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## **Estimates of Transaction Costs in Transfer of Development Rights Programs**

Authors: Sina Shahab, J. Peter Clinch and Eoin O'Neill

**Problem, research strategy, and findings:** Local jurisdictions in 36 US states have implemented Transferable Development Rights (TDR) programs to provide a market-based approach to preserving farmlands and open space while redirecting future development to targeted areas. Participation in TDR programs involves transaction costs which are costs over and above paying for TDR credits. Planners know little about the magnitude of transaction costs, who, if anyone, incurs a disproportionate share of these costs, or how transaction costs impact TDR participation. We estimated the magnitude and distribution of transaction costs incurred by participants in four county-wide TDR programs in Maryland, a TDR pioneer, by interviewing multiple participants in these programs. We found that total transaction costs were high and borne largely by private sector participants, although we excluded initial public-sector costs of establishing the programs. Total transaction costs ranged from 13% to 21% of total TDR costs per transaction. Our findings were based on data reported by participants and may not be scalable; transaction costs, however, might deter landowners from participating in TDR programs, thus thwarting the land-use goals of planners.

**Takeaway for practice:** Planners should work to reduce transaction costs by better constructing TDR programs and providing greater information on TDR sale prices and potential buyers and sellers. Lowering, and more fairly, distributing transaction costs will make the TDR program a more successful approach to achieving land-use goals and addressing the externalities arising from land-use markets.

**Keywords:** Transferable Development Rights (TDR), Transaction Costs, Preservation.

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### **Introduction**

Transferable Development Rights (TDR) programs in the United States are multi-objective policy instruments that planners implement to address a wide range of planning objectives. City, township, and county-level planners use these programs to preserve historic landmarks, protect ecologically sensitive lands and farmlands, prevent urban sprawl, and develop more compact urban areas. As of 2016, US local governments operated 254 TDR programs in 36 US States, most dating from the 1980s. TDR programs establish markets to trade and transfer 'development rights' translated into TDR credits between different areas, allowing planners to protect lands which they would otherwise need to buy. Landowners in 'sending areas' may sell development rights, calculated as TDR

credits, with prices set by the market. Developers may purchase and use those credits in ‘receiving areas’, which planners designate for development. The original landowners maintain the property rights, but forgo the development rights in perpetuity after selling them. TDR programs normally provide developers with an option to obtain extra density (bonus density) to develop beyond a specific permitted level in receiving areas.

There are costs to operating and participating in TDR programs. Private parties participating in TDR programs - landowners and developers - incur ‘transaction costs’, over and above paying the sale prices for TDR credits set by the market; these include negotiating TDR sale prices, finalizing contracts, meeting administrative requirements, and collecting information on potential TDR buyers/sellers and TDR sale prices. Public parties - planners and program administrators - also incur transaction costs that include training staff, holding public TDR educational workshops, and reviewing TDR applications. TDR programs have not always been successful in achieving their preservation and development objectives; some researchers speculate that high transaction costs involved in operating and participating in these programs might be one of the reasons. High transaction costs can have considerable impacts on policy efficiency and equity and can discourage private parties from participating in TDR programs. We can find no studies in the planning literature which attempt to estimate the significance of the transaction costs associated with TDR programs.

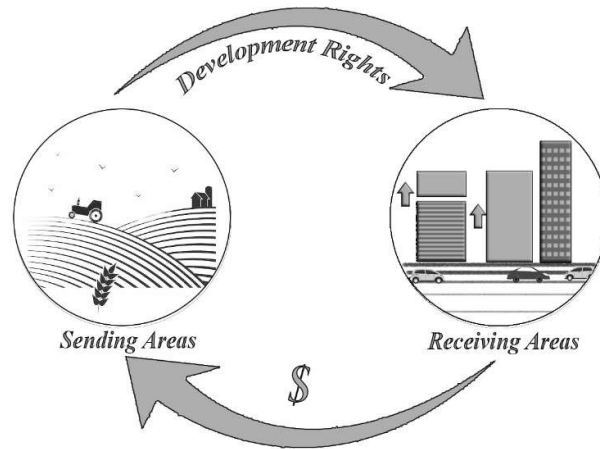
This paper addresses this gap by providing estimates of the magnitude of transaction costs incurred by different stakeholders involved in ‘operating’ and ‘participating’ in four county-wide TDR programs in Maryland, a pioneer in implementing TDR programs. Our goal is to highlight the significance and distribution of transaction costs of these TDR programs. We give a very brief overview of the literature on TDR programs and transaction costs and describe the methodology we used. We then present our estimates of transaction costs in the TDR programs we consider. We find that the transaction costs of operating/participating in TDR programs are sizeable and unevenly distributed among public and private parties. We also find that preparing a land survey and hiring intermediaries, such as brokers and land-use attorneys, are the most costly activities in operating/participating in TDR programs.

## **Transferable Development Rights (TDR): Rationale, Application, and Associated Costs**

TDR programs are market-based instruments that planners have proposed as a solution to preserving open space, environmentally sensitive areas, agricultural land, and better managing development (Johnston & Madison, 1997; Linkous, 2016; Pfeffer & Lapping, 1994; Pruetz & Pruetz, 2007; Shih & Chang, 2015). Figure 1 shows that TDR programs transfer development rights from sending areas to receiving areas. Planners implement these programs as an alternative to traditional regulatory instruments, such as zoning, subdivision regulations, and purchase of development rights (PDR) programs. TDR and PDR programs normally have similar policy objectives, but they use different approaches to achieve them. Local governments use PDR programs to purchase development rights in preservation areas, using public funds. TDR programs, in contrast, do not use public funds and instead let the development market pay to preserve land and purchase development rights from lands within designated areas. The TDR approach is similar to zoning - public-sector planners recommend which areas are to be developed and which are to be preserved. TDR programs, however, use market mechanisms to achieve greater efficiency than traditional regulatory instruments, allowing development rights to be ‘traded’ in a way that protects sensitive lands, reducing the preservation costs for local governments. Some researchers also argue that these programs achieve greater equity through these trades, as money flows from those who benefit from being allowed to develop to compensate those who have been prevented from developing fully the land that they own (Clinch & O’Neill, 2010; L. Janssen-

Jansen, Spaans, & van der Veen, 2008; Pruetz, 2003). TDR programs are superior to traditional instruments like zoning where large benefits are conferred on those lucky enough to be zoned for development but there is no transfer of funds to compensate those whose land is zoned for preservation.

