for rural districts): the average income of a wage and salary worker, total personal income, population, the number of immigrants, the number of Mexican immigrants. The coefficient on the marginal tax price with respect to the tax rate falls to 0.009 (still significantly different from zero) but the coefficient on the marginal tax price with respect to property values rises to 0.102. We find these results broadly confirmatory of our preferred specification but do not wish to give them much weight. This is because the predicted property tax base (and, thus, the simulated parameters) is already based on the covariates. Thus, the coefficients on the simulated parameters are identified only by restrictions imposed by the parameters' form.

VI. Interpretation

Table 6 is designed to help us see the big picture –how has Robin Hood worked as a school finance scheme designed to equalize school spending? The left column shows that the coefficient of variation in per pupil spending in Texas fell from 0.22 in 1986-87 to 0.12 by 2000-01. Another, and perhaps more easily interpreted, measure of equality is the change in the spending difference between the highest-spending and lowest-spending quartile (where quartiles are defined as 5 percentiles of the per-pupil property wealth distribution). This gap fell from $2,271 in 1986-87 to a nadir of $1,324 in 1997-98 and was $1,941 in 2000-01. These are not insignificant gains in school spending equality, but they came at a cost.

The right-column in Table 6 shows the losses from capitalization, per pupil. We computed these by subtracting predicted property values from actual property values. Losses due to capitalization are pure societal losses –people have lost wealth, period. Capitalization is convenient in this way: property

values capitalize the value of services bought with taxes so we need only look at the losses due to capitalization to appreciate the true social cost of the Robin Hood program. The loss from capitalization was $34,300 per pupil in 1993-94, $29,896 per pupil in 1987-88, and $34,565 per pupil in 2000-01. We cannot directly compare the losses to, say, the spending gap per pupil shown in the previous column. This is because the loss is a stock and the gap is a flow (an amount needed every year). Nevertheless, if we multiply the losses in the right hand column by a normal return on investment, such as 5 percent, we get about $1,725 per pupil. This amount is much more than enough to close the spending gap since only the worst-off students experience the maximum gap. In other words, if we could simply invest the lost capitalization and use its proceeds for redistribution, we could probably eliminate the inequality of per pupil spending in Texas and raise the average level of spending too. This is not a realistic scenario, of course, because there is always deadweight loss associated with a tax. However, the calculation certainly suggests that Robin Hood is not a particularly efficient scheme of taking money from the rich to give to the poor (students).

Why is Robin Hood so inefficient? There are two reasons. First, by relying on property as the basis of the state tax and the basis of state aid, the system invites capitalization. Capitalization makes the tax base shrink much faster with the scheme than we are used to seeing for a typical tax. Thus, capitalization magnifies the deadweight loss. It should be emphasized that there is really no reason why Robin Hood had to be based entirely on property values. If state aid had been funded with a tax on income or sales, say, and distributed more on the basis of household incomes, the amount of capitalization would probably have been *much* smaller. (It is probably not possible to distribute entirely on the basis of household incomes owing to oil and gas property, so some capitalization would have occurred.)

Second, Robin Hood is very inefficient because the scheme does not make good use of the foundation system, which is at heart a lump-sum system of redistribution. That is, a self-supporting

foundation system takes a lump of revenue from each rich district and gives a lump of revenue to each poor district. Then, it allows all districts to generate marginal spending from their own local tax bases. The foundation component of Robin Hood is minor –the guaranteed level system (which is not pseudo lump sum in character) generates much of the aid for poor districts. Moreover, the rich district do not contribute through the foundation system at all –confiscation is used instead. In other words, Robin Hood is minimizing its reliance on lump sum redistribution and maximizing its reliance on high marginal tax rates. This is unnecessary: numerous states rely largely or wholly on foundation systems, which can be generous.

The reclassification of students to maximize WADA also plays a role in Robin Hood's inefficiency, but the scale of the losses is small relative to the due to the first two causes (reliance on a scheme maximizes capitalization and minimizes lump-sum redistribution).

Texas' Robin Hood scheme contained the seeds of its own self-destruction. This was unintentional. A better understanding of how school finance works might lead to the adoption of schemes that are so much more efficient that they can simultaneously be more stable, more equalizing, less burdensome to taxpayers, and –in the long run– more supportive of school spending.

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Figure 1

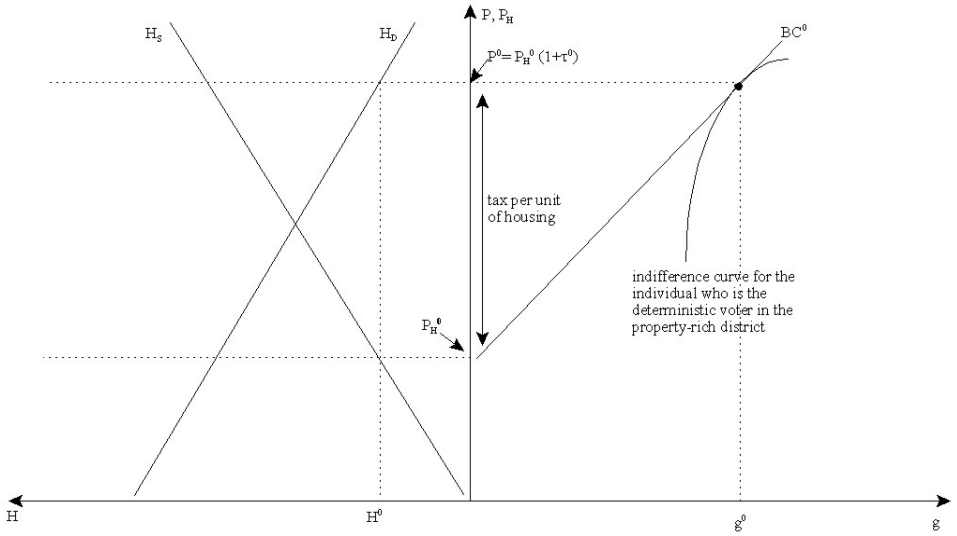
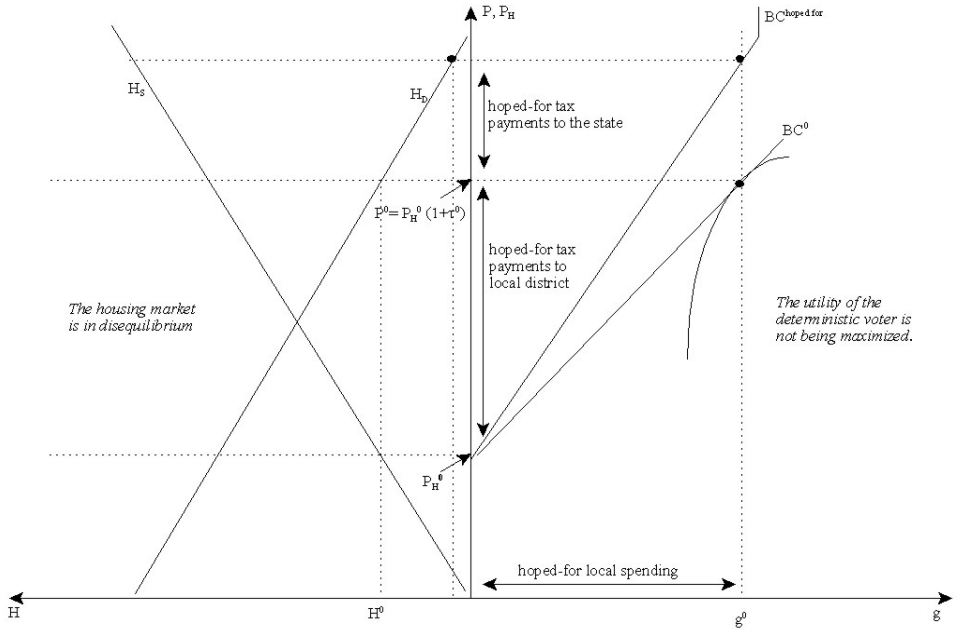
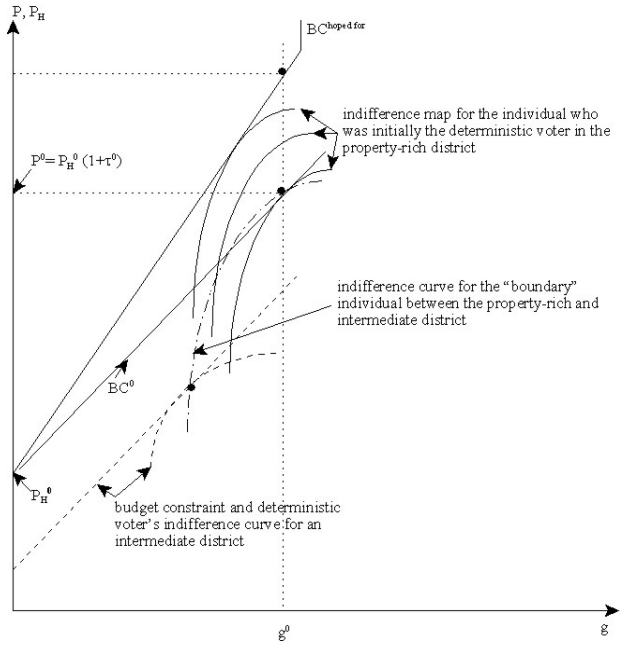


