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Letting the market preserve land: The case for a market-driven transfer of development rights program

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Abstract (Document Summary)

The inequalities in conventional zoning-based policies leave urban-fringe jurisdictions unable to meet the growing demand for permanently preserved open space. Allocating marketable development rights (MDR) among all landowners treats this problem directly. It also leaves open the option of allowing the market to allocate land to undeveloped uses. A simple market model is used to develop a framework that describes the mechanics of such a program; it allows for comparison with other commonly considered policies. Several concerns policy makers have raised about a market in development rights are addressed. Alternative regulatory responses to perceived market failures are presented. It is suggested that and MDR program offers significant advantages over existing preservation efforts.

Full Text (6504   words)

[Headnote]
The inequities inherent in conventional zoning-based policies leave urban-- fringe jurisdictions unable to meet the growing demand for permanently preserved open space. Allocating marketable development rights (MDR) among all landowners treats this problem directly. It also leaves open the option of allowing the market to allocate land to undeveloped uses. This paper uses a simple market model to develop a framework that describes the mechanics of such a program and allows comparison with other commonly considered policies. The paper then addresses several concerns policy makers have raised about a market in development rights. Finally, the paper looks at alternative regulatory responses to perceived market failures. The analysis suggests that an MDR program offers significant advantages over existing preservation efforts. (JEL Q2, R1, RS)

[Headnote]
ABBREVIATIONS
MDR: Marketable development rights
PDR: Purchase of development rights

I. INTRODUCTION

The issue of farmland and open space preservation is now decades old and much discussed but, from a practical perspective, still largely unsettled. As development accelerates, urban-fringe jurisdictions feel pressure from farm and homeowners to slow development, and often to take measures that permanently preserve farmland or natural areas. The almost ubiquitous policy response is command-and-- control, in this case, zoning. Information requirements make zoning extremely difficult to do well. But of apparently more concern to local planning commissions is the impact of binding restrictions on the value of zoned land. The owners of land restricted to farm use, e.g., feel unjustly deprived of the capital gains their neighbors receive from selling to developers. In some cases the supporters of zoning prevail, and these rent-seeking efforts reduce the net benefits of zoning (Mills, 1989). In others, the rent seeking wears down zoning supporters, the government eases the zoning restrictions, and the potential benefits of land preservation are lost. In short, however efficient the allocation of land, the inequitable distribution of costs and benefits plagues open-space zoning.

Some 25 years ago land-use planners discovered a "new tool" for addressing the inequities inherent in open-space zoning: transfer of development rights (TDR). TDR programs grew out of the difficulty of funding purchase of development (PDR) programs (Wolfram, 1981). In a conventional TDR program the zoning authority limits the allowed development density in areas targeted for higher-density development and then sells zoning variances to developers. The revenue goes to purchase development rights in areas zoned for preservation. As the value of the rights is the difference between the land's value in developed and undeveloped uses, the compensation reduces opposition from the owners of land zoned to remain undeveloped.

Not surprisingly, the economists who have studied conventional zoning-based TDR programs find little to applaud. Several early papers-Field and Conrad (1975), Mabbs-Zeno (1981), and Barrese (1983), e.g.-conclude that the complex process of regulating land use and brokering the transfer of development rights is costly for public administrators, is unlikely to result in efficient land allocation, and invites strategic behavior by private interests. The experience in areas that have experimented with zoning-based TDR programs comports with economists' predictions: supply and demand conditions for development rights are not what planners expect, leading either to the TDR program languishing or to involved and ad hoc attempts to alter the system until it generates some revenue. Neither situation seems satisfying.

Despite its difficulties, interest in TDR programs remains strong. Price (1981) reports that by 1980 ten municipalities and two counties in the United States had implemented TDR programs. Danner (1997) reports that by 1995 over 100 TDR programs were implemented and that "a government TDR program will probably be coming to an area near you soon" (p. 142). For every jurisdiction that implements a TDR program, many more undoubtedly consider it as an option. The interest is understandable: continuing growth in population and income in urban-fringe areas increases the demand for environmental amenities, and neither zoning nor direct purchase of open space or development rights seems an adequate tool to meet the demand.