Figure 1: Transferring TDR credits from sending areas to receiving areas



Researchers usually consider the Coase theorem as the intellectual foundation of TDR programs (Wang, Tao, Wang, & Su, 2010). The Coase Theorem argues that, if transaction costs are negligible and property rights of any resource are clearly attributed, market transactions will lead to more efficient outcomes in dealing with externalities than public interventions through negotiation between parties. Most planning actions are designed to address externalities, the positive or negative impacts of an individual's action on unrelated third parties. Allowing landowners to change agricultural or sensitive lands into residential areas, for example, normally creates costs to society (social costs) that are greater than the private costs developers incur. Developing land in areas where planners want development, in contrast, can create public benefits by, for example, creating dense and diverse neighborhoods where people can walk and use public transit; these public benefits are likely to be greater than the private benefits to developers. Economists refer to the former costs as external costs or negative externalities, and consider the latter benefits as external benefits or positive externalities. The Coase theorem asserts that it is not always necessary to regulate externalities with regulatory instruments like zoning if there is a possibility of creating a market for property rights (Clinch, O'Neill, & Russell, 2008; Micelli, 2002). Planners thus design TDR programs to assist in defining property rights and create a property-rights market, which can replace direct forms of public intervention protecting certain types of land uses or encouraging development in specific areas.

The concept of TDR is not new. The 1916 New York City zoning ordinance gave rise to the concept of so-called 'air rights'; previously New York City did not regulate the height of buildings. Lot owners were then permitted to sell their unused air rights (development potential) to adjacent lots under the proposed zoning. The owners of 'sending' parcels could earn a considerable profit from selling their development potential, and the owners of 'receiving' parcels could, after purchasing these rights, erect a building that exceeded the height that the zoning and density regulations would ordinarily allow. In 1986, the New York City Planning Commission introduced a more elaborate density-transfer mechanism to protect landmarks by allowing the transfer of development rights to parcels several blocks away (Giordano, 1987). Grand Central Terminal, South Street Seaport, Old Slip, and Christ Church are some of the landmarks that sold and transferred their unused air rights to other areas in New York City.

Most US TDR programs, however, did not commence until the late 1970s and early 1980s (Danner, 1997; Renard, 2007).

As of 2016 only seven out of 36 states have more than 10 TDR programs (Pruetz, 2016). TDR programs are mainly located in the Northeast and in Florida, California, and Washington State. The Northeast region has almost 40% of all TDR programs in the US. At least 25 out of 36 US states, including Maryland, in which TDR programs are active, have adopted enabling legislation explicitly permitting local governments to adopt such programs (Nelson, Pruetz, & Woodruff, 2011). Eight other states have not enacted enabling legislation although they have active TDR programs at a local level with the relevant general planning powers delegated to lower levels of government, which have come to include TDR programs. State statutes vary (in the States with TDR enabling acts) from granting powers in brief subsections (e.g. Florida Statute's Land Development Regulations) to lengthy statements of principles and procedures (e.g. Title 40 of New Jersey's Code). In Florida, for example, the brief grant of power to local governments encourages the use of 'innovative land development regulations' including 'provisions such as transfer of development rights' as well as other planning instruments, but provides no detail on how any TDR program should operate.

TDR programs involve a multi-step process (Shahab, Clinch, & O'Neill, 2017). The process starts when city, township, and county-level planners choose TDR programs to preserve specific lands. They normally allocate TDR credits to lands located in sending areas (e.g. 1 TDR per 5 acres) and specify the number of credits needed to build one unit of development in receiving areas (e.g. 3 TDR credits per dwelling unit). How planners allocate TDR credits to sending and receiving areas varies. Landowners in sending areas usually need to apply for TDR credits from the relevant local government's planning department in order to participate in market trading and transfer. Table 1 shows that this step, which we refer to as the 'TDR creation' stage, consists of collecting information, hiring a land-use attorney, preparing a title report, applying for TDR credits, and reviewing the TDR application. Participating landowners can then find a TDR buyer (normally a developer), negotiate a price for credits, and receive a payment for selling the TDR credits. This step, which we refer to as the 'contracting' stage, involves collecting information, hiring a broker, negotiating a TDR price, and preparing a contract. Developers can purchase TDR credits from landowners if they wish to develop beyond a specific permitted level in receiving areas. Developers usually need to submit purchased TDR credits to the planning department to use the bonus density arising from TDR credits in their development projects. This step, which we refer to as the 'TDR-retirement' stage, involves collecting information, recording the contracts in land records, applying the purchased TDR credits in development projects, and recording all relevant documents. We focus on only the three stages: creating TDR credits, contracting, and retiring TDR credits. We refer to these three stages together as TDR transactions.

Table 1: Three stages involved in operating/participating in TDR programs and their relevant activities and stakeholders involved

Stages involved in operating/participating in TDR programs	Main activities involved	Main stakeholders involved
TDR Creation	Hiring a land-use attorney Preparing a title report Preparing a land survey Applying for TDR credits Reviewing TDR applications	Landowners, program administrators, and intermediaries
Contracting	Finding a TDR seller/buyer Consulting with program administrators, land-use attorneys, and brokers Hiring a broker and paying a brokerage fee Negotiating a TDR price Preparing a contract Payment for TDR credits	Landowners, developers, and intermediaries
TDR Retirement	Recording the contract in land record Applying the purchased TDR credits in development project Recording the transfer documents	Developers and program administrators

*Adapted from Shahab et al. (2017)*

Operating and participating in TDR programs creates many transaction costs. Transaction costs, in simple terms, are all the costs involved in a transaction that are not directly related to the production of a product (Lai, 1994; McCann, Colby, Easter, Kasterine, & Kuperan, 2005). Some researchers claim that transaction costs in TDR programs may be very high (Bruening, 2008; Chomitz, 2004; L. B. Janssen-Jansen, 2008; Messer, 2007; Tripp & Dudek, 1989), in part, because these programs are not always easy to administer (Arendt, 2004). High transaction costs may arise from lengthy and time-consuming negotiations over TDR prices, difficulties in finding and connecting potential sellers and buyers, and complex rules, requirements, and/or regulations. High transaction costs lower the incentives for different stakeholders to participate in the program and discourage potential transactions (Bruening, 2008; Messer, 2007).

Claims of high transaction costs in TDR programs, however, are not based on systematic research or empirical data. We have found no empirical research in the planning policy literature that measures the magnitude of transaction costs. Some researchers have attempted to calculate the magnitude of such costs in other policy areas, such as environmental, agricultural, and natural resource policies; researchers find that these costs vary widely across policies. Transaction costs have ranged from as low as 8% of water purchase costs for the California water bank (Howitt, 1994) to as high as 110% of the payment to farmers for wildlife enhancement scheme in the UK (Falconer & Saunders, 2002). Policy-related transaction costs studies also find that such costs are normally not evenly distributed among the stakeholders involved in policy instruments (Coggan, Whitten, & Bennett, 2010; Shahab, Clinch, & O'Neill, 2018).