Figure 2



"Hoped-for" = property prices stay same & school spending does not change in reaction to change in budget constraint

Figure 3



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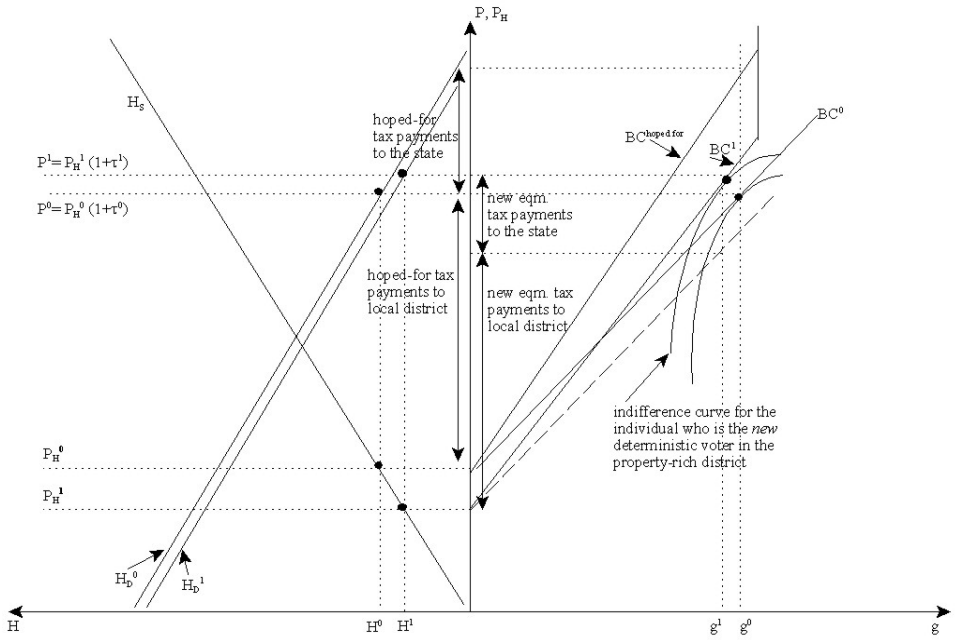

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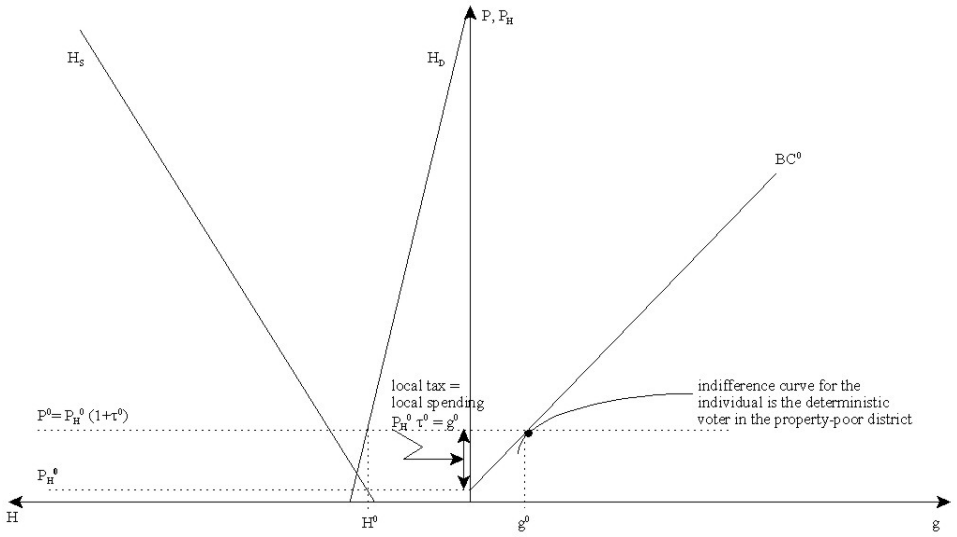

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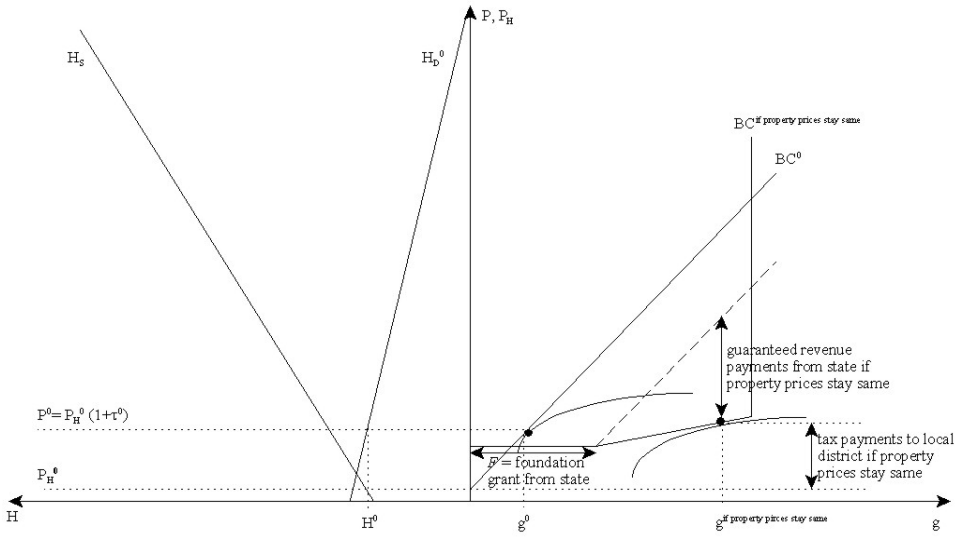

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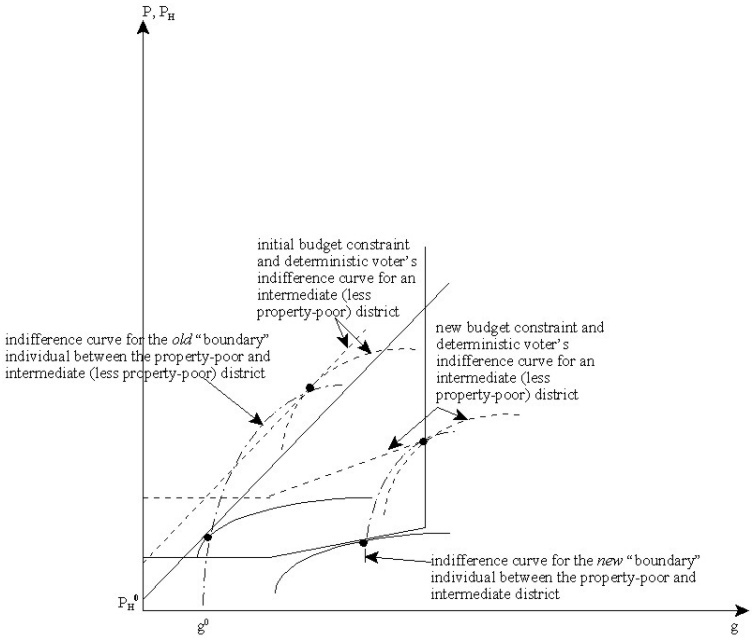

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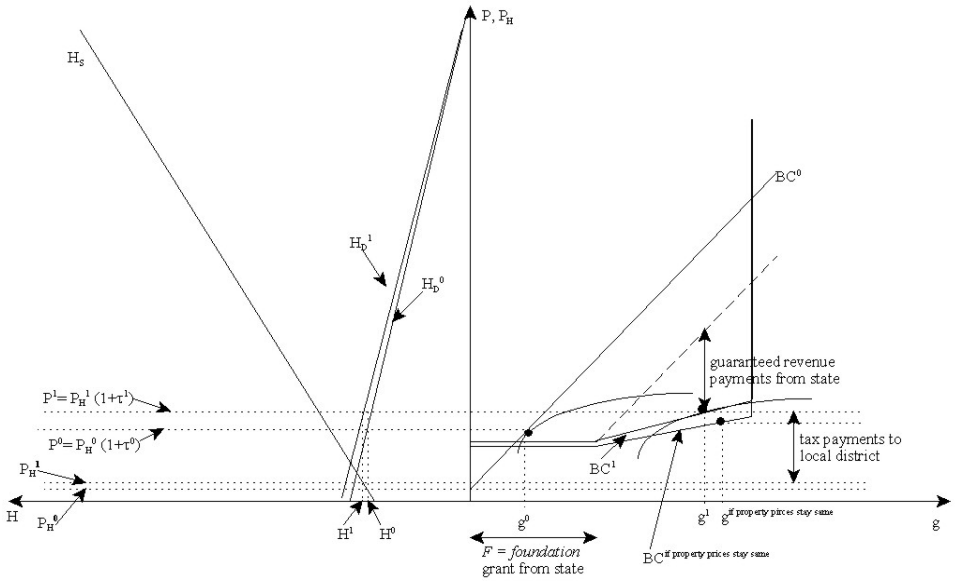