There is, of course, an alternative to a highly administered, zoning-based TDR program that economists were quick to recognize: a marketable development rights (MDR) program. The idea is simple: define and equitably allocate the rights to develop an agreed-upon proportion of land within a jurisdiction, and let the market allocate those rights among landowners. The equitable allocation of rights treats the problems associated with zoning because it spreads the cost of land preservation. Carpenter and Heffley (1982) and Mills (1980, 1989) develop formal models of land markets that include markets in development rights. From a theoretical perspective, the development rights market does what markets usually do well. First, under the right conditions, the market in development rights allocates land to undeveloped uses efficiently; i.e., it maximizes the total value of land in the jurisdiction. Second, and perhaps most important from a practical perspective, it distributes the benefits and costs of land preservation relatively equitably: the owners of land that receives the benefits of preservation, i.e., the land that develops, compensate the owners of the preserved land through purchase of development rights. Third, the program potentially does all this at relatively low administrative cost.

Yet despite these advantages, and the continuing interest in open-space preservation, the idea of an MDR program has failed to catch on. Part of the difficulty may be that it is less than obvious to most local policy makers that the problem is one of ill-defined property rights, and that a market is a good way to treat this. Section II addresses this difficulty and lays the foundation for the rest of the paper, by describing the mechanics of a market in development rights. The analysis in section II is not new-it is consistent with existing formal analyses, including Carpenter and Heffley (1982) and Mills (1980, 1989)ut it is written to make the market model and its implications accessible to people who lack extensive training in economic modeling. The model is useful in that it provides a framework to compare and

contrast a marketable development rights program with other policies that are used to preserve undeveloped land: zoning, property-tax abatements, PDR, and TDR. And, in addition to revealing the efficiency and distributional aspects of the various programs, it identifies and clarifies some of the practical yet seldom discussed issues associated with the various policies.

A more important reason for the lack of interest in MDRs, however, is a lack of confidence in how well the market will allocate those rights. The MDR program treats the externality problem by defining the heretofore undefined rights to the open space that generates the external benefits. If undeveloped land generates maximum benefits, as assumed in the existing economic models, then the market works. But critics argue that the configuration and the use of open space matter and express concern that defining the rights to undeveloped land is insufficient to guarantee anything but a hodgepodge pattern of development.

Section III uses the model developed in section II to address several of these issues in detail. Section III begins with a discussion of the circumstances in which the market in development rights will preserve highly productive farmland. Here, again, the analysis is not new-both Gardner (1977) and Fischel (1982) contain similar arguments-but the issue is often important and the present discussion, though nontechnical, is more complete than that in the earlier papers. Then the effects of the size of the jurisdiction on the MDR program are examined. This is important because jurisdictions differ considerably in size, and small ones can agree to a joint program or a large one can limit the program's scope. Finally, section III looks at discontiguous development, such as residential development in farm areas, or poorly networked open space. In each of these cases, a market in which participants seek only to maximize the value of their land and development rights may not allocate land efficiently.

There are two potential policy responses to this kind of market failure, which are the subjects of section IV. One is to overlay some form of open-space zoning onto the tradable rights program. If the market does work, then the zoning either doesn't matter or makes things worse: permit prices fall and land-value differentials reappear. In addition, of course, there is the administrative cost of zoning. On the other hand, if the market fails, the political process behind the zoning may enhance the program by revealing a superior pattern of undeveloped land.

The issue turns, then, on whether the market in development rights generates a more-or-less efficient pattern of land development. The model indicates failure to the extent that property rights remain ill-defined. However, the MDR program may reduce the costs of the bargaining among landowners and developers necessary to better internalize the remaining externalities. This suggests the second option for the role of government: the government serves as a facilitator for the groups who may benefit from well-organized open space. It may be that the combination of a required amount of land left undeveloped, compensation in the form of sales of development rights, some interest among landowners in the greater social good, and support from the local government will reveal a reasonably efficient allocation of open space. This important aspect of an MDR program has not been much discussed in the existing literature.

