Affordable Housing and the Impact Fee in Pennsylvania: Policy Goals, Financing Mechanisms, and Distorted Outcomes

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Abstract

In 2012, Pennsylvania passed Act 13, a law that imposed an impact fee upon drillers of wells for the extraction of natural gas through hydraulic fracturing. The law allocated a portion of the receipts from the impact fee to fund affordable housing. However, that funding is only available in the counties in which drilling takes place. Although Act 13 provides just a small portion of Pennsylvania’s affordable housing funding, its geographic restriction has disrupted the state’s larger system for allocating those funds: the Low Income Housing Tax Credit program. This paper makes two central claims about the results of Act 13. First, Act 13 has enabled a substantial shift in the geographic distribution of affordable housing funding in Pennsylvania, above and beyond the funds that the act itself allocates towards affordable housing. And second, this shift has come at the expense of regions of the state that are most in need of affordable housing.
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Introduction

This paper examines a case of interaction between two seemingly unrelated policy areas: the construction of affordable housing, and the extraction of shale natural gas through fracking. The two topics nevertheless intersect through Pennsylvania’s Act 13 of 2012, a substantial amendment to the Oil and Gas section of the state’s Consolidated Statutes. Since the mid-2000s, Pennsylvania had experienced a dramatic increase in the use of hydraulic fracturing technology, commonly known as fracking, to extract natural gas from the Marcellus Shale formation (Fischetti, 2010, p. 82). In response to the fracking boom, Act 13 imposed an “impact fee” (which the gas industry calls a tax) upon drillers of wells to be used for fracking in the state. Revenues from the impact fee have totaled about $200 million per year since it was enacted (“Disbursements and Impact Fees,” 2016).

Most of these revenues are not earmarked for a specific purpose, either being diverted into statewide conservation and infrastructure funds, or distributed to municipal or county governments. Affordable housing is one of the few exceptions. Indeed, millions of dollars each year in impact fee revenues are dedicated for the construction and rehabilitation of affordable housing. However, this funding comes with a catch. Like the majority of disbursements from the impact fee, funds for affordable housing are restricted to only the counties in which fracking is actively taking place (Ellis et al., 2012). The map in Figure 1 below shows which counties are eligible for the affordable housing funds (“Act 13 County and Municipality Disbursement,” 2016). The region covers the western and northern parts of the state, including the Pittsburgh metro area and many rural
counties. Approximately half of Pennsylvania’s counties are excluded from receiving these revenues, including the populous counties of the Philadelphia metro area.

**Figure 1**

Produced by the author, using Map Chart

The justification for the impact fee is in the name itself. Pennsylvania’s former governor Tom Corbett, who signed the impact fee into law, explained that natural gas drilling “does have an impact into the community” (Corbett, 2014). As discussed in Chapter 2 of this paper, the fracking boom has directly affected the localities in which drilling is taking place. Drilling sites expose nearby residents to environmental risk, and the influx of industry workers in mostly rural areas has displaced many low-income households. For these reasons, Act 13 restricted most of its revenues, including all of
those dedicated to affordable housing, to counties in which drilling is taking place. Even as the impact fee has had a number of vocal critics both before and after its passage, that provision has not yet been a source of controversy.

This paper calls attention to the unintended consequences of Pennsylvania’s creation of a source of funding for affordable housing that is only available to the Marcellus Shale region. While the fracking boom has created certain housing needs in affected areas, different regions of the state have equal or greater needs for other reasons. Moreover, the complex and interrelated nature of affordable housing policies in the United States means that a small change in one program can have significant ripple effects. Although Act 13 provides just a small portion of Pennsylvania’s affordable housing funding, its geographic restriction has disrupted the state’s larger system for allocating those funds. This paper makes two central claims about the results of Act 13. First, Act 13 has enabled a substantial shift in the geographic distribution of affordable housing funding in Pennsylvania, above and beyond the funds that the act itself allocates towards affordable housing. And second, that shift has come at the expense of regions of the state that are most in need of affordable housing. Affordable housing advocates in Pennsylvania ought to take notice and push for the implementation of a more equitable system. Furthermore, this case should serve as an example to policymakers, of the repercussions when the connections between interrelated programs are not fully considered.