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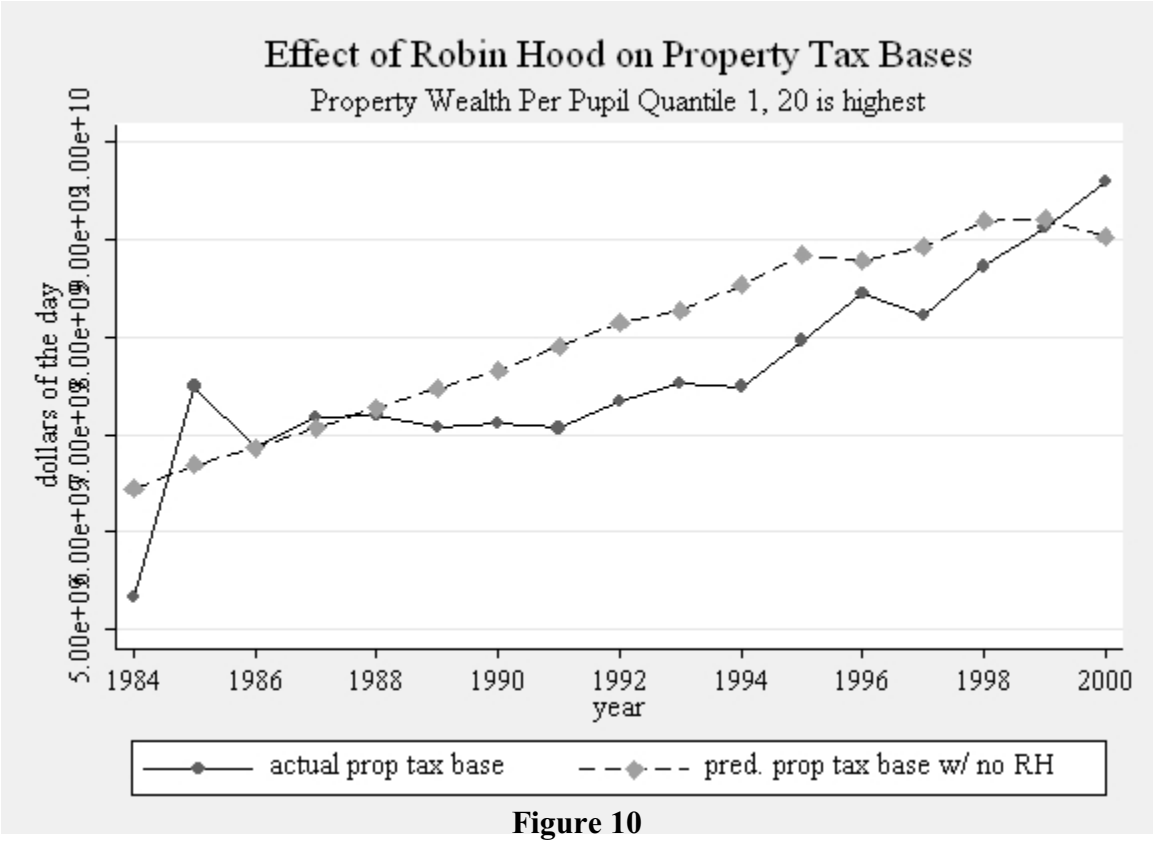

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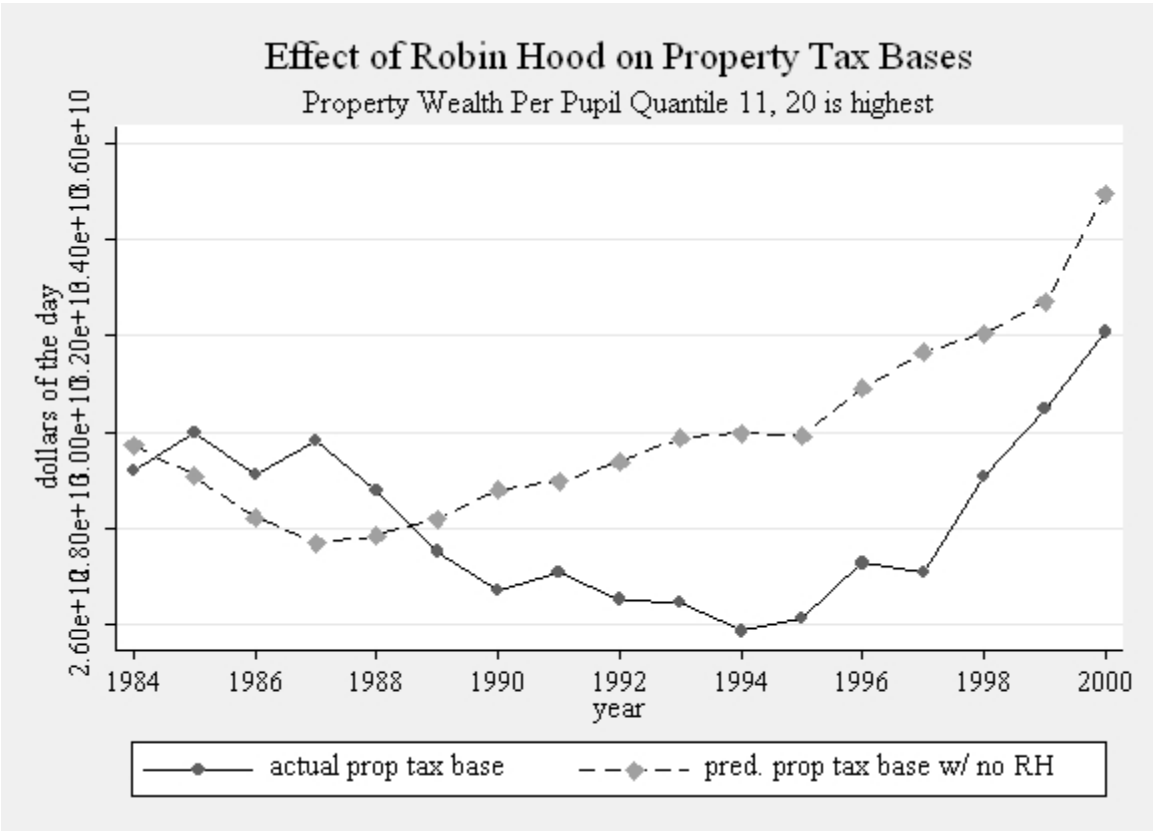

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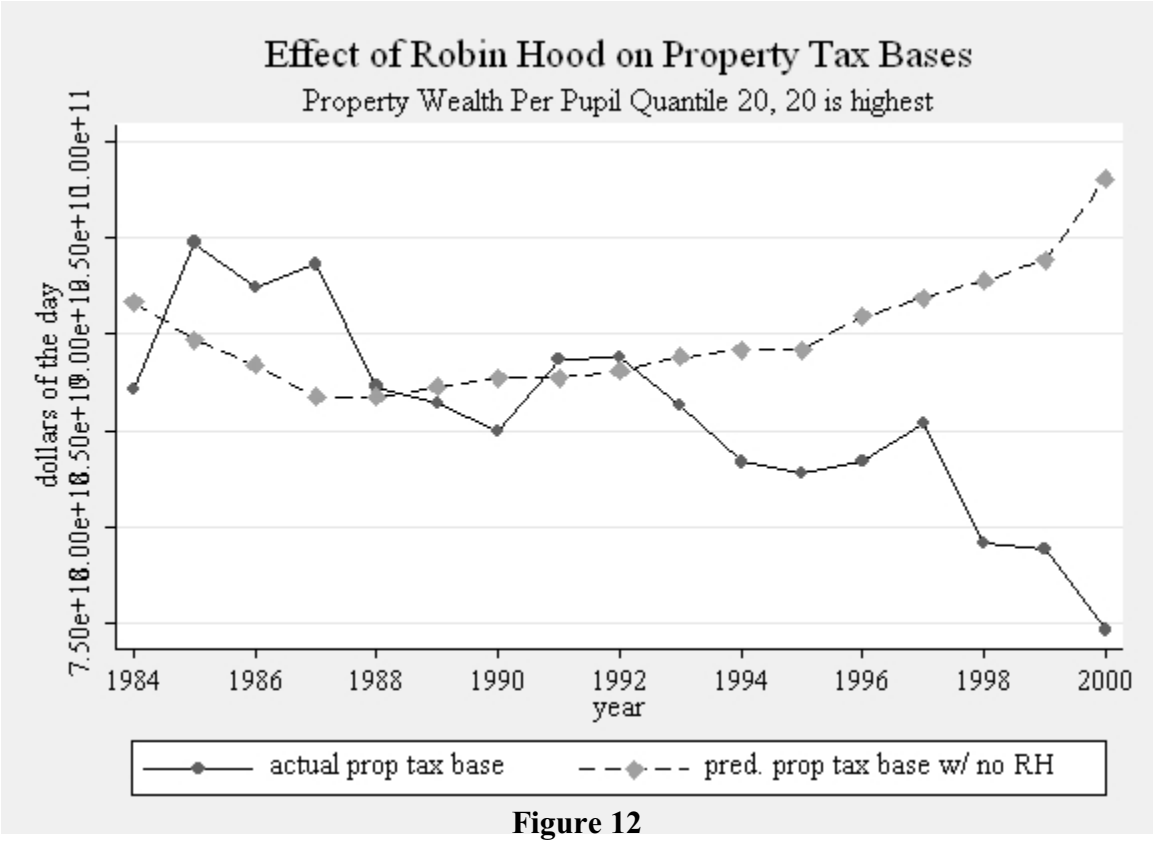