Researchers have used different methodologies to collect data to measure transaction costs in different policy studies. McCann et al. (2005) list five different sources of information for such studies, including, 1) surveys or interviews of people and parties involved in a policy, 2) secondary data from other studies, 3) government reports, 4) financial reports, and 5) proposed budgets. Several studies have used interviews to measure the transaction costs of public policy instruments (Falconer & Saunders, 2002; Fang, Easter, & Brezonik, 2005; Kuperan, Abdullah, Pomeroy, Genio, & Salamanca, 2008; McCann & Easter, 1999; Ofei-Mensah & Bennett, 2013), because other methods and databases are not always available. McCann et al. (2005) argue that surveys or interviews are often the only way to obtain information regarding policy-related transaction costs, although they are relatively more difficult and time-consuming.

## TDR Programs in Maryland

There are 13 county-wide TDR programs in Maryland, one of the highest numbers of executed TDR programs among the US states. Table 2 shows where county-level planners in Maryland have applied TDR programs to preserve mainly farmlands, natural resources, and the rural character of counties. As of 2008, TDR programs in Maryland had preserved over 80,000 acres or 61% of all agricultural lands protected by TDR transfers in the US, according to a national study conducted by American Farmland Trust (2008). Three programs out of the seven TDR programs in the US that have preserved more than 10,000 acres by 2008 are located in Maryland: Montgomery County, Calvert County, and Queen Anne’s County (Pruetz & Standridge, 2008). We selected four county-wide case studies of TDR programs in Maryland, including Calvert, Montgomery, St. Mary’s, and Charles Counties. Our approach - selecting TDR case studies from only one state - allowed us to minimize the contextual differences between the case studies, and facilitate the comparison of policy design and implementation, while keeping other components of the institutional environment constant, including legislation. These counties, however, were considerably different in population and distance from Washington D.C. Montgomery County, located north-west of Washington D.C., is the largest county, with a population almost three times that of the other three counties combined, resulting in a higher level of demand for development.

*Table 2: Characteristics of TDR programs in different counties of Maryland*

TDR Programmes	Year Initiated	County Population (2010)	County Area (Sq. Miles)	Acres Preserved (2016)	Main Goals of the Program
Calvert County	1978	88,737	213.15	14,700	Preserving the rural character
Caroline County	1989	33,066	319.42	2,827	Preserving farmlands
Carroll County	1992	167,134	447.60	-	Protecting mineral resources
Cecil County	2006	101,108	346.27	-	Preserving natural resources
Charles County	1992	146,551	457.75	5,274	Agricultural preservation
Frederick County	2014	233,385	660.22	-	Agricultural preservation
Harford County	1982	244,826	437.09	-	Preserving farmlands
Howard County	1992	287,085	250.74	4,980	Preserving farmlands
Montgomery County	1980	971,777	491.25	52,052	Agricultural preservation
Queen Anne’s County	1987	47,798	371.91	28,230	Preserving farmlands
St. Mary’s County	1990	105,151	357.18	4,107	Preserving natural resources and farmlands
Talbot County	1990	37,782	268.54	580	Preserving rural character
Wicomico County	2004	98,733	374.44	-	Preserving farmlands

*Data sources: Maryland Department of Planning (2016); Pruetz (2016); Dehart and Etgen (2007); McConnell, Walls, and Kelly (2007); Pruetz and Standridge (2008); The Maryland State Data Center (2015)*

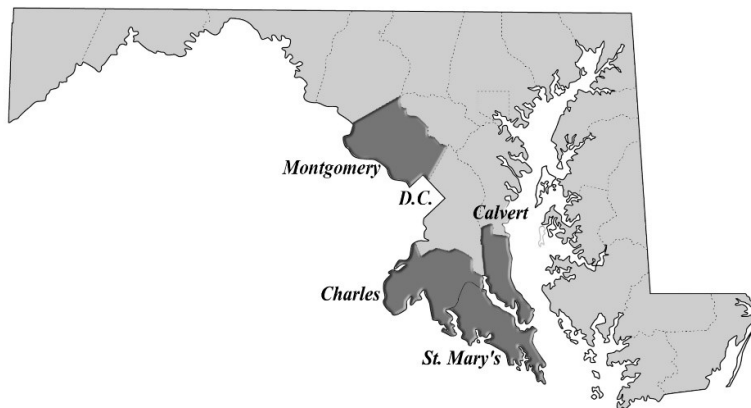
We considered many factors in selecting the county-wide TDR case studies, including the requirement that each have: 1) a number of TDR transactions or transfers; 2) a number of people who were involved in the programs; 3) programs that were initiated in different years/decades; 4) different levels of success - acres preserved through the program; and, 5) reasonably close proximity to each other so as to maximize the number of face-to-face interviews that the researchers could conduct and thereby minimize research costs. Table 3 shows that the four TDR case studies differ in their institutional design and arrangements, such as how they approached the location of sending and receiving areas, how they allocated TDR credits, and the main county departments involved in their TDR programs. Figure 2 shows that these four TDR case studies are located in reasonable proximity to each other.

Calvert County, located in southern Maryland, initiated its TDR Program, the first in Maryland, in 1978. This program allows rural to rural TDR transfers. Montgomery County initiated its TDR program in 1980 and allows TDR transfers from the farmlands in the western and northern parts of the county to more urbanized areas, close to Washington D.C., in the south of the county. Walls and McConnell (2007) and McConnell et al. (2007) consider Calvert and Montgomery TDR programs as successful in preserving lands specified for protection. Pruetz and Standridge (2008) also list these two programs among the top six TDR programs that have preserved the largest acreage in the US. St. Mary's and Charles Counties are two neighboring counties, located in southern Maryland, which initiated their TDR programs in the 1990s. St. Mary's County allows rural to rural TDR transfers. Charles County designated a development district in the north of the county, the areas closer to Washington, D.C., as a receiving area, while the rest of the county are sending areas. McConnell et al. (2007) and Dehart and Etgen (2007) conclude that St. Mary's and Charles TDR programs have been comparatively less successful in land preservation.

*Table 3: Characteristics of Maryland TDR case studies*

TDR Programs	Sending areas	Receiving areas	Acres in sending areas needed for creating one TDR credit	No. of TDRs needed to build one unit in receiving areas	Main County Departments Involved
Calvert County	Lands located in Rural Community District	Lands located in Rural Community District	1	5	Department of Planning & Zoning
Montgomery County	Farmlands in the west and north of county	More urbanized areas in the south of county	5	1	Planning Department & Department of Economic Development
St. Mary's County	Lands located in Rural Preservation District	Entire county	3	1	Department of Land Use & Growth Management
Charles County	Entire county, except receiving areas	Development district in the north of county	3	1	Department of Planning and Growth Management

*Figure 2: Four TDR case-study areas in the State of Maryland*





## Estimating Transaction Costs in Four Maryland TDR Programs

We aimed to estimate the magnitude of transaction costs incurred by private and public parties involved in the four county-wide TDR programs in Maryland. We confined our estimates of transaction costs to the expenses of operating TDR programs and the expenses to the stakeholders arising from TDR transfers. Only the public sector (the program administrators of each county) bears the transaction costs involved in operating these programs, while both the private (developers and landowners/farmers) and public sectors incur the costs involved in TDR transfers. We were unable to estimate transaction costs in the policy-design and establishment stage, largely because the TDR case-study programs were established a number of decades ago.