At this stage, it is important to articulate the reasons for studying how affordable housing is distributed. The questions of where and how to build housing for the less well off have been relevant in the United States since the first major public housing initiatives
of the New Deal. In the intervening years, federal housing policy has shifted away from strictly public housing, towards a decentralized system of subsidies for private developers (Tighe, 2011, pp. 91–92). For the purposes of this paper, affordable housing is defined as any housing that is receiving a public subsidy in order to serve low-income households. Affordable housing programs exist at the federal, state, and local levels, with bipartisan support among lawmakers for the role of the government in providing housing for those who cannot afford it at market prices. But as a whole, these programs do not supply nearly enough funding to meet the housing needs of the nation’s low-income citizens. As a society, the United States has never committed to providing affordable housing to all those who need it.

Because they are both scarce and lucrative, subsidies for the construction of affordable housing developments are highly sought after. In big cities and small towns with significant populations of low-income citizens, officials see state and federal funding for affordable housing as a way to improve the lives of their constituents, and will lobby the state for their share. Additionally, while low-income citizens themselves may not have much say in where affordable housing is built, the decisions made in the state capital certainly impact their quality of life and economic prospects. For a family struggling to pay their medical bills, or for a senior living in substandard housing, the decision of which developments to finance can make an enormous difference. Due to Act 13, the geographic distribution of affordable housing funding has shifted away from Pennsylvania’s most needy areas. The consequences have been felt by some of the state’s most vulnerable citizens.
Outline

This paper proceeds in four chapters. The first chapter is dedicated to explaining the primary system through which affordable housing in the United States has been funded since 1986: the Low Income Housing Tax Credit, or LIHTC. Developers are not awarded enough funds from impact fee receipts in order to pay fully for affordable housing developments. Rather, the impact fee money typically contributes to a larger financing package, of which the most substantial component is LIHTC. An understanding the inner workings of the LIHTC program is essential to explaining why the additional funds made available through Act 13 can make a significant difference in the geographic distribution of affordable housing developments. In addition to scholarly work on this subject, I draw on my own experience working with Diamond & Associates, a Philadelphia-based consulting firm that assists developers of affordable housing in applying for funds (primarily LIHTC) to finance their projects. The information in Chapter 1 is foundational to the arguments presented later in the paper.

Chapter 2 moves to discussing Act 13 in greater detail. The chapter begins with an explanation of fracking, as well as the history and geography of the Marcellus Shale. The following section deals with the environmental and social costs of fracking, which the impact fee was intended to remediate. This includes an investigation into the effects of the fracking boom on housing affordability in Pennsylvania, and why one could justify dedicating funds from the impact fee towards affordable housing. Next is a more complete explanation of Act 13 itself than could be provided in this introduction. The politics behind Act 13’s passage form an important part of this section, both to put the law into context and to understand its base of support. To tell this history, Chapter 2
draws upon the excellent coverage of Act 13 by the NPR-produced blog StateImpact Pennsylvania. The chapter also explains the mechanics of Act 13: how the impact fee is assessed and the funds are distributed. The last portion of Chapter 2 covers the provisions of Act 13 that deal with affordable housing, and how a seven-figure sum each year passes from natural gas drillers, through the Pennsylvania Housing Affordability and Rehabilitation Enhancement (PHARE) Fund, and to developers of affordable housing.

Chapter 3 contains the quantitative analysis of the effects of the impact fee on the geographic distribution of affordable housing developments in Pennsylvania. After a discussion of methodologies and sources, the findings are presented, with maps and tables to visualize the data. Chapter 3 also contains a discussion of variables that could complicate the analysis. The decision-making process that determines where funding is allocated for affordable housing is opaque and inherently political. While there is not publicly available information about all of the factors that determine which projects receive funding, Chapter 3 includes a discussion of potential factors and how they may explain some of the observed geographic variation. Additionally, by comparing the geographic distribution of projects after 2012 to the distribution before, the analysis attempts to control for confounding variables to the extent possible.

The fourth and final chapter addresses the meaning of these results in the context of Pennsylvania’s affordable housing needs. Chapter 4 measures the effects of Act 13 against two standards: efficiency and equity. The chapter starts by asking whether Act 13 provides an efficient mechanism for funding affordable housing. While impact fee receipts are able to leverage much larger sums of money to fund affordable housing in the Marcellus Shale region, this system causes the rest of the state to lose funding in equal
measure. Considering the full picture, the impact fee provides no advantages in cost-effectiveness. Then there is the second question, of whether Act 13 serves as an equitable model for allocating funding towards affordable housing. This section assesses whether impact fee revenues are going towards the areas that are most in need of affordable housing. And while the fracking boom has had some local impacts on housing affordability, there remains a significant mismatch between the places that are eligible for additional affordable housing funding and the places that most need it. Despite its intentions, Act 13 has led to a less equitable distribution of affordable housing. Finally, Chapter 4 concludes with a look towards the future, as Pennsylvania’s lawmakers debate whether to pass a new, tougher tax on the natural gas industry. This could lead to any number of changes to the current system, although at the present it appears that very little will change at all.