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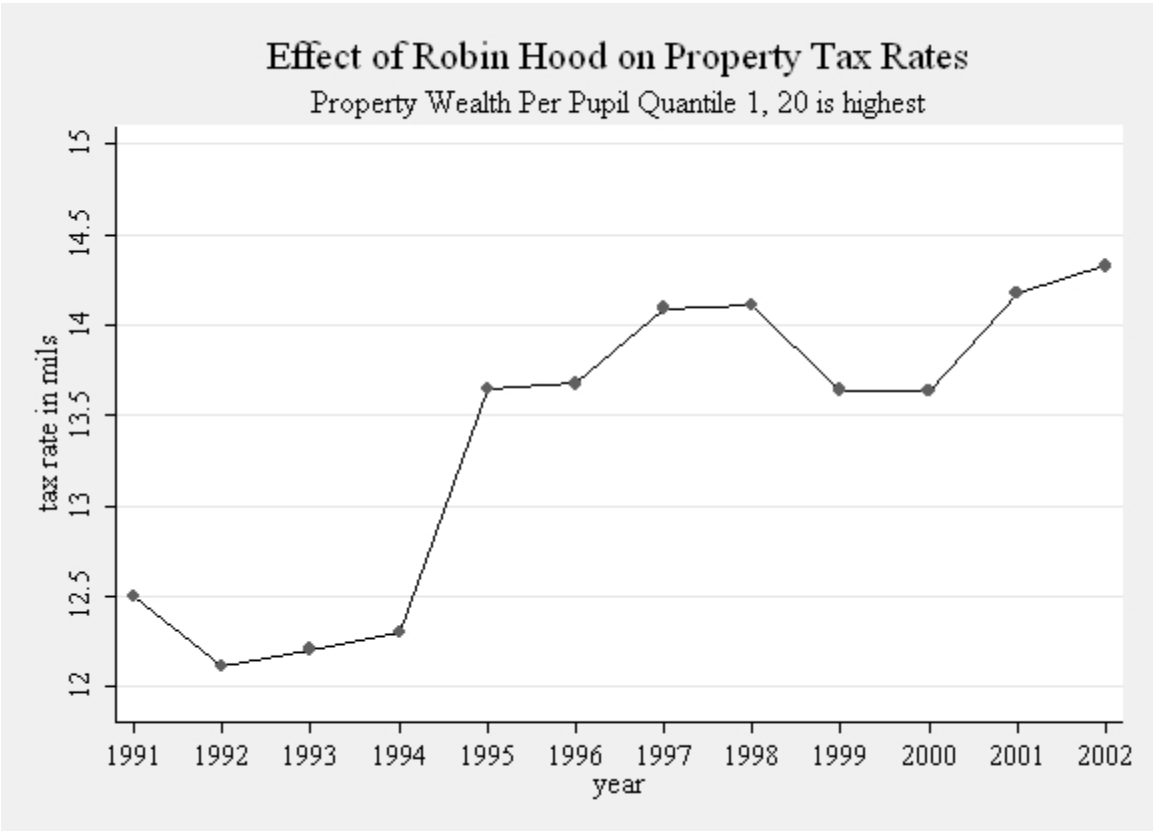

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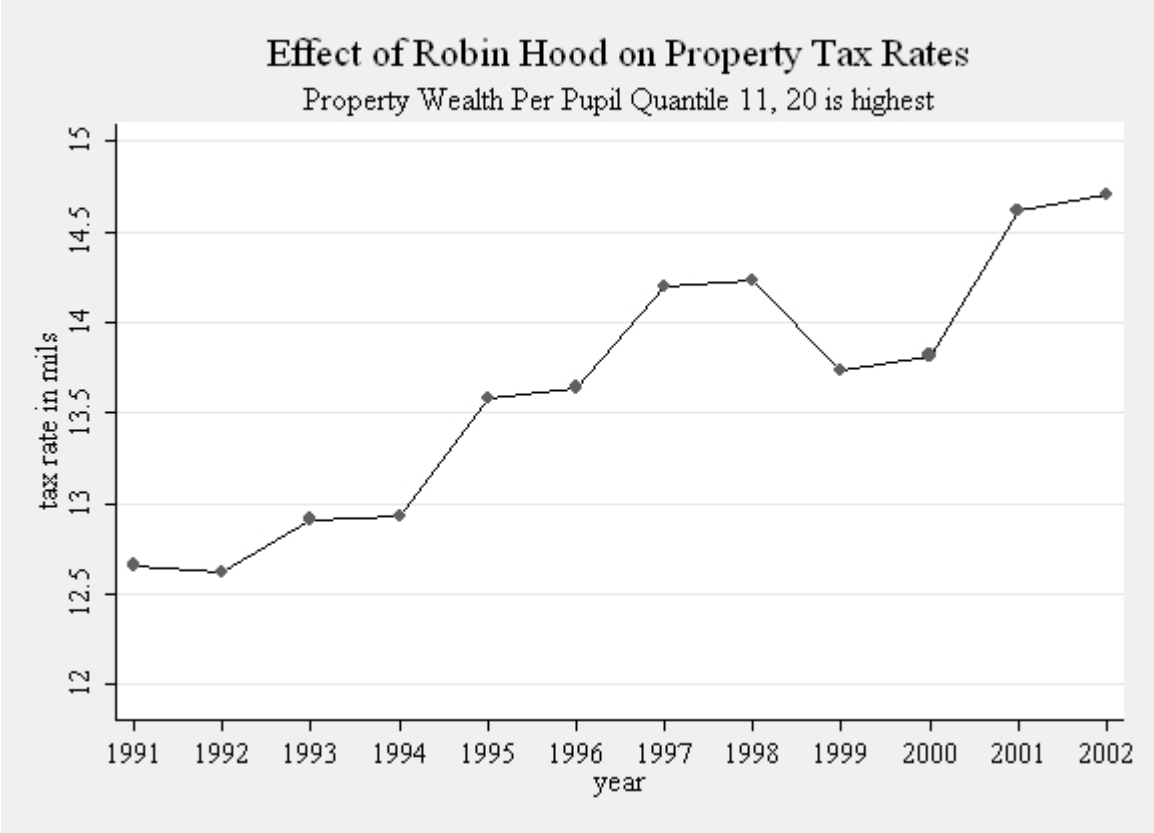