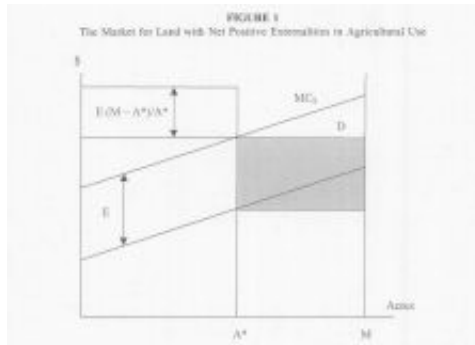## II. HOW DOES AN MDR PROGRAM WORK?

Urban-fringe jurisdictions typically consider alternatives to zoning when landowners complain about the cost of the zoning restrictions; these landowners want to capture the capital gains others have enjoyed from a strong development market. Assume that the local government's goal is to maximize the market value of real property in its jurisdiction. From a practical standpoint, this goal implies several objectives: (1) something close to the desired amount of land remains undeveloped, (2) the land most suitable for undeveloped use remains undeveloped, (3) the costs and benefits of the regulation are distributed equitably, and (4) all this is achieved at a reasonable administrative cost. Creating a market in development rights is a potential means toward achieving these objectives.

To analyze the functioning of such a market, suppose that landowners prefer to sell to the highest bidder. The bid for a particular parcel depends on the parcel's characteristics (such as soil quality, drainage, and elevation) and on how these characteristics are valued across uses. Importantly, the amount a residential developer is willing to pay for a given characteristic differs from the amount a farmer is willing to pay for that same characteristic. Some characteristics, such as school quality, type of street access, and distance from water and sewer mains, are more important to a developer than a farmer.

$$(1) \qquad B_D = D_0 + \sum_i D_i C_i.$$

where D_0 is the combined value to the developer of the characteristics that do not vary across parcels within the jurisdiction. Each C_i is a characteristic of the particular parcel. D_i is the maximum amount the developer is willing to pay for each characteristic. Equation (2) expresses in a similar fashion the maximum a farmer would be willing to bid per acre for the same parcel:

FIGURE 1
The Market for Land with Net Positive Externalities in Agricultural Use

$$(2) \qquad B_F = F_0 + \sum_i F_i C_i.$$

where F_0 is the value in farm use of a typical acre within the jurisdiction, C_i is the characteristic of the parcel that matter to a farmer, and F_i is the maximum values that these characteristics have for farm uses. The subscript i appears in equation (2) to indicate that the characteristics that matter to a farmer may differ from those that matter to a developer.

Figure 1 illustrates how the market allocates land to residential uses within a rural-fringe jurisdiction containing M acres of currently undeveloped land, i.e., land currently in farm use. The supply curve S shows the maximum amount a farmer would be willing to bid for each acre; a developer must be willing to outbid a farmer to purchase the land. To get the continuous upward slope to the supply curve, each acre has been sorted along the horizontal axis in increasing value in farm use, B_F. The demand curve D shows the maximum amount a residential developer would be willing to bid for each acre. The horizontal demand curve indicates our present simplifying assumption that each acre has the same value in developed use, which equation (1) shows is not generally the case. However, because each acre's value in each use depends on numerous characteristics, it is not possible to sort acres on both residential and farm values on the same two-dimensional drawing.

Equation (1) shows the maximum that a land developer is willing to bid per acre for a given parcel in a rural-fringe jurisdiction that is small relative to the size of the metropolitan area:

The market in Figure 1 allocates all the land to residential development. Even land that has relatively high value in farm use has greater value to homeowners. That the market allocates highly productive farmland to residential uses is not by itself a sign of market failure. The market works (i.e., maximizes social value) when it allocates land to its most valued use.