One author (to ensure consistency) interviewed 46 representatives from different stakeholders involved in the TDR transactions across the four TDR case-study programs, including, landowners/farmers, developers, program administrators, and intermediaries such as land-use attorneys and brokers. Table 4 describes the number of interviews we conducted with different stakeholders in each TDR case-study program. We pre-tested our interview questions by undertaking two pilot interviews. From March to July 2016, we conducted semi-structured interviews on a face-to-face basis along with two telephone interviews. We digitally recorded and anonymously transcribed all of the interviews, which lasted from 45 to 90 minutes each. We first interviewed program administrators in each county. We informed the interviewees about the objectives of the study, the details of the interviews, and their voluntary and anonymous nature, prior to the interviews.

We asked interviewees to explain the TDR transaction process from their own perspective and report the relevant activities they undertook and completed. We then asked a number of questions based on the participants' experience and position. We finally asked interviewees, in line with snowball sampling, to recommend other potential interviewees and/or to provide information helpful for contacting other stakeholders. Snowball sampling allowed us to identify people who were information-rich yet not easy to identify and contact. Table 5 outlines the questions we asked each type of stakeholder about the time they spent, and the costs they incurred, in each activity involved in TDR transactions. We also reviewed the government reports and administrative databases, such as recorded TDR prices, to complement the data collected from interviews.

*Table 4: Number of stakeholders interviewed in four Maryland counties*

Participants	Landowners	Developers	Local Authorities	Intermediaries	Total
Montgomery County	3	3	5	4	15
Calvert County	2	2	5	2	11
St. Mary's County	2	2	4	4	12
Charles County	2	2	2	2	8
Total			46		

Table 5: The interview questions we asked from different stakeholders

Type of questions		Questions
Opening questions		Briefly describe your experience of participating in the TDR program and the process you have gone through.
Questions for different stakeholders	Landowners	What had to be done in order to sell your required TDR? Could you please take me through the process step by step? How many hours/days did you spend on each activity? What was the cost of each hour you spent on each activity? Did you engage an intermediary to assist in the TDR transaction? If yes, how much did that intermediary cost?
	Developers	What had to be done in order to buy your required TDR? Could you please take me through the process step by step? How many hours/days did you spend on each activity? What was the cost of each hour you spent on each activity? Did they engage an intermediary to assist in the TDR transaction? If yes, how much did that intermediary cost?
	Program administrators	From receiving the initial TDR application until final transfer and contract, what has to be done in the administration of the TDR program? Could you please take me through the process step by step? How many people are involved in each activity? How many hours/days did you spend on each activity? What would be the total person hours involved in each activity? What would be the standard hourly rate (salary cost) for the staff involved in each activity?
	Intermediaries	What had to be done in the process of a TDR transaction? Could you please take me through the process step by step? How much do you charge for carrying out each activity? What are the total costs of involving in this activity for a TDR seller/buyer?
Closing questions		Were there any other costs involved in each activity? What were the total costs of being involved in each activity? Would you be able to recommend other people (landowner, developer, intermediary, and program administrator) we could talk to about this?

We calculated the total transaction costs of operating and participating in TDR programs as a sum of the time-related costs and direct monetary expenses (financial costs). We defined time-related costs as the dollar costs of time spent on each activity involved in TDR transactions. We estimated the time-related transaction costs involved in operating and participating in each TDR program for different stakeholders in three categories of activities: TDR creation, contracting, and TDR retirement. The direct monetary expenses, on the other hand, refer to all other direct financial costs involved in operating and participating in TDR programs, which are not time-related (Coggan, van Grieken, Boullier, & Jardi, 2015). These costs include administration fees, brokerage fees, and the costs of preparing a land survey.

We monetized time-related costs by multiplying the reported time inputs by the standard hourly rates for each category of stakeholders. Several other studies measuring transaction costs have used such an approach (Coggan et al., 2015; Falconer & Saunders, 2002; Fang et al., 2005; Kuperan et al., 2008; McCann & Easter, 1999). We set the cost for program administrators at an average level of \$45 per hour, as reported by those we interviewed<sup>1</sup>. We assessed the standard value of time for Maryland farmers as \$22.80 per hour. We calculated this rate based on the average net income per farm in 2015, i.e. \$40,797 (Maryland State Archives, 2017), divided by the average annual hours actually worked per worker in the US in 2015, i.e. 1790 hours (OECD, 2017). We estimated the charges of land use attorneys at \$400 per hour, based on the self-reported costs specified by interviewees. We set the costs for developers' time at \$100 per hour, using their self-reported rates. The considerable difference in the hourly rates attributed to the different stakeholders involved reflects their net added-value and, at least in part, recognizes how society places different values on the time of these various stakeholders (Falconer & Saunders, 2002).

1. This self-reported rate is consistent with the official salary data available as published in *Report of County Employee Salaries, Health Benefits & Pensions - Fiscal Year 2016* (MACo, 2016).

## Revealing Some of the Hidden Costs of TDR Programs

We first present here our estimates of the total transaction costs involved in operating and participating in TDR programs in the four Maryland TDR programs. We then present the two components of these total costs, time-related and direct monetary transaction costs. We then discuss how estimated transaction costs are distributed between private and public sector actors involved in operating and participating in the TDR case-study programs.

### Total Transaction Costs

We summed the total time-related costs and total direct monetary expenditures reported by our respondents to estimate total transaction costs for various stakeholders involved in operating and participating in the four Maryland TDR programs we used as case studies. The average total transaction costs per TDR transaction in all four counties was \$19,611 in 2016 dollars. The transaction costs in Calvert, Montgomery, and Charles Counties were relatively similar; total transaction costs in St. Mary's County, however, were substantially lower, largely because that county removed the requirement that landowners provide a land survey as part of the TDR application process. Table 6 shows our estimates of the total transaction costs per TDR transaction in each of the four counties.

We also calculated the total transaction costs as a percentage of total payment for TDR credits in each transaction in each of the four counties. Total transaction costs averaged 17.3% of total payment for TDR credits in each transaction across the four counties. This rate was highest (21.2%) in St. Mary's County and lowest (12.7%) in Calvert County. The St. Mary's County TDR program had the lowest total transaction costs among the studied programs, but its smaller number of transferred TDR credits per transaction means that transaction costs were a higher percent of total payment for TDR credits in each transaction. Total transaction costs in Calvert County were the highest among the four counties but the higher amount of total payment for TDR credits in each transaction means that transaction costs were a lower percentage of total payment in each transaction.