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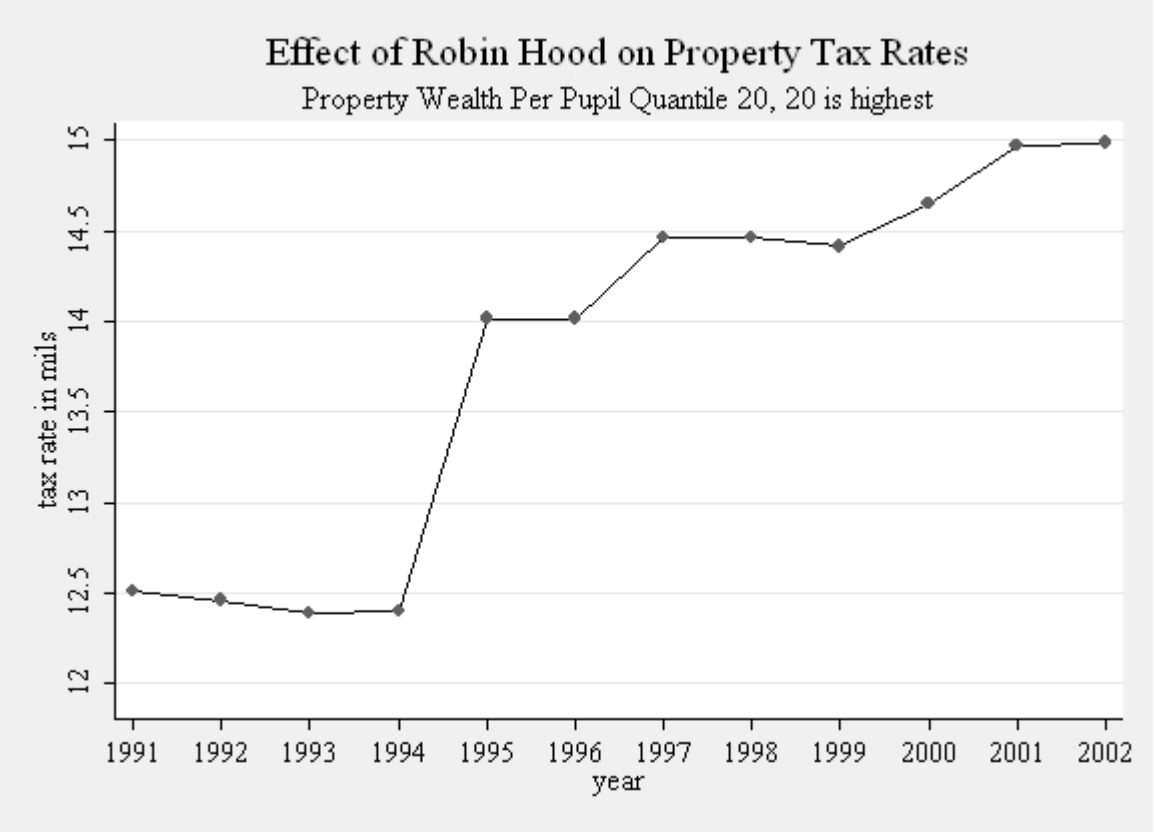

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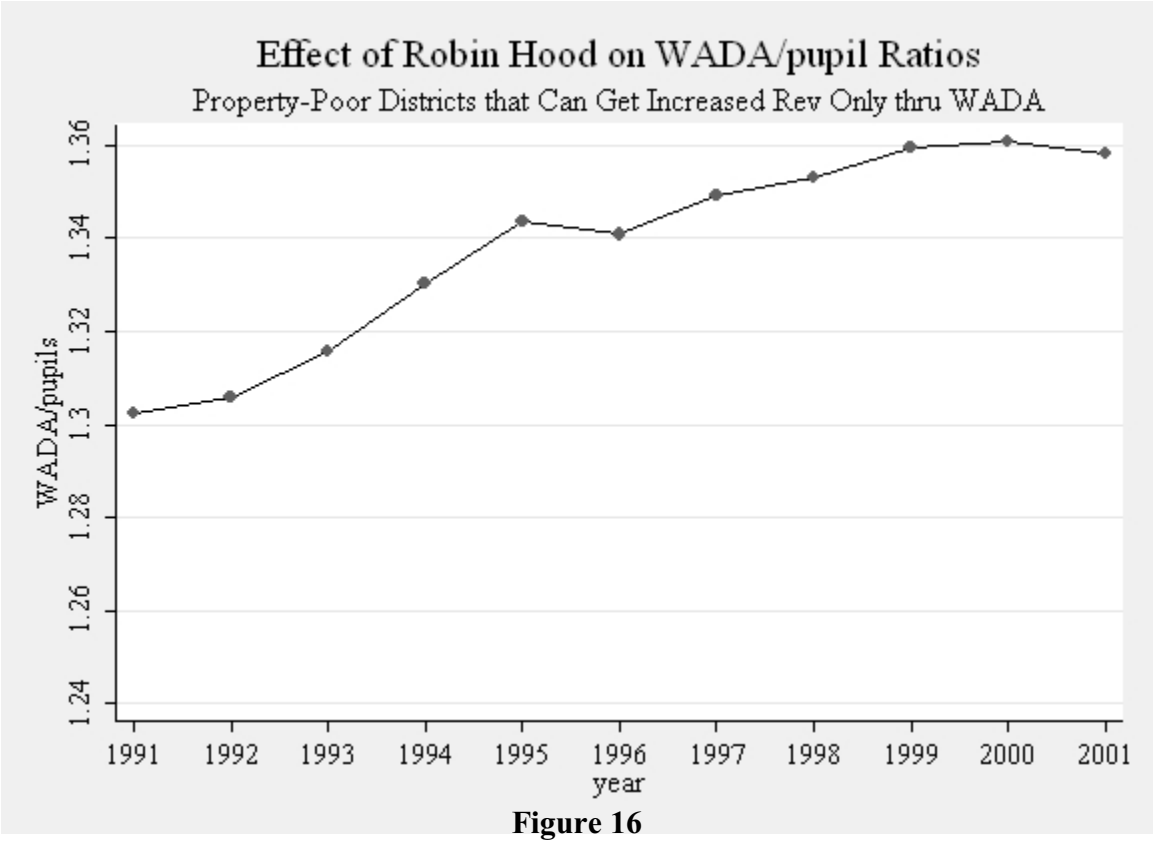

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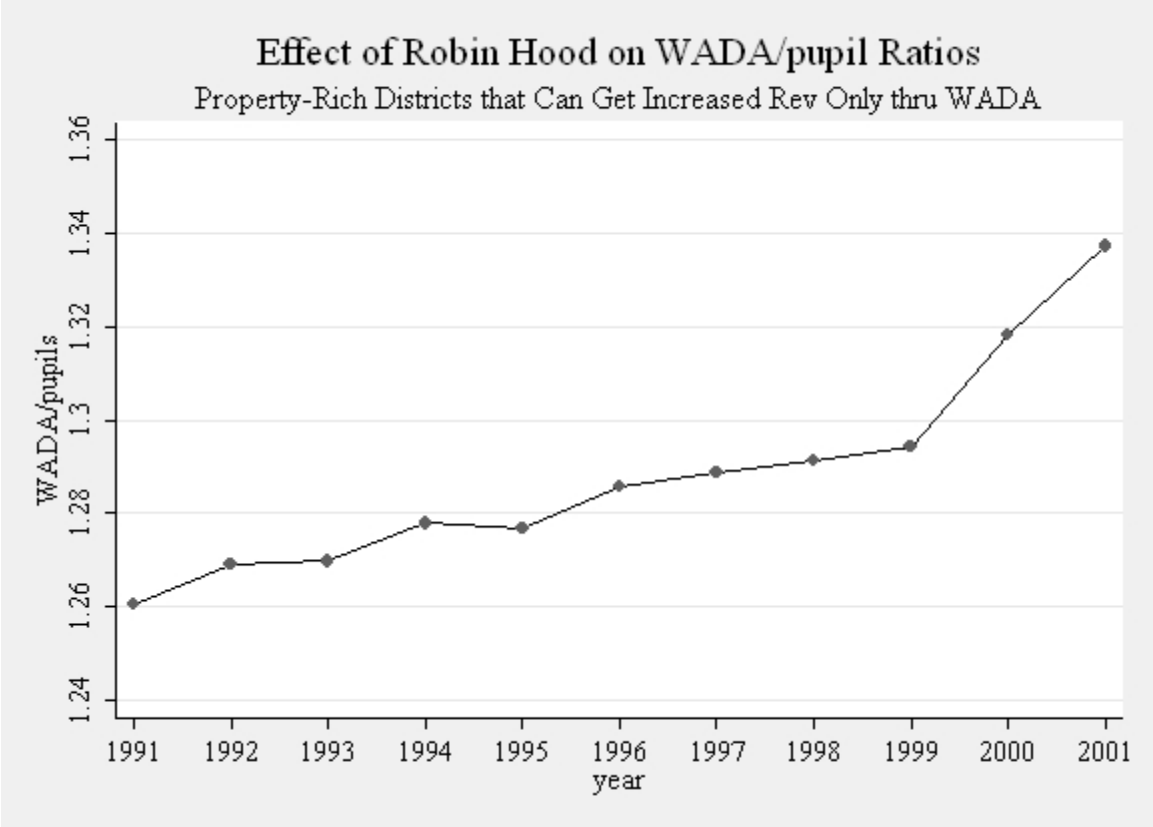
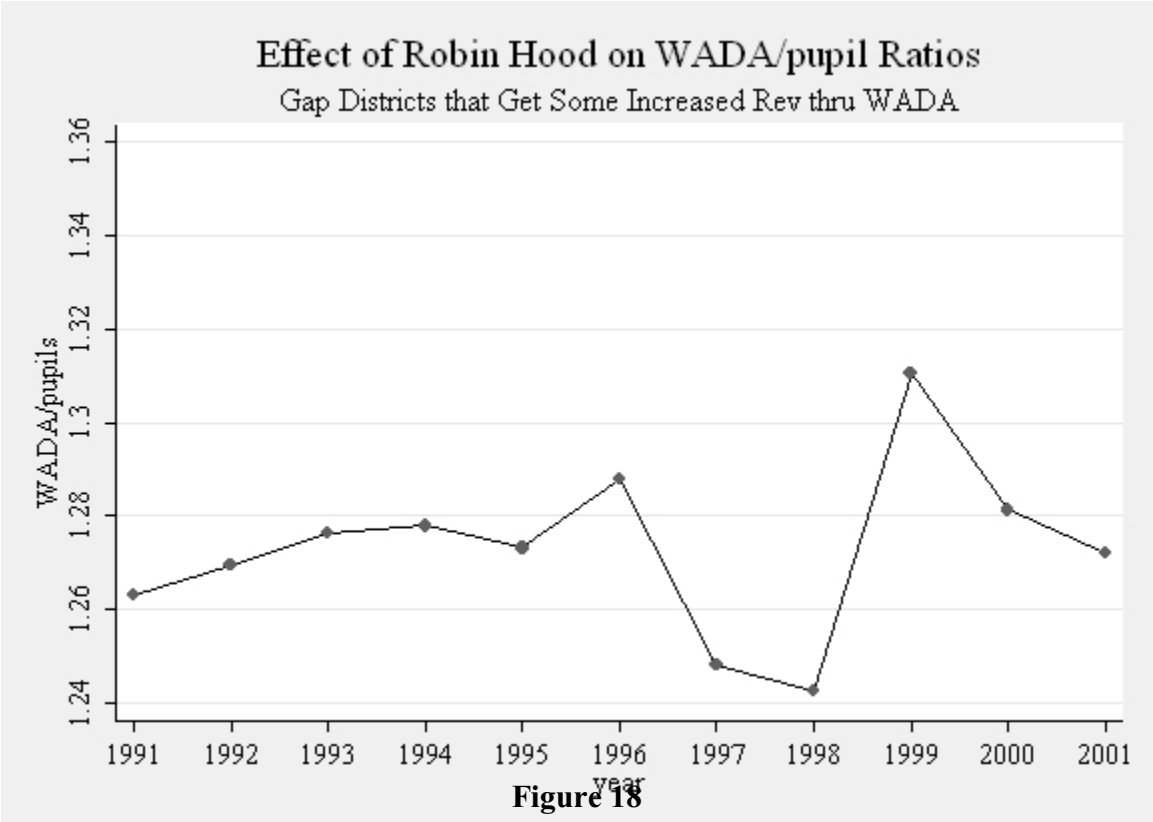