This competitive market fails if the value to society of the land as farmland exceeds the value of the land to an individual farmer. If the external benefits from farming outweigh the external costs, then the cost to society of developing the land exceeds the costs to the farmer. The curve MCs shows the marginal social cost of developing each acre assuming each acre left in farm use generates $E in net benefits external to the farmer. Assuming that transactions costs prevent private negotiations among landowners to internalize the external benefits of undeveloped land, the market allows too much land to develop. Under these conditions the government can improve allocative efficiency, i.e., increase the total value of land in the jurisdiction, by implementing a policy that preserves acres A* through M.

The default policy option is zoning, which is almost ubiquitous in developed and developing areas alike. The alternatives most often recommended by economists are externality taxes, in this case a tax on land development, or tradable permits, in this case tradable development rights. Most jurisdictions combine some form of taxation with zoning.

Zoning can allocate land across uses efficiently if the jurisdiction can correctly identify and zone acres A* through M at a reasonable administrative cost. To determine which acres to preserve, the jurisdiction must gather and correctly analyze information about the characteristics of each tract of land and about their value in each use. The less complete the information about land characteristics and their market values, the more difficult it is to zone efficiently.

In addition, even if the zoning authority manages to allocate land across uses efficiently, the zoning distributes the benefits inequitably. The zoning restrictions burden the owners of acres A* through M by reducing the market value of their land. The shaded area in Figure 1 shows the aggregate loss in land value from zoning. The benefits of zoning accrue to the owners of the land on which external benefits fall, and the market capitalizes the value of these benefits into the price of developable land. Assume, e.g., that the external benefits are local and distributed uniformly over the developable land within the jurisdiction. The market value of each of the acres 0 through A* then increases by $E(M - A*)/A*$. In this case the zoning restrictions both maximize the aggregate value of land in the jurisdiction and create a big differential in value between land allowed to develop and land restricted to undeveloped uses. A politically stable policy is therefore likely to require a more equitable distribution of benefits.

One option is to compensate the owners of acres A* through M through a purchase of development rights (PDR) program. In principle, the value of the development rights on a given acre of land, Ao, is the difference between the acre's market value in developed versus undeveloped use. However, is the correct value in developed use that before or after the external benefits are capitalized into the value of the land? Taxpayers should prefer the smaller one, in which case the total cost of development rights equals the shaded area in Figure 1. In principle, the owners of acres A* through M should be satisfied with payments equal to the shaded area because their total wealth would be similar in the absence of the preservation program. But the smaller values are hard to estimate from observations on sales of land on which benefits are capitalized. Moreover, part of the marginal land value differential persists; the payments for purchase of the development rights may not satisfy the owners of the restricted land when they observe the now higher sale price of developable land. Increasing the compensatory payments to the owners of restricted land reduces (and may eliminate) the net social benefit of the program.

Given adequate information about land values, the jurisdiction could impose a tax on development sufficient to purchase the development rights on acres As through M. The market capitalizes the tax into the value of developable land, which reduces its price and eliminates the land-value differential. A tax that generates revenues equal to the area shaded in Figure 1 leaves the aggregate net increase in the value of developable land equal to the net social benefit of the zoning. A somewhat larger tax, and correspondingly larger payments for development rights, spreads the benefits of the zoning restrictions equally over all the land in the jurisdiction.

This kind of reasoning lends support to most existing TDR programs. One can view the tax on developable land as a fee for purchase of development rights, with the fee compensating the owners of land zoned for preservation. All that this requires is that the zoning authority gather the information necessary to allocate land across uses efficiently; analyze that information properly; convince elected officials that the analysis is accurate; adopt a zoning map and ordinance; choose, implement, and collect the optimal tax; monitor and enforce the whole system; and alter as necessary with changing conditions. Piece of cake.

The high cost of a command-and-control system motivates market-driven alternatives. One option is to define development rights and allow trades in an open market. This gets at the root of the problem: ill-defined property rights. The market preserves too little land because individual landowners receive none of the external benefits of their undeveloped land. Suppose that all M acres are undeveloped. The local jurisdiction foresees encroaching urban development, chooses the amount of land on which to allow development, At, and then distributes A* permits to landowners. Each landowner can then choose whether to use, sell, or purchase additional permits.