*Table 6: Estimates of total transaction costs for interviewed participants in operating/participating in four Maryland counties per TDR transaction*

TDR Programs	Time-related costs (\$)	Direct monetary expenses (\$)	Total transaction costs (\$)	Transaction costs as a % of payment in each TDR transaction
Calvert County	3,701.80	22,647	26,348.80	12.70
Montgomery County	5,588.60	19,442	25,030.60	20.50
St. Mary's County	3,433.40	1,324	4,757.40	21.20
Charles County	3,581.80	18,726	22,307.80	14.80

## **Time-related Transaction Costs**

The average total time-related transaction costs per TDR transaction was \$4,076 in 2016 dollars across the four case studies. The time-related transaction costs in the three TDR programs in Calvert, St. Mary's, and Charles Counties were similar, but the costs in Montgomery County were considerably higher. Table 7 presents the estimates of time-related transaction costs involved in operating and participating in each TDR program per TDR transaction, as well as the distribution of time-related costs across different stakeholders involved in the different stages of the TDR lifecycle. The TDR-creation stage involved higher time-related transaction costs in all counties; Montgomery County was the exception because the TDR-retirement stage created higher costs. Landowners and program administrators incurred the time-related transaction costs involved in creating TDR credits. Collecting information and applying for TDR credits were comparatively more time-consuming activities for landowners. Landowners also had to pay for the time spent by their land use attorneys in preparing title reports, unless developers agreed to cover these costs.

Program administrators reported that the activities associated with TDR creation were more time-consuming than tasks in the two other stages. Program administrators spent more of their time in this stage consulting with landowners and reviewing TDR applications. Program administrators, nevertheless, reported that reviewing a TDR application is a straightforward task unless there is an issue with the title report or the mortgage company. The mortgage company can delay the project, since the lender needs to sign off on the documents related to land titles. The time-related transaction costs in the TDR-creation stage for program administrators in Charles County were comparatively higher. In Charles County eligibility and availability of TDR credits vary according to specific soil, size, and location criteria while, in other counties, the number of TDR credits available for lands only depends on its acreage.

All respondents reported that they incurred time-related transaction costs in the contracting stage. Landowners and developers spent more time during the contracting stage than did program administrators because TDR transactions are largely market-based. Research and information collection activities were the main components of the time-related transaction costs for all stakeholders, in general, and landowners, in particular. Counties normally maintain a list of available TDR credits, as well as potential TDR sellers. There is, however, no comparable listing of developers or potential TDR buyers. Landowners who were willing to sell their TDR credits were, therefore, often left with no means other than 'word of mouth' to find TDR buyers. Landowners who were interested in selling their TDR credits were uncertain about how long they would have to wait to find a buyer, which might take from a few hours/days to a number of months or even years. The waiting time appeared to vary with the local land-use market. This is a very real cost but one we do not include in calculating policy-related transaction costs. The respondents also reported that other activities, which they undertook in the contracting stage, such as negotiating a TDR price, preparing a contract, and paying for the TDR credits, were straightforward tasks that did not require a large investment of time.

Table 7: Estimates of respondents' time-related transaction costs in operating/participating in four Maryland counties per TDR transaction

TDR Programs	Stages	Time associated with each activity by actor (hours)*				Costs of time inputs for each activity by actor (\$)				Total Time-related costs (\$)
		Landowners	Developers	Program admins	Intermediaries	Landowners	Developers	Program admins	Intermediaries	
Calvert County	TDR Creation	15	0	6	3	342	0	270	1200	1812
	Contracting	16	5	2	0	364.80	500	90	0	954.80
	TDR Retirement	0	8	3	0	0	800	135	0	935
	<b>Total</b>	<b>31</b>	<b>13</b>	<b>11</b>	<b>3</b>	<b>706.80</b>	<b>1300</b>	<b>495</b>	<b>1200</b>	<b>3701.80</b>
Montgomery County	TDR Creation	18	0	5	3.5	410.40	0	225	1400	2035.40
	Contracting	21	7	2	0	478.80	700	135	0	1313.80
	TDR Retirement	0	17	13	0	0	1700	585	0	2285
	<b>Total</b>	<b>39</b>	<b>24</b>	<b>21</b>	<b>3.5</b>	<b>889.20</b>	<b>2400</b>	<b>945</b>	<b>1400</b>	<b>5588.60</b>
St. Mary's County	TDR Creation	14	0	6	3	319.20	0	270	1200	1789.20
	Contracting	14	4	2	0	319.20	400	90	0	809.20
	TDR Retirement	0	7	3	0	0	700	135	0	835
	<b>Total</b>	<b>28</b>	<b>11</b>	<b>11</b>	<b>3</b>	<b>638.40</b>	<b>1100</b>	<b>495</b>	<b>1200</b>	<b>3433.40</b>
Charles County	TDR Creation	17	0	10	3	387.60	0	450	1200	2037.60
	Contracting	14	4	2	0	319.20	400	90	0	809.20
	TDR Retirement	0	6	3	0	0	600	135	0	735
	<b>Total</b>	<b>31</b>	<b>10</b>	<b>15</b>	<b>3</b>	<b>706.80</b>	<b>1000</b>	<b>675</b>	<b>1200</b>	<b>3581.80</b>

\* The numbers of hours are rounded to the nearest hour

Developers and program administrators also incurred time-related transaction costs in the TDR retirement stage. Respondents did not report that most of these activities were very time-consuming; an exception was Montgomery County. Interviewees in Calvert, St. Mary's, and Charles Counties reported that the activities, such as recording the contract in the County land record, applying the purchased TDR credits to specific development projects, and recording transfer documents, were straightforward and not time consuming. Respondents in Montgomery County, in contrast, reported that applying the purchased TDR credits to development projects created greater time-related transaction costs. Using purchased TDR credits was 'by right' in the other three counties. Developers in Montgomery County, however, were required to go through lengthy development reviews and consent processes in order to use bonus densities derived from purchased TDR credits. They had to negotiate with the County Planning Department staff as well as conducting public hearings on the use of purchased TDR credits in their proposed development, thereby increasing time-related transaction costs for both developers and program administrators in Montgomery County. The significantly higher demand for development in Montgomery County, arising from its comparatively large population and close proximity to Washington, D.C., probably explains why the County has a more contentious, and thus time-consuming, development environment.

### Direct Monetary Transaction Costs

Participating in TDR programs also creates direct monetary transaction costs, the most common of which are administration fees, the costs of preparing a land survey, and brokerage fees. Table 8 shows our estimates of these costs for each TDR transaction in each TDR case study. The administration fees were comparatively low, but other direct monetary transaction costs were sizeable. Landowners paid land surveyors, or other agents, between \$10,000 – 15,000 for preparing a land survey, where it was required (generally when the landowner had not already conducted a survey prior to involving TDR transactions). St. Mary's County removed the requirement that the landowner prepare a land survey in order to apply for TDR credits in order to simplify and streamline the TDR administrative process in 2006.