Figure 17



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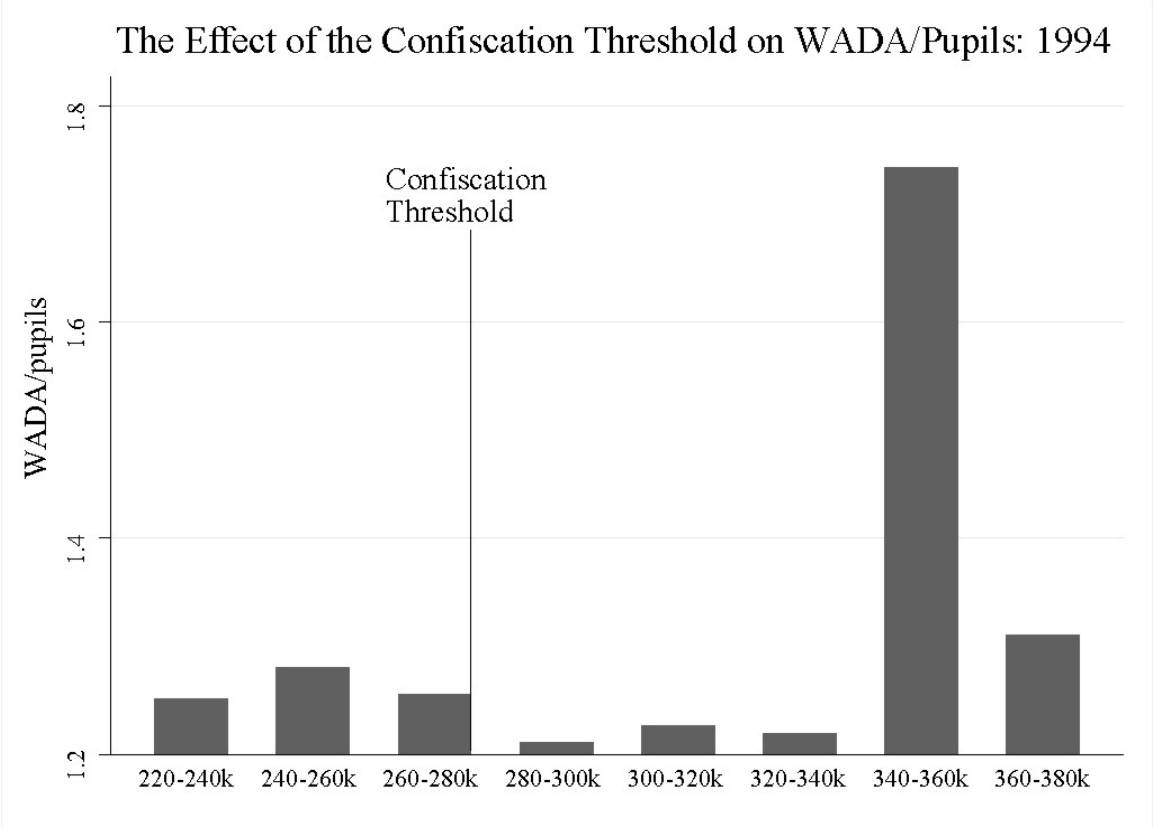