This paper cannot answer every outstanding question about fracking or affordable housing policy. However, the background on those issues is necessary to understand what has happened in Pennsylvania since 2012. Impact fee revenues have had disproportionate influence on the state’s affordable housing program, shifting funds away from the regions of greatest need. This paper makes the ethical case that those changes ought to be remedied.
Chapter 1: The Low Income Housing Tax Credit

This paper contends that the revenue supplied by the impact fee has produced a disproportionate shift in the geographic distribution of affordable housing funding in Pennsylvania. Specifically, the Marcellus Shale region of Pennsylvania has received a greater proportion of affordable units through the Low Income Housing Tax Credit (LIHTC) program than it did before the law was passed. Low Income Housing Tax Credits are the primary source of funding for affordable housing in the United States, and the mechanics of the system are what have allowed the impact fee receipts to have such an outsized impact. This chapter begins with an explanation of how the LIHTC program works, including several of the program’s idiosyncrasies. The second section explores the history of the LIHTC system, and how its benefits and drawbacks have been addressed since the program was created in 1986. The discussion in this chapter will demonstrate why one would expect the new funds available through Act 13 to influence where tax credits are awarded.

The Mechanics of the LIHTC Program

As the largest single source of subsidized rental housing in the United States (Schwartz, 2011, p. 125), the LIHTC program defies a number of stereotypes about low income housing. The program does not build public housing (in the sense that the government does not own or operate it). Moreover, the LIHTC program for the most part is not responsible for erecting the high-rise complexes commonly associated with public
housing. The typical LIHTC development contains about 50 units,¹ and in the program’s early years the tax credits would often fund one unit at a time.

The process through which the program channels federal funds to assist low-income households is quite convoluted. While the other main federal housing programs are run by the Department of Housing and Urban Development, the LIHTC program is administered via the Internal Revenue Service (Schwartz, 2011, p. 125). However, the program largely operates at the state level. The IRS allocates tax credits to the states, and state agencies are responsible for awarding those tax credits to various developers (Schwartz, 2011, pp. 126). In Pennsylvania, tax credit awards are made by the Pennsylvania Housing Finance Agency. PHFA has a long list of criteria for determining where to award LIHTC funds, though its decisions are also subject to political influences.

When a developer receives an award of LIHTC, they do not get the tax credits immediately. Instead, the tax credits are paid out over the first ten years of the building’s operation (Schwartz, 2011, p. 126). To complicate matters further, there are two different levels of tax credit that a developer may receive: the 4% credit and the 9% credit. These names refer to certain multipliers in the respective formulas through which tax credit amounts are calculated.² 4% credits are only available in certain circumstances, often when the developer has already secured other federal subsidies such as tax-exempt bonds (Gramlich, 2014, p. 3). The 4% credits are non-competitive; developers need only to

¹ A “unit” can be as small as one bedroom for a single person, or as large as five bedrooms for a large family.
² Specifically, they refer to the percentage of “qualified basis” that the developer can receive in tax credits each year for ten years. Qualified basis is calculated by adding up all costs related to construction, excluding the acquisition of land. Additionally, qualified basis can be increased by 30% if the project site is located in a HUD-designated Qualified Census Tract or Difficult to Develop Area (Gramlich, 2014, p. 3).
submit a valid application in order to receive them (Smith, 2009, p. 1). 9% credits are available to all developers, but the application process is highly competitive. States are allocated a limited amount of 9% credits each year on a per-capita basis (Schwartz, 2011, pp. 126–127).

In Pennsylvania, PHFA is responsible for reviewing the applications for 9% credits and deciding which ones should be awarded funding. In doing so, it must make some tough choices. PHFA’s Executive Director Brian Hudson reports that the agency can only award credits to a third of the applicants each year (“Governor Wolf Announces Tax Credits and PennHOMES Funding for Affordable Multifamily Developments in Pennsylvania,” 2016). Another key difference between 4% and 9% credits is the amount of the project they will pay for. The 4% credit is designed to cover 30% of construction costs, while the more lucrative 9% credit will pay for roughly 70% (Schwartz, 2011, p. 126). Because 9% credits come from a limited pool, they have a zero-sum nature. If one region of the state is receiving more 9% awards, the rest of the state is losing out. The analysis that follows in this paper focuses on the geographic distribution of 9% LIHTC awards across Pennsylvania.