Landowners often used a broker to find a TDR buyer. Respondents reported that the normal brokerage commission was approximately 5% of the total payment for TDR credits. Landowners tended to involve brokers in TDR transactions when information about available buyers was hard to find, usually in less active markets. It was easier and quicker for TDR sellers to find a buyer without a broker in more active markets, avoiding brokerage fees. TDR sellers had two choices when there were few developments occurring in a county, making demand for TDR credits low - either wait for a positive change in market conditions, which might take a long time, or ask a broker to find a potential buyer for the TDR credits and pay a commission. Landowners in Montgomery County were more likely to report using brokers, as access to information about contacting buyers was more limited and the market was less transparent.

*Table 8: Estimates of interviewees' direct monetary expenses involved in participating in four Maryland counties per TDR transaction*

TDR Programs	Administration fees* (\$)	Costs of preparing land survey (\$)	Brokerage fees (\$)	Total direct monetary expenses (\$)
Calvert County	250	12,000	10,397	22,647
Montgomery County	350	13,000	6,092	19,442
St. Mary's County	200	-	1,124	1,324
Charles County	200	11,000	7,526	18,726

*\* The numbers are rounded*

We calculated the brokerage fee as 5% of the average total payment for TDR credits in each transaction. We computed the total payment for TDR credits in a typical transaction by multiplying the median of transferred TDR credits by the average price of TDR credits. Table 9 presents our estimate of total payments for TDR credits in a typical transaction in each county. We also used the median number of transferred TDR credits in each TDR case study to remove the effects of outliers in measuring central tendency. The median number of transferred credits in St. Mary's county was the lowest, probably because the farms in this county are the smallest of the four counties we studied (US Department of Agriculture, 2012). We also calculated the average price of TDR credits, from the date when each county's program was initiated until 2016. The average price of TDR credits varies widely in the TDR programs, ranging from \$4,332 per TDR credit in Calvert County to \$20,306 per TDR credit in Montgomery County. The substantial differences are largely due to how each county allocated TDR credits, that is, how many credits are created from one acre as demonstrated in Table 3. The different counties also had different land values. Montgomery County farms had the highest estimated market value (US Department of Agriculture, 2012). Differences in market value have considerable impact on the number and value of TDR credits created in each of the four counties. TDR prices have, however, substantially fluctuated in the years since these four counties began their TDR programs. Price fluctuations can have an impact on the relative significance of transaction costs, since transaction costs likely remain relatively more constant than the price of TDR credits.

Table 9: Estimates of total payment for TDR credits in a TDR transaction in four Maryland counties

TDR Programs	Median no. of transferred TDR credits per transaction	Average price of a TDR credit* (\$)	Average total payment in each transaction (\$)
Calvert County	48 (1979-2014)	4,332	207,936
Montgomery County	6 (1980-2015)	20,306	121,836
St. Mary's County	2 (1990-2015)	11,238	22,476
Charles County	17 (1992-2013)	8,854	150,518

Data sources: Administrative records and price/data reported by interviewees

\* Based on 2016 prices

### Distribution of Transaction Costs

We found that private participants, landowners and developers, incurred 84.1% of estimated time-related transaction costs and 95.2% of estimated total transaction costs involved in operating and participating in TDR programs, on average and across the county programs. Table 10 outlines the distribution of transaction costs between private and public participants in the TDR programs in the four case counties. TDR transactions are market-based so it is not surprising that the costs appear to fall almost entirely on the private sector. Public-sector participants, on the other hand, felt that operating TDR programs was more straightforward and less time-consuming than traditional regulatory instruments. Program administrators, with whom we spoke, felt that the traditional regulatory instruments, such as PDR programs, require more of their time and effort. It is time consuming to collect significant information and to successfully negotiate, and make contracts, to purchase development rights from landowners in preservation areas. Planners operating traditional regulatory instruments decide which farms and lands to preserve and what to pay landowners while, in TDR programs, the private market renders these decisions automatic.

Table 10: Distribution of transaction costs between private and public sector respondents

TDR Programs	Time-related Transaction Costs				Total Transaction Costs			
	Private sector		Public sector		Private sector		Public sector	
	\$	%	\$	%	\$	%	\$	%
Calvert County	3206.80	86.60	495	13.40	25,853.80	98.10	495	1.90
Montgomery County	4643.60	83.10	945	16.90	24,085.60	96.20	945	3.80
St. Mary's County	2938.40	85.60	495	14.40	4,262.40	89.60	495	10.40
Charles County	2906.80	81.20	675	18.80	21,632.80	97.00	675	3.00

Our research shows that, during the years of operation, private sector participants bear the overwhelming majority of the transaction costs involved in TDR programs. Our estimates, however, do not include the range of transaction costs incurred by the public sector in developing the programs. We did not include, for example, the transaction costs involved in activities such as designing and establishing relevant policy instruments and enacting enabling legislation, which can be significant. We also did not include in our cost estimate any expenses that public-sector participants incur in running county planning systems (such as the costs of equipment, accounting fees, etc.), largely because we could not obtain reliable data. We did not, at the same time, include comparable private-sector expenses either, such as the costs of running a business and making business decisions about development

projects. We believe, therefore, that our results are a fair estimate of the comparable transaction costs incurred by the public and private sectors while operating and participating in TDR programs in the four Maryland counties that served as our case studies.

This study has some other limitations. We assumed uniform values of time for all people in each type of stakeholder group involved in the TDR programs. These values may, in reality, vary widely. The hourly cost of developers'/farmers' time varies, for example, with a number of factors, such as the size of the development project/farm, the type of development/farm business, the time of year, and the development/farming market in general. We did not conduct a full social cost-benefit analysis but, rather, calculated only the financial costs attributable to the stakeholders. We would have, ideally, liked to interview the people who completed TDR transactions most recently, but few TDR transactions occurred in the case-study counties over the last few years. The low level of activity in TDR markets is partly attributable to the effects of the global financial crisis of 2007/8. We have, as a result, interviewed some people who completed a transaction several years ago and, thus, our data may be limited by the fact that interviewees reported their 'perceptions after the fact' (McCann et al., 2005). It was not possible to estimate hourly rates based on standardized/official data, rather than self-reported data. The results of this study may not be generalizable to other cases but we believe that the estimates of transaction costs generated are an interesting start to the debate about the level of transaction costs in planning policy instruments and a good starting point for further research on this topic.