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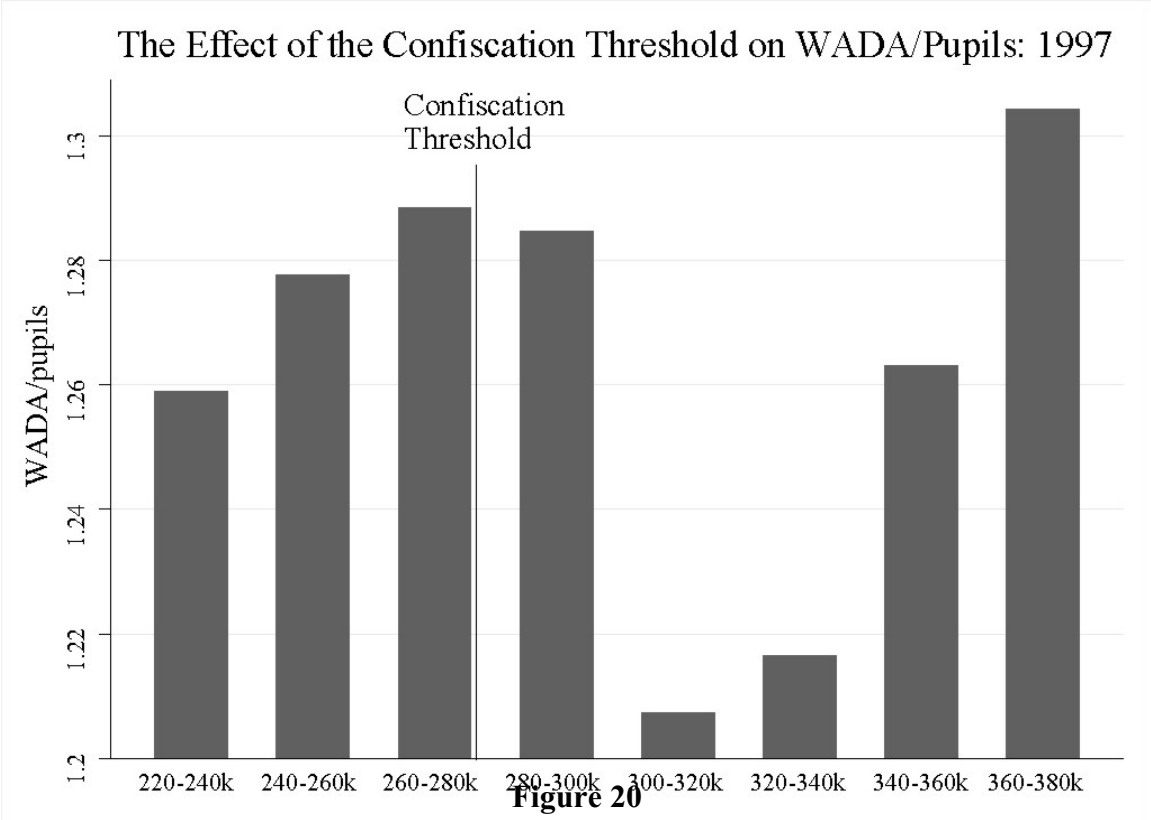
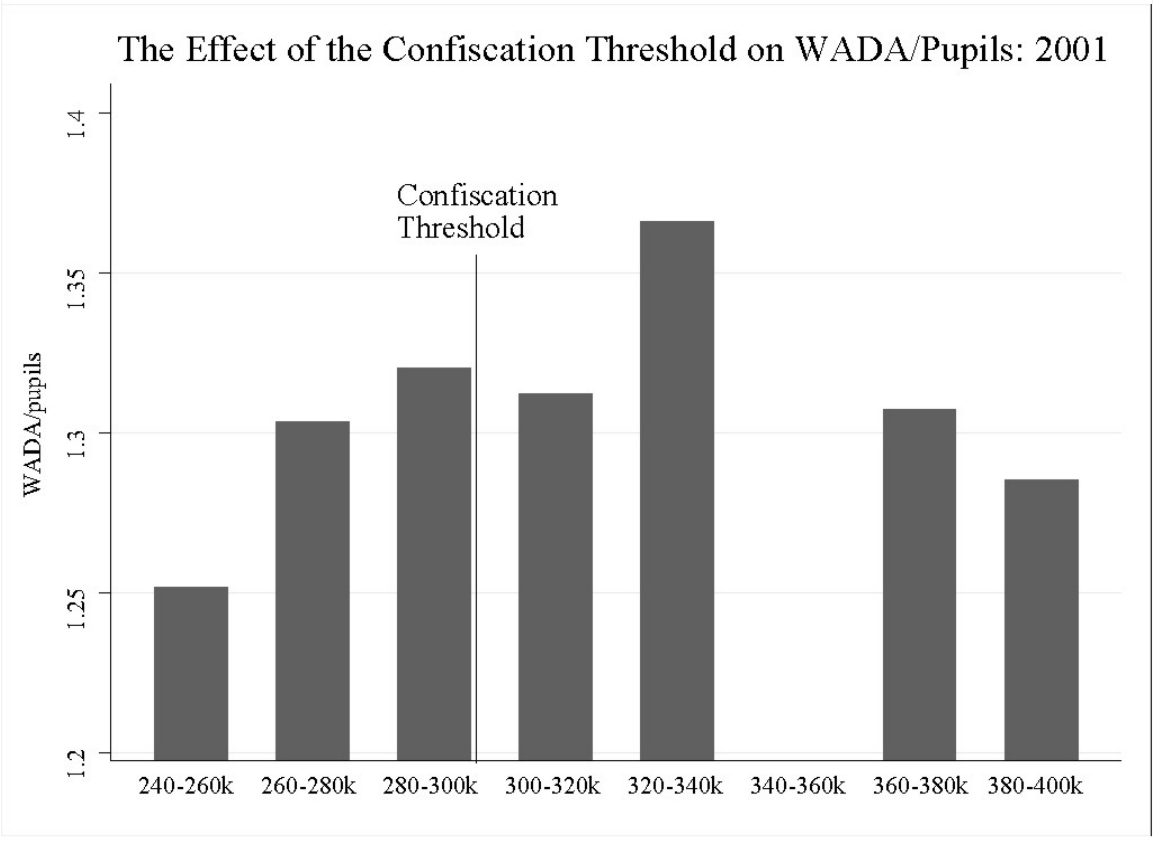


Figure 20



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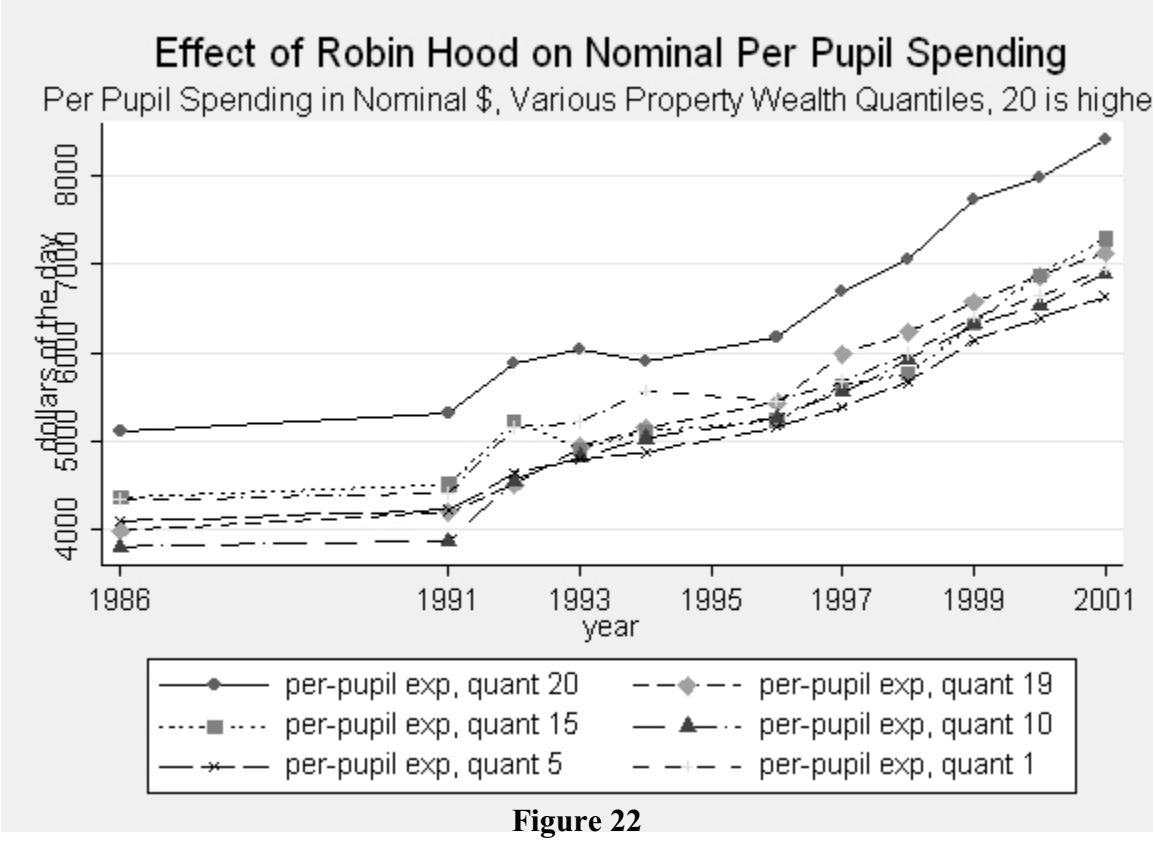

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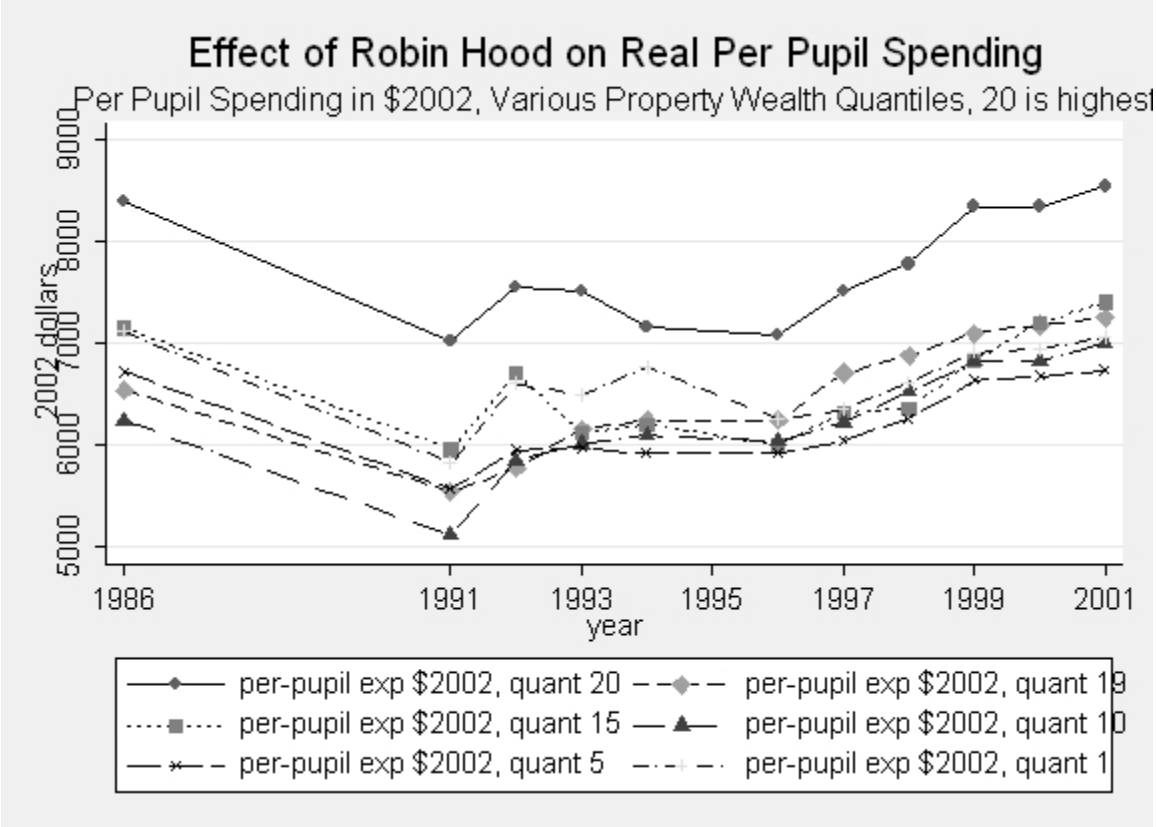