The market then establishes a permit price equal to the difference between the value of the A*th tract in developed versus undeveloped use. Given the capitalization of the external benefits into the value of developable land, the market price of a permit is $E(M/A*)$. At that price, landowners maximize their wealth by selling the rights to develop acres A* through M. If the permits are distributed in proportion to total holdings, the sellers would net $E per acre. Then no landowner is worse off after the restrictions, and most are better off. In aggregate, the entire net social benefit accrues to the owners of the land that remains undeveloped.

The local government could generate the same allocation of land using a tax equal to the equilibrium price of the permits. The tax encourages land owners to reveal the true value of their land through their choice of whether or not to

develop. Of course, the government would have to estimate that price. Moreover, the tax generates revenue for the government that could be distributed so that all land owners benefit equally (per acre). This might be superior to the distribution generated by the tradable permits program, but it is not obvious that the government would in practice distribute revenues so equitably.

The foregoing analysis, as simple as it is, provides insight into the current interest in tradable permits. With possibly low administrative costs, such programs distribute the costs and benefits of regulation relatively equitably, reducing the rent seeking so common with zoning. The market approach may appeal to jurisdictions with small budgets or constituents who are suspicious of strong government regulation of land use. Perhaps less important from a political perspective, it addresses the source of the market failure. To the extent that it fixes the market failure, it increases the net benefits of the regulation by better allocating resources across uses.

III. WHAT ARE THE CONCERNS ABOUT AN MDR PROGRAM?

The preceding discussion indicates that an MDR program has significant advantages over more conventional policies. Yet, to our knowledge, no program yet exists that allows the market to both price development rights and allocate land to undeveloped use. Part of the problem is that many policy makers are unaccustomed to thinking about their regulatory actions as defining and reallocating property rights. But conversations with public officials indicate a potentially more important reason: they are far from confident that the market will allocate land in ways that meet public objectives. This section applies the model of section II to address several concerns that matter to local officials. The issues are similar in that each represents a case in which the market may not work as desired, but they differ in the nature of the problem.

A. Does an MDR Program Protect Prime Farmland?

One component of many land preservation programs is protection of "prime" farmland. It is not clear, though, that this is particularly important in urban-fringe areas. One argument given for preserving farmland is that urban sprawl threatens the adequate production of food and fiber. Somewhat more convincing is that prime farm lands generate a variety of external benefits. In the model developed above, the market-driven program succeeds in preserving relatively high-value farmland. However, efficiency (maximizing the total market value of land) does not require that the land of highest value in its best undeveloped use remain undeveloped; the market could efficiently allow preservation of relatively low-- value land at the expense of prime agricultural land. This section extends the model to identify some of the conditions under which an MDR program protects prime farmland. The discussion here builds from the selection model of Roy (1951), which was applied to the land market by McMillen et al. (1992).

Equations (1) and (2) are key to understanding how markets allocate land. Land goes to the highest valued use, with the value depending on its characteristics. There are three possibilities: (1) the characteristics valued in farm use differ from those valued in residential use; (2) the same characteristics are valued in both uses, but more so in agricultural use; (3) the same characteristics are valued in both uses, but more so in residential use. Whether the development rights market preserves prime agricultural land depends on which condition holds.

Case 1. Here, the land most highly valued by residential developers is least valued by farmers. Under these conditions the market works the way we expect, by preserving the highest value farmland. And the land that develops has the characteristics most highly valued by homeowners. Brueckner and Fansler (1983) and McMillen et al. (1992) find empirical support for this view of the market land-allocation process.

Case 2. Here, developers and farmers are most interested in the same land, but the farmers are willing to outbid developers for the best land. The land most likely to develop is again that with below average value in agricultural use. But this land also has lower than average value in urban use. Here we have the opposite of urban sprawl: urban development gets crowded out by high-value farm use.

Case 3. Here, the land most likely to convert to urban use is that with relatively high value in agriculture. Once developed, this land will have a higher-than-average value in urban use. This is the situation that drives the concern about urban sprawl in general-the market allocates the most productive farmland to nonfarm uses-and though the MDR program guarantees that open space is preserved, it is not the land with the highest value in farm use.