### **Transaction Costs Are Substantial and Distributed Unevenly Among Stakeholders Involved**

TDR programs seek to establish markets for development rights and facilitate a trade between landowners and developers; the public policy goal is to protect farmlands, or any areas that a community wishes to preserve. TDR programs can provide a win-win situation for both public and private participants because they create a market mechanism that: a) allows public-sector planners to promote preservation of specific lands without having to expend public funds to purchase that land; b) provides compensation to those landowners whose properties are located in designated preservation areas; and c) provides developers with another alternative to obtain extra density in designated development areas. The activities involved in TDR transfers, or transactions, generate different types of costs; we focused on transaction costs. Both the public and private sectors incur transaction costs in TDR programs, that is, all the costs involved in a TDR transaction other than the payment for TDR credits. Transaction costs include both direct monetary expenses, for example, administration fees, and indirect time-related costs, for example, the time participants spend negotiating TDR sale prices. Planners often do not consider the existence and magnitude of such transaction costs when designing and implementing policy instruments such as TDR programs.

We show that the transaction costs of operating and participating in TDR programs are sizeable and paid largely by the private-sector participants. We do not include, however, the original public-sector costs incurred in developing the TDR programs because we lack good data. The average total transaction costs per TDR transaction, across the four Maryland counties, were \$19,611 in 2016 dollars. These costs varied, on average, from 13% of total payments for TDR credits per TDR transaction in Calvert County to 21% in St. Mary's County. Private actors incurred 84% of estimated time-related transaction costs, and 95% of total estimated transaction costs involved in operating and participating in TDR programs. TDR sellers, landowners, tend to bear the largest proportion of such transaction costs. Estimated transaction costs might be a small share of the costs that a developer incurs for an entire development project. These costs, however, represent a very large share of average farm incomes for those selling development rights. Relatively high transaction costs could act as a significant barrier to



participating in the TDR process, since transaction costs might considerably lower the net benefits to landowners who sell their development rights in a TDR transaction.

Transaction costs arose from different types of activities. Collecting required information, preparing land surveys, and paying brokerage fees, comprised the major transaction costs for landowners participating in TDR programs. Brokerage fees were not insignificant; the need for brokerage services resulted from insufficient or asymmetric information about TDR buyers. Conducting land surveys to apply for TDR credits generated significant costs in three of the four counties; St. Mary's County did not require TDR participants to conduct a land survey, substantially reducing the transaction costs for landowners participating in its TDR program. The incidence of such costs in some cases fell on the developers rather than the landowners. This varied based on the agreement between TDR sellers and buyers.

Developers whom we interviewed reported that, participating in TDR programs in the three counties where TDR credits were allowed by right to obtain bonus densities in development projects, was a straightforward activity. The Montgomery County TDR program, however, did not allow development by right to obtain bonus densities and, thus, increased the time and effort, and hence transaction costs, which developers had to invest in the TDR process. Public officials in the four Maryland counties reported that the market-based nature of TDR transactions led to fewer public-sector transaction costs; they incurred fewer expenses for administrative activities and information collection than they would have if using traditional regulatory instruments, such as PDR programs.

We found that the various institutional arrangements created different transaction costs and distributed them differently among TDR participants. Planners and program administrators should work to minimize transaction costs, particularly those borne by the private sector, by designing better institutional arrangements and promoting greater transparency in TDR markets. We believe that planners should provide more comprehensive information to landowners and developers on TDR administrative processes and on TDR prices; planners should play more of the role that brokers now play providing up-to-date and accurate information about which landowners have TDR credits to sell and which developers are interested in buying TDR credits. Planners should also attempt to simplify administrative processes to reduce the private transaction costs associated with TDR programs to encourage more private parties to participate in such programs.

We need additional research to understand if reducing private transaction costs, by requiring more public-sector involvement to facilitate market transactions, increases the net social benefits of TDR programs relative to alternative instruments such as zoning or PDR programs. We suggest that comparing the size of transaction costs, and their distributions among the stakeholders involved, in different planning policy instruments, would be a helpful area for future research. We need further research on the best ways to lower the total costs of designing, operating, and participating in TDR programs and related planning policy instruments.

Transaction costs affect the efficiency and equity of a TDR program; planners may find that, depending on the magnitude and distribution of these costs, the effectiveness of the policy instruments they choose to achieve specific land use objectives may be reduced. Proponents of TDR programs, posit that, by using the market mechanism, these instruments lead to more efficient and equitable outcomes, particularly when compared to traditional regulatory instruments. We do not know, however, if such market-based instruments generate fewer or more equitable transaction costs. Neither do we know if they better achieve the public-policy goals of planners in terms of addressing the externalities arising from land use markets.

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## References

- American Farmland Trust. (2008). Fact Sheet: Transfer of Development Rights. Northampton, MA: Farmland Information Center.
- Arendt, R. (2004). Linked landscapes: Creating greenway corridors through conservation subdivision design strategies in the northeastern and central United States. *Landscape and Urban Planning*, 68(2-3), 241-269. doi: 10.1016/S0169-2046(03)00157-9
- Bruening, A. D. (2008). The TDR Siren Song: The Problems with Transferable Development Rights Programs and How to Fix Them. *Journal of Land Use & Environmental Law*, 23(2), 423.
- Chomitz, K. M. (2004). Transferable Development Rights and Forest Protection: An Exploratory Analysis. *International Regional Science Review*, 27(3), 348-373. doi: 10.1177/0160017604266030
- Clinch, J. P., & O'Neill, E. (2010). Assessing the Relative Merits of Development Charges and Transferable Development Rights in an Uncertain World. *Urban Studies*, 47(4), 891-911. doi: 10.1177/0042098009352365
- Clinch, J. P., O'Neill, E., & Russell, P. (2008). 'Pure' and 'impure' Coasian solutions in planning. *TPR: Town Planning Review*, 79(6), 623-649. doi: 10.3828/tpr.79.6.3
- Coggan, A., van Grieken, M., Boullier, A., & Jardi, X. (2015). Private Transaction Costs of Participation in Water Quality Improvement Programs for Australia's Great Barrier Reef: Extent, Causes and Policy Implications. *Australian Journal of Agricultural and Resource Economics*, 59(4), 499-517. doi: 10.1111/1467-8489.12077
- Coggan, A., Whitten, S. M., & Bennett, J. (2010). Influences of Transaction Costs in Environmental Policy. *Ecological Economics*, 69(9), 1777-1784. doi: <http://dx.doi.org/10.1016/j.ecolecon.2010.04.015>
- Danner, J. C. (1997). TDRs--great idea but questionable value. *Appraisal Journal*, 65(2), 133.
- Dehart, H. G., & Etgen, R. (2007). The Feasibility of Successful TDR Programs for Maryland's Eastern Shore: Maryland Center for Agro-Ecology, Inc.
- Falconer, K., & Saunders, C. (2002). Transaction Costs for SSSIs and Policy Design. *Land Use Policy*, 19(2), 157-166. doi: 10.1016/S0264-8377(02)00007-8
- Fang, F., Easter, K. W., & Brezonik, P. L. (2005). Point-nonpoint source water quality trading: A case study in the Minnesota River basin. *JAWRA Journal of the American Water Resources Association*, 41(3), 645-657. doi: 10.1111/j.1752-1688.2005.tb03761.x
- Giordano, M. (1987). Over-Stuffing the Envelope: The Problems with Creative Transfer of Development Rights. *Fordham Urb. LJ*, 16, 43.
- Howitt, R. E. (1994). Empirical Analysis of Water Market Institutions: The 1991 California Water Market. *Resource and Energy Economics*, 16(4), 357-371.
- Janssen-Jansen, L., Spaans, M., & van der Veen, M. (2008). *New Instruments in Spatial Planning: An International Perspective on Non-Financial Compensation*. Amsterdam: IOS Press.