Table 1
Parameters of Texas' School Finance System, Before and After Robin Hood
for Exemplary Districts Property-Poor and Property-Rich Districts

District	Income per Household 1989	Inverted Marginal Tax Price with respect to the Property Tax ***Rate***			Net Foundation Grant (confiscation shown as a negative foundation grant)		Inverted Marginal Tax Price with respect to the Property Tax ***Base***			Tax Rate (mils)	
		Before Robin Hood (1988)	1991	After Robin Hood (1997)	Before Robin Hood (1988)	After Robin Hood (1997)	Before Robin Hood (1988)	1991	After Robin Hood (1997)	1991	After RH (1997)
Edgewood ISD (Bexar County)	33,065	2.49	7.67	9.07	30,666,644 (2,143/pup)	42,666,900 (3,329/pup)	0.33	0.38	0.00	11.7	15.0
Alamo Heights ISD (Bexar County)	252,288	1.00	1.00	0.72	1,179,542 (334/pup)	-18,096,946 (-4458/pup)	1.00	1.00	0.00	11.7	15.0

Note: 1988-89 is the best "before" year for Robin Hood because it predates the school finance legislation. 1997 is a fairly typical year "after" the full implementation of Robin Hood: we could substitute 1994 through 1996 without changing the substance of the table. The Net Foundation Grant shown treats the confiscation districts as though they were in a self-supporting foundation grant system but the negative amount shown is actually what Alamo Heights pays through the confiscation system.

Table 2
Parameters of Texas' School Finance System, Before and After Robin Hood
for 20 Quantiles of the Property Wealth Distribution

Property Wealth per WADA Quantile (20 is highest)	Inverted Marginal Tax Price with respect to the Property Tax ***Rate***			Net Foundation Grant/Pupil (confiscation shown as a negative foundation grant)		Inverted Marginal Tax Price with respect to the Property Tax ***Base***			# of Districts in this Quantile
	Before Robin Hood (1988)	1991	After Robin Hood (1997)	Before Robin Hood (1988)	After Robin Hood (1997)	Before Robin Hood (1988)	1991	After Robin Hood (1997)	
1	2.43	8.56	8.65	2,278	3,704	0.33	0.00	0.00	29
2	1.61	4.66	4.56	2,181	3,610	0.33	0.00	0.00	101
3	1.43	3.58	3.55	2,045	3,272	0.33	0.00	0.00	84
4	1.34	2.93	2.98	1,984	3,203	0.33	0.00	0.00	149
5	1.22	2.50	2.53	1,965	3,118	0.33	0.00	0.00	78
6	1.20	2.26	2.33	1,834	2,823	0.33	0.00	0.00	53
7	1.15	2.03	2.05	1,840	2,729	0.33	0.00	0.01	74
8	1.12	1.84	1.89	1,709	2,530	0.33	0.01	0.00	41
9	1.08	1.73	1.79	1,716	2,651	0.33	0.03	0.00	42
10	1.08	1.64	1.70	1,561	2,203	0.33	0.03	0.00	39
11	1.00	1.52	1.56	1,568	2,183	1.00	0.13	0.00	30
12	1.00	1.45	1.52	1,483	2,082	1.00	0.12	0.00	20
13	1.00	1.37	1.44	1,515	2,129	1.00	0.15	0.00	37
14	1.00	1.25	1.33	1,477	1,974	1.00	0.24	0.01	36
15	1.00	1.12	1.17	1,320	1,723	1.00	0.45	0.04	33
16	1.00	1.05	1.20	1,214	1,573	1.00	0.57	0.07	6
17	1.00	1.00	1.08	1,218	418	1.00	0.59	0.11	28
18	1.00	1.00	1.00	1,176	585	1.00	0.59	0.22	31
19	1.00	1.00	0.98	956	-2,502	1.00	0.60	0.16	28
20	1.00	1.00	0.57	0	-5,484	1.00	0.43	0.00	92

Note: 1988-89 is the best "before" year for Robin Hood because it predates the school finance legislation. 1997 is a fairly typical year "after" the full implementation of Robin Hood: we could substitute 1994 through 1996 without changing the substance of the table. The Net Foundation Grant shown treats the confiscation districts as though they were in a self-supporting foundation grant system but the negative amount shown is actually what they pay through the confiscation system.

Table 3

Year	Confiscation Threshold (nominal $)	Confiscation Threshold (1994 $)	Texas Students in Confiscation Districts	Predicted (in absence of Robin Hood) Texas Students in Confiscation Districts
1994	280,000	280,000	4.7%	12.5%
1995	280,000	272,283	4.7%	15.1%
1996	280,000	264,474	5.7%	12.9%
1997	280,000	258,542	5.5%	13.0%
1998	280,000	254,577	6.4%	17.9%
1999	295,000	262,419	6.1%	16.9%
2000	295,000	253,885	8.3%	23.1%
2001	300,000	251,045	8.9%	24.7%
2002	305,000	251,256	10.3%	28.5%

Table 4
Effect of "Robin Hood" School Finance Scheme on WADA/pupils
(To Raise WADA/pupils, a District must Classifying More Pupils as Disabled or Limited English Proficient)

dependent variable: WADA/pupils	
additional spending for $1 of increased tax payments from property value increases[a]	-0.041
	(0.004)
district fixed effects	yes

a. This can be the *inverted* marginal tax price with respect to property values.

Note: 11341 observations. Standard errors are in parentheses. An observation is one of Texas' 1031 school districts in the years from 1991 to 2001 (the panel is very slightly unbalanced owing to consolidation of a few districts and a tiny number of missing values). The dependent variable is the natural log of the actual property tax base of a district and has mean 1.576 and standard deviation 0.313.

Table 5
Effect of "Robin Hood" School Finance Scheme on Property Tax Bases

dependent variable: ln(actual property tax base of district)					
predicted ln(property tax base)	0.340 (0.016)	0.847 (0.016)	0.280 (0.021)	0.260 (0.021)	0.210 (0.018)
additional spending for $1 of increased tax payments from increase in property tax rate[a]	0.043 (0.003)	0.127 (0.003)	0.035 (0.003)	0.022 (0.003)	0.009 (0.003)
ln(virtual lump sum grant)	0.002 (0.001)	0.004 (0.001)	0.002 (0.001)	0.002 (0.001)	(0.002) (0.001)
additional spending for $1 of increased tax payments from property value increases[b]	0.044 (0.022)	0.079 (0.023)	0.053 (0.022)	0.005 (0.022)	0.102 (0.019)
district fixed effects	yes	yes	yes	yes	yes
no adjustment for new homestead exemption (affects 1998 onwards)		yes			
linear time trend			yes		
quadratic time trend				yes	
other county and metro area covariates (see note)					yes

a. This can be called the *inverted* marginal tax price with respect to the property tax rate.
b. This can be the *inverted* marginal tax price with respect to property values.

Note: 11338 observations. Standard errors are in parentheses. An observation is one of Texas' 1031 school districts in the years from 1991 to 2001 (the panel is very slightly unbalanced owing to consolidation of a few districts and a tiny number of missing values). The dependent variable is the natural log of the actual property tax base of a district and has mean 18.803 and standard deviation 1.499. The country and metropolitan area covariates are the natural log of the average income of a wage and salary worker, the natural log of total personal income, the natural log of the population, the natural log of the number of immigrants, the natural log of the number of Mexican immigrants. Annual immigration numbers are for admitted immigrants and are available only for large Texas metropolitan areas and the remainder of the state.

Table 6
Benefits and Cost of "Robin Hood" Scheme:
Change in School Spending Inequality and Lost Property Value

Year(s)	Coefficient of Variation of Per-Pupil Spending	Per-Pupil Spending Difference between Highest and Lowest Spending Quantiles (2002 $)	*Losses* from Capitalization Per Pupil (2002 $)
1986-87	0.22	2,271	d/n/a
1993-94	0.18	1,972	34,330
1997-98	0.12	1,324	29,896
2000-01	0.12	1,941	34,565

Losses from capitalization per pupil are equal to (total predicted property value in Texas – total actual property value in Texas)/total pupils in Texas. Numbers in the table are inflated using the CPI.