There are a couple of points worth noting in case (3). First, the market allocation is efficient: even though good agricultural land gets developed, its value in urban use more than makes up for the loss. Moreover, the allocation appeals to wealth-maximizing landowners: the market maximizes the aggregate value of the land. Second, the results of our model depend on the assumption of wealth maximization.

But farmers may be willing to forgo some wealth to preserve farmland, even when that land has greater market value in developed use. These farmers may choose to sell their development rights, thereby preserving their farmland, even

if using the development rights and selling to a developer raises more cash. From a wealth perspective, the sale of the development rights also gives an option intermediate to strict agricultural zoning and selling to a developer.

In conclusion, then, the market in development rights will tend to preserve prime farmland in two of the three possible cases. Even in the third case, the development of prime farmland may be efficient. Also, however, to the extent that farmland owners are concerned with more than just monetary wealth, the development rights market allows them the option of selling development rights, and preserving farmland, even if the sum of the values of those rights and the land in farm use is less than the land's value in developed use.

B. Does the Size of the Jurisdiction Matter?

Some jurisdictions that might consider an MDR program are relatively large, such as counties, while others, such as townships, are small. Large jurisdictions might consider limiting the scope of the program, while smaller jurisdictions might agree to a joint program. Competitive effects aside, the size of the jurisdiction can affect the price of permits and distribution of benefits in two ways. First, some of the external benefits may fall on land outside the jurisdiction. Second, the distribution of the characteristics of land may vary more across a larger land area than within a smaller jurisdiction.

Consider first the effects of benefits spilling over onto land in neighboring jurisdictions. Assume for simplicity that all external benefits fall outside the jurisdiction. Then the market price of development permits falls to $E, which is the difference between the marginal values of land in each use prior to capitalization of the effects of the program. After capitalization, the market value of developable land falls in reaction to the cost of purchasing permits. The total value of land and permits of acres in the range At to M falls by the same amount. The result is that though all of the owners of undeveloped land receive compensation from the sale of permits, some but not all are fully compensated. The losers in this case are predominantly the owners of developable land because they receive no external benefits from the program but have to purchase permits. The winners are predominantly those owners of land outside the jurisdiction on whose land benefits fall.

The MDR program works relatively equitably when the external benefits are relatively local. When some benefits spill over onto neighboring jurisdictions (e.g., the benefits from lower congestion), the landowners there benefit. Then increasing the size of the jurisdiction internalizes more of these benefits. However, if most of the benefits are local, the MDR program may still make sense for jurisdictions as small as a township.

A larger scale program may significantly alter both the price of permits and the allocation of land. For example, suppose that two urban-fringe townships agree to a joint MDR program. If the land has similar characteristics in both townships, that the program is joint will make little difference in permit price or land allocation. But if land characteristics differ across jurisdictions, the market will encourage cross-jurisdictional trades that will have real effects.

To see this in Figure 1, suppose that land in township A has characteristics of higher value in agriculture than land in township B, all else equal. Under separate, but similar, programs, the price of permits will be higher in B because of the relatively greater value in developed use. In a joint program, the price of permits will lie between the prices established in the separate programs, and the market will allocate more development rights to township B. More of the relatively good farmland in A will be preserved, and the owners of the best farmland (that would have remained undeveloped under separate programs) will be better off as the price of permits they sell rises. The owners of the land in B that would have remained undeveloped in a separate program will be worse off under the joint program. In aggregate, if externalities depend only on the amount of land left undeveloped, the joint program raises the value of land.

This suggests that the issue of joint programs will be a concern for landowners. In the above case, owners of farmland in A will prefer a joint program. However, if the external benefits of undeveloped land are local, the joint program would harm the owners of developable land in B. Clearly, relatively small units of government can negotiate over joint programs. Larger units may also wish to consider the geographic scope of the program.

C. Will the Market Preserve Contiguous Blocks of Land?

A common objective of land-preservation programs is to preserve contiguous blocks of land. The argument is that the benefits from a patchwork pattern are considerably lower than those generated by a contiguous block.