- Janssen-Jansen, L. B. (2008). Space for Space, a transferable development rights initiative for changing the Dutch landscape. *Landscape and Urban Planning*, 87(3), 192-200. doi: 10.1016/j.landurbplan.2008.06.002
- Johnston, R. A., & Madison, M. E. (1997). From Land marks to Landscapes: A Review of Current Practices in the Transfer of Development Rights. *Journal of the American Planning Association*, 63(3), 365-378. doi: 10.1080/01944369708975929
- Kuperan, K., Abdullah, N. M. R., Pomeroy, R. S., Genio, E. L., & Salamanca, A. M. (2008). Measuring Transaction Costs of Fisheries Co-Management. *Coastal Management*, 36(3), 225-240. doi: 10.1080/08920750701681991
- Lai, L. W. C. (1994). The Economics of Land-Use Zoning: A Literature Review and Analysis of the Work of Coase. *The Town Planning Review*, 65(1), 77-98. doi: 10.3828/tpr.65.1.j15rh7037v511127
- Linkous, E. R. (2016). Transfer of Development Rights in Theory and Practice: The Restructuring of TDR to Incentivize Development. *Land Use Policy*, 51, 162-171. doi: 10.1016/j.landusepol.2015.10.031
- MACo. (2016). Report of County Employee Salaries, Health Benefits & Pensions - Fiscal Year 2016. Annapolis, MD: Maryland Association of Counties.
- Maryland Department of Planning. (2016). Transfer of Development Rights (TDR) Committee Report.
- Maryland State Archives. (2017). Maryland Manual On-Line. Retrieved 29/04/2017, 2017
- McCann, L., Colby, B., Easter, K. W., Kasterine, A., & Kuperan, K. V. (2005). Transaction Cost Measurement for Evaluating Environmental Policies. *Ecological Economics*, 52(4), 527-542. doi: 10.1016/j.ecolecon.2004.08.002
- McCann, L., & Easter, K. W. (1999). Transaction Costs of Policies to Reduce Agricultural Phosphorous Pollution in the Minnesota River. *Land Economics*, 75(3), 402-414. doi: 10.2307/3147186
- McConnell, V., Walls, M., & Kelly, F. (2007). Markets for Preserving Farmland in Maryland; Making TDR Programs Work Better: Report Prepared for the Maryland Center for Agroecology.
- Messer, K. D. (2007). Transferable development rights programs: An economic framework for success. *Journal of Conservation Planning*, 3, 47 — 56.
- Micelli, E. (2002). Development Rights Markets to Manage Urban Plans in Italy. *Urban Studies*, 39(1), 141-154. doi: 10.1080/00420980220099122
- Nelson, A. C., Pruetz, R., & Woodruff, D. (2011). *The TDR Handbook: Designing and Implementing Transfer of Development Rights Programs*. Washington: Island Press.
- OECD. (2017). Labour Force Statistics: Average Annual Hours Actually Worked Per Worker (Publication no. <https://stats.oecd.org/Index.aspx?DataSetCode=ANHRS>). Retrieved 29/04/2017
- Ofei-Mensah, A., & Bennett, J. (2013). Transaction Costs of Alternative Greenhouse Gas Policies in the Australian Transport Energy Sector. *Ecological Economics*, 88(0), 214-221. doi: 10.1016/j.ecolecon.2012.12.009
- Pfeffer, M. J., & Lapping, M. B. (1994). Farmland preservation, development rights and the theory of the growth machine: the views of planners. *Journal of Rural Studies*, 10(3), 233-248. doi: [https://doi.org/10.1016/0743-0167\(94\)90051-5](https://doi.org/10.1016/0743-0167(94)90051-5)
- Pruetz, R. (2003). *Beyond Takings and Givings: Saving Natural Areas, Farmland and Historic Landmarks with Transfer of Development Rights and Density Transfer Charges*: Arje Press.
- Pruetz, R. (2016). TDR Updates. 2016
- Pruetz, R., & Pruetz, E. (2007). Transfer of Development Rights Turns 40. *Planning & Environmental Law*, 59(6), 3-11. doi: 10.1080/15480755.2007.10394447
- Pruetz, R., & Standridge, N. (2008). What Makes Transfer of Development Rights Work?: Success Factors From Research and Practice. *Journal of the American Planning Association*, 75(1), 78-87. doi: 10.1080/01944360802565627
- Renard, V. (2007). Property Rights and the 'Transfer of Development Rights': Questions of Efficiency and Equity. *The Town Planning Review*, 78(1), 41-60. doi: 10.2307/40112701
- Shahab, S., Clinch, J. P., & O'Neill, E. (2017). Timing and Distributional Aspects of Transaction Costs in Transferable Development Rights Programs. *Habitat International*, Forthcoming.

- Shahab, S., Clinch, J. P., & O'Neill, E. (2018). Accounting for Transaction Costs in Planning Policy Evaluation. *Land Use Policy*, 70, 263–272. doi: 10.1016/j.landusepol.2017.09.028
- Shih, M., & Chang, H. B. (2015). Transfer of development rights and public facility planning in Taiwan: An examination of local adaptation and spatial impact. *Urban Studies*, 53(6), 1244-1260. doi: 10.1177/0042098015572974
- The Maryland State Data Center. (2015). Maryland 2010 Urban and Rural Population by Jurisdiction. from Maryland Department of Planning
- Tripp, J. T. B., & Dudek, D. J. (1989). Institutional Guidelines for Designing Successful Transferable Rights Programs *Yale journal on regulation*, 6(2).
- US Department of Agriculture. (2012). *Census of Agriculture - Maryland, County Summary Highlights*.
- Walls, M. A., & McConnell, V. D. (2007). Transfer of Development Rights in U.S. Communities: Evaluating Program Design, Implementation, and Outcomes. *Resources for the Future*.
- Wang, H., Tao, R., Wang, L., & Su, F. (2010). Farmland preservation and land development rights trading in Zhejiang, China. *Habitat International*, 34(4), 454-463. doi: 10.1016/j.habitatint.2009.12.004