Once the housing has been built, any unit that received LIHTC funding must remain affordable for 30 years, with some exceptions after the 15th year (Schwartz, 2011, p. 134). These units are restricted to income-qualified residents, meaning households that

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3 Since the tax credits are paid out over a span of ten years, the present value of the funds has to be taken into account, and so 9% times ten years does not simply equal 90%. In fact, the rates of 4% and 9% were originally designed to “float,” responding to market conditions in order to always pay for 30% and 70% of construction costs, respectively. As a result, the rates were typically closer to 3% and 8%. Subsequently, the Housing and Economic Recovery Act of 2008 set 9% as a floor for the higher rate (Schwartz, 2011, p. 126). The 4% rate is still able to float.
earn less than 50% or 60% of Area Median Income (AMI), depending on the unit. Rents are limited to 30% of the income threshold for each unit (Schwartz, 2011, p. 127). This works well for households that are right at the income threshold, but is expensive for households earning much less. Housing is typically deemed affordable when tenants are spending no more than 30% of their income on rent. Therefore, LIHTC housing is affordable for those earning 50% or 60% of AMI, but lower-income households may need additional assistance in order to take advantage of the program. In practice, residents of LIHTC units typically earn 50%-60% of AMI, which corresponds to just below 200% of the federal poverty line (Schwartz, 2011, p. 133). So while the LIHTC program does a great deal to help households that are above the poverty line but still cannot afford market rate rents, it is not very effective for households below the poverty line.

The LIHTC’s inability to serve very-low-income households is a common critique of the program. Another common critique is the complexity of assembling a viable financing package. Because the tax credits are paid out over the first ten years of the building’s operation, developers typically sell their future tax credits to investors in exchange for funds to cover immediate construction costs. Sometimes syndicators become involved as middlemen, bundling multiple sets of tax credits in order to reduce the risk faced by investors (Schwartz, 2011, p. 127). Each of these steps adds transaction costs, and directs LIHTC funding away from low-income households, and towards professionals in the affordable housing industry. Furthermore, as discussed in the following section, the price that investors are willing to pay for LIHTC has fluctuated over time, responding to changes in the industry and the wider economy. In this way, the
success of the LIHTC program is highly dependent on the market for tax credits. The same amount of LIHTC will translate into less affordable housing if investors are not willing to buy them at a good price.

Finally, recall that a 9% credit award will only pay for about 70% of a project’s construction costs. That reality forces developers to find additional sources of funding to complement the LIHTC. These may include private capital, charitable donations, and federal, state, or local government programs. For example federal HOME funds are commonly paired with LIHTC (Schwartz, 2011, p. 130). It is not unusual for developers of affordable housing to have to piece together six to eight different sources of funding in order to finance their projects. This makes affordable housing development particularly difficult for nonprofit organizations, which often do not have the capacity to navigate the complex procedure of LIHTC financing (Tighe, 2011, p. 96). But most importantly for the purposes of this paper, these additional sources of funding can be a determinative factor in deciding where LIHTC projects get built. When making its awards, PHFA considers the totality of the financing package that the developer is able to assemble. Therefore, it would be reasonable to expect that a developer with more sources of funding available to them would have an advantage in the competitive process of applying for a 9% LIHTC award.

History of the LIHTC Program, 1986-2017

As alluded to above, the contours of the Low Income Housing Tax Credit system have evolved over the more than 30 years since it was created. The LIHTC program was established during the Reagan presidency, at a time when the political environment was
largely hostile to government intervention in the free market. Federal affordable housing policy had previously included both direct appropriations and tax breaks for developers. But the Reagan Administration believed that affordable housing should be provided by the private sector. HUD sold some of its housing stock to private owners, and direct funding was slashed (Stearns, 1988, p. 206). Next, tax incentives came under attack. In its original form, the Tax Reform Act of 1986 would have eliminated a wide variety of shelters in the federal tax code, including all those related to affordable housing (Stearns, 1988, p. 208). Amidst concerns that this was a step too far, the LIHTC program was added to the bill at the last minute and received support in Congress from across the ideological spectrum. It was the only new tax spending included in the Tax Reform Act of 1986 (Stearns, 1988, p. 209).