Consider farmland preservation. Land with good access to a rural arterial street may have relatively high value to both farmers and homeowners. Suppose too that conflicts arise between homeowners and neighboring farmers. The market produces too many isolated residential parcels if the seller fails to take into account the negative effect of his sale on the owners of neighboring farms. Also, homeowners in rural areas may receive public services at less than cost, which increases the sale price of the parcel but reduces public-service quality. Net social benefit may increase by preventing

isolated residential development.

Another example is networked open space. Suppose that network externalities increase the value of linear open space; homeowners are willing to pay more if the network of open space and bike paths extends beyond their own subdivision. Without negotiations between landowners and developers to internalize this benefit, the market cannot generate efficient allocation.

The market in development rights fails here because the rights to the services generated by the open space, as opposed to the rights to the open space itself, remain undefined. Local officials will easily recognize the solution: zoning. Zoning, or any change in land policy, may affect permit price and land allocation. As it is unlikely that an MDR program will completely displace zoning, it seems worthwhile to look at the effects of zoning on the MDR program.

IV. HOW CAN THE GOVERNMENT RESPOND TO PERCEIVED MARKET FAILURE?

The preceding section describes concerns about the efficiency of the market allocation of undeveloped land. The MDR program guarantees preservation of a certain amount of land, but it does not guarantee that the land is configured or used in the manner that generates the largest sum of use and external values. Also, maximizing the aggregate value of land may not be the only objective of the jurisdiction. The optimization problem is a difficult one, and simply defining the rights to undeveloped land does not solve it in a market with high transactions costs.
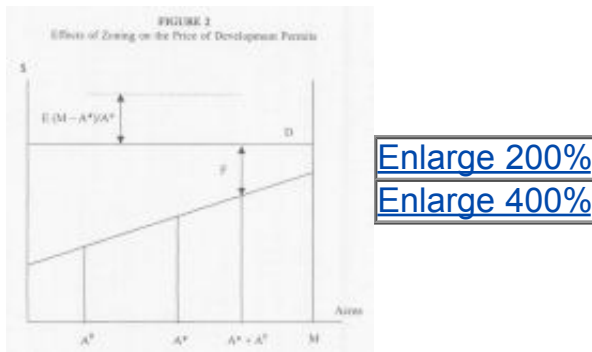

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FIGURE 2

The conventional approach to this kind of problem is zoning. In contrast to highly administered TDR programs, a local jurisdiction could define and distribute the rights to develop land, then overlay zoning onto the MDR program. For example, a jurisdiction may impose agricultural zoning on blocks of especially desirable farmland, or may zone land to create a network of connected open space. As a jurisdiction will very likely continue zoning for purposes other than open-space preservation, it seems unlikely that it will resist some form of open space zoning. The purpose of the MDR program then becomes distributive rather than allocative.

Altering the land allocation may influence permit prices and the compensation owners of land zoned for preservation receive. Returning to Figure 1, one possibility is that the effects of zoning on the price of permits are negative. Above it was assumed that the use and configuration of the undeveloped land maximize the external benefits. To see how zoning can alter this configuration, suppose that the jurisdiction distributes A*IM development rights per acre and also zones acres 0 through A^0 in Figure 2 for agricultural use only. As a result of their relatively low agricultural value, acres 0 through A^0 would have developed under an unrestricted MDR program. With the zoning restrictions, the owners of the zoned land are willing to sell their development rights at any nonnegative price. In equilibrium, the acres A^0 through $A^* + A^0$ will develop, and the price of permits will fall by the difference between E and F in Figures 1 and 2. Here the cost of zoning is a decrease in the market price of permits. The sale of permits does not completely compensate the owners of acres 0 through Ao for the restrictions placed on their land. This example may appear extreme in that zoning to preserve land with the greatest net value in development may be uncommon. Rather, the jurisdiction may zone to preserve prime agricultural land. If the market preserves such land anyway, the zoning has no effect. However, if the land is also highly valued in developed use, the zoning has the effect described above. Zoning land near wetlands for preservation may have similar effects: such land may have only average value in undeveloped uses, but high value in residential use.