When it was first introduced, the LIHTC system faced a number of criticisms. Some of these have been addressed in subsequent years, while others have not. The program originally included sunset provisions, which created a great deal of uncertainty for developers and investors (Stearns, 1988, p. 217). Congress acted to make the program permanent in 1993 (Schwartz, 2011, p. 127). This helped to alleviate another early concern: the low price that investors were willing to pay for the tax credits. LIHTC was initially viewed as a risky program, and at first investors paid developers as little as 50 cents for every dollar of tax credit. Furthermore, high transaction costs meant that only about 40 cents of every tax credit dollar went towards funding affordable housing (Schwartz, 2011, p. 129). In its early years, the LIHTC program was rightfully attacked as an inefficient use of federal funds (Stearns, 1988, p. 225). However, the program has become much more efficient in subsequent years. After Congress provided certainty in
1993, transaction costs have decreased as all parties have become more familiar with the program (Schwartz, 2011, p. 129). Nevertheless, while the price of the tax credit was never lower than it was in the late 1980s, it has remained far from stable in the years since.

As explained in the previous section, the success of the LIHTC system depends largely upon the market price of the tax credit. The lower the price, the less efficient the system becomes. The graph in Figure 2, created by real estate consultants Novogradac & Company LLP, gives the price per dollar of LIHTC over the period 2002-2017 (“LIHTC Pricing Trends - History,” 2017). By 2002, tax credits were selling for 80 cents on the dollar, and by 2006 that figure reached 90 cents. Then the financial crisis hit, and the market for tax credits declined precipitously. The major financial institutions, which had previously been the most prominent investors in LIHTC, had very little taxable income in those years, greatly diminishing the value of the tax credit. To make up for the declining efficiency of the program, the Housing and Economic Recovery Act of 2008 increased the quantity of tax credits that were allocated to the states (Schwartz, 2011, pp. 136–137). At a time when an increasing number of Americans were suffering economic hardship, it made sense to prop up the amount of affordable housing being built. But because the market for tax credits was hit by the crisis as well, this came at an increased cost.

Although LIHTC prices returned to normal following the recession, another criticism of the program emerged: the dependence of the system on the health of the overall economy. It should be cause for alarm if a social program becomes ineffective at the time when it is needed the most. One proposal to remedy this would be to make the tax credits refundable (Schwartz, 2011, p. 140). Thus, the tax credit would retain its value
Figure 2
regardless of whether the recipient has any taxable income. This would help to stabilize the tax credit market and lead to the more efficient production of affordable housing. Yet despite the fact that this reform has been suggested since the 1980s (Stearns, 1988, p. 225), it has not yet been enacted.

Finally, despite the program’s criticisms, its strengths should not be understated. As a supply side intervention, the program has increased the United States’ inventory of affordable housing by 2.3 million units through 2011 (Gramlich, 2014, p. 1). And unlike voucher-style programs, the LIHTC spurs economic activity. According to the National Association of Home Builders, the program creates 95,000 jobs each year (“Low Income Housing Tax Credit,” 2017). The LIHTC program also has advantages over the public housing from an earlier era. Compared with public housing structures, which are typically concentrated in high-poverty neighborhoods, LIHTC developments have been spread much more evenly across neighborhoods of different income levels (Schwartz, 2011, p. 132). And in a number of cases, LIHTC developments in less well-off neighborhoods have led to further private investment in those neighborhoods (Schwartz, 2011, p. 133).

For these reasons, the LIHTC program has retained strong support in Congress throughout its history. Even when the financial crisis exposed some of the program’s flaws, Congress showed its faith by increasing the program’s funding.

While the merits and drawbacks of the LIHTC system can be debated, it has become the nation’s most significant affordable housing program over the past three decades. Given that a major overhaul of federal housing policy is unlikely, the LIHTC program will continue to dictate how and where affordable housing is built in the United States for the foreseeable future. At the same time, factors outside of the LIHTC program
can influence where its funds are directed. This paper goes on to analyze how the LIHTC system in Pennsylvania has been thrown off by the new funding source that Act 13 created. Several features of the LIHTC system discussed in this chapter will help to explain why these changes have occurred. Those features include the necessity of coupling LIHTC with other funds, the role of PHFA in deciding where to award funding, and the sensitivity of the system to economic conditions.
Chapter 2: Fracking, the Impact Fee, and Consequences for Affordable Housing