Another possibility is that zoning improves the efficiency of the land allocation. Here the market capitalizes the benefits of zoning into the value of developable land, which will increase the permit price. In Figures 1 and 2, the zoning shifts the realized MCs curve closer to the ideal represented by the MCs curve as drawn. For example, if the zoning generates positive network externalities or prevents undesirable isolated development, the total value of development increases, which is reflected in the price of development rights.

The important question, then, is whether zoning really can improve the market allocation of land, or whether another approach can better solve the problem of bargaining and coordination among landowners. The question is analogous to that in organizing a relatively large business: the trend in manufacturing, e.g., has been toward less centralized control in favor of flatter organizational systems that give more decision-making authority and responsibility to the people with the best information to make those decisions. A key to the success of these flatter organizations is that they provide the necessary opportunity and incentives for cooperation.

The question then becomes whether the MDR program reduces the transactions costs that prevent the negotiations necessary to internalize external costs and benefits. Ill-defined rights to the benefits from land preservation raise transactions costs. The MDR program does not entirely correct the problem, but by defining the rights to undeveloped land, which generate the external benefits, it appears to reduce transactions costs: it ensures that some land remains undeveloped and provides a mechanism to redistribute costs and benefits. Since transactions costs always exist, the question is whether and when a TDR program reduces these costs enough to generate reasonably coordinated development patterns without direct government regulation of land use.

Local government may take actions that further reduce transactions costs. The authority could choose to act as a facilitator of negotiations among landowners and developers rather than directly regulate land use. For example, the TDR program arguably improves the prospects for farmers to agree to sell their development permits rather than sell isolated parcels or especially productive land to developers; the sale of permits reduces, but may not eliminate, the cost of not developing. The program may also encourage the owners of adjacent land both to preserve a portion as open space and to work together to ensure the open space networks well. Still, transactions costs inhibit mutually beneficial negotiations. The local government may encourage transactions, at low administrative cost relative to zoning, by acting as a facilitator.

Which role the local authority takes-regulator or facilitator-probably depends on the jurisdiction's financial resources, and the cultural preferences of its constituents. Though zoning is virtually ubiquitous in developing areas, which is unlikely to change with implementation of an MDR program, the degree of regulatory zeal varies considerably; some planning commissions defend their zoning ordinance and planning process, while others are quick to make modifications and grant variances. In general, it seems likely that adoption of an MDR program would induce at least marginal changes in the way local governments view their regulatory role.

V. CONCLUSIONS

This paper investigates the opportunities to improve the practice of farmland and open-- space preservation by implementing a marketable development rights (MDR) program. The issue is important for two reasons. First, the demand for open-space preservation is increasing in the urban-fringe areas of growing metropolitan areas. Second, existing preservation programs, typically zoning based, work poorly in part due to the inherent inequities in the distribution of costs. One conclusion is that a relatively simple MDR program treats this problem effectively, with relatively low administrative cost. It is likely that some form of MDR program is necessary for effective open-- space preservation. When the bulk of external benefits are highly localized, even a relatively small jurisdiction, such as a township, could implement an MDR program.

Another clear conclusion is that the definition of the rights to undeveloped land is, by itself, insufficient to guarantee, in a simple market model, that the land left undeveloped will be optimally configured or used; ill-defined property rights remain. One option is zoning, which, given their familiarity and commitment to it, local governments are likely to implement. The effect of the zoning on the price of development rights depends on whether the zoning enhances external benefits. This, of course, will be impossible for the jurisdiction to measure.

Arguably, however, the MDR program reduces the transactions costs of the bargaining needed to improve the market allocation. The local jurisdiction could take an unconventional stance and decide to act as a facilitator of those negotiations. This evolution in management practice is analogous to that occurring in large businesses. Whatever the jurisdiction's response, however, it seems likely that the incentives generated by the MDR program would lead to a market allocation of undeveloped land superior to that suggested by the simple market model.

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