The connection between fracking and affordable housing is not obvious, even as the impact fee has been a hot button issue in Pennsylvania politics. The connection arises from a specific provision of Act 13, which allocates a subset of the revenue from the impact fee to the Pennsylvania Housing Affordability and Rehabilitation Enhancement (PHARE) Fund. That money is available in the Pennsylvania counties where fracking takes place. This chapter begins with an explanation of what fracking is, as well as its history and geography within Pennsylvania. That is followed by a discussion of how fracking has impacted both the environment and housing affordability. The next section explains Pennsylvania’s Act 13 of 2012, which places a so-called “impact fee” on wells that utilize fracking. Act 13 received most of its support from Republicans, though it faced opposition from both the left and the right. But most important for the purposes of this paper is how the revenues from the impact fee are distributed. In fact, the portion dedicated towards affordable housing is a small fraction of the total. Nevertheless, the final section of this chapter explains how the money that passes through the PHARE Fund affects the LIHTC system, significantly altering the geographic distribution of affordable housing production in Pennsylvania.

Fracking in Pennsylvania

The Marcellus Shale, which sits beneath a large portion of the eastern United States, may contain enough natural gas to meet 40 years of American demand. But only in the past decade have drillers been able to extract these reserves at a large scale, due to
Improvements in hydraulic fracturing technology (Fischetti, 2010, p. 82). In Pennsylvania, the number of permits issued per year for drilling in the Marcellus Shale increased dramatically, from 71 in 2007 to 3,314 in 2010 (Marcellus Shale Advisory Commission, 2011, p. 33). The state’s fracking boom, and the environmental and social consequences associated with it, provided the impetus for the passage of Act 13 in 2012.

In order to extract natural gas through hydraulic fracturing, several acres of land must be cleared at the drill site. A drill then bores thousands of feet into the ground, until the shale layer is reached. Next, the drill bit makes a 90 degree turn, and tunnels horizontally through the shale for thousands more feet. After steel piping is inserted along the path of the well, a mixture of water, sand, and a proprietary blend of chemicals is pumped in at high pressure. This fluid exits the pipe through small holes, causing the surrounding shale to crack as a result of the high pressure. This is the part of the process known as hydraulic fracturing, or fracking. Once the shale has been fracked, the fluid is pumped back out of the well, along with minerals and chemical compounds originating from the shale itself.\(^4\) Finally, the natural gas that had been trapped inside the shale is able to flow through the cracks and up the well, to be captured by the drilling company (Fischetti, 2010, pp. 82–84). The complete process goes by several different names. Because the well bores through the shale formation laterally, the process is often called horizontal drilling. The text of Act 13 defines any well that makes use of hydraulic fracturing as an “unconventional gas well” (Ellis et al., 2012). Yet, while the colloquial term, fracking, refers only to a part of the process, it is both more convenient and more commonly understood than the more technical terminology.

\(^4\) There are a number of options for managing this wastewater. See Figure 5 for a summary of various disposal processes.
The geography of fracking in Pennsylvania is determined largely by geological characteristics of the Marcellus Shale. The map in Figure 3, created by Pennsylvania’s Marcellus Shale Advisory Commission in 2011, shows the extent of the Marcellus Shale in gray. But geological conditions dictate that natural gas extraction is economically feasible in only a subset of that area, which the map labels the “Marcellus Fairway,” outlined in blue. The “Sweet Spots,” in the southwestern and northeastern corners of Pennsylvania, are the areas where the most intensive drilling is possible (Marcellus Shale Advisory Commission, 2011, p. 19).
The map in Figure 3 was produced in 2011, but it accurately predicted the current geography of fracking in Pennsylvania. Today, the “Sweet Spots” in Figure 3 are the areas with the highest density of drilling activity. Pennsylvania’s Department of Environmental Protection (DEP) maintains a map of all active unconventional gas wells in the state. That map, as of December 2, 2017, is presented in Figure 4 (“PA Oil and Gas Mapping,” 2017). Figure 4 shows that while fracking is taking place across Western and Northern Pennsylvania, drilling activity is most concentrated in the southwestern and northeastern corners of the state. These are the regions that are experiencing the costs of fracking most intensely.

Figure 4

Pennsylvania Department of Environmental Protection
Environmental and Social Consequences

Fracking is a highly controversial practice. While supporters claim that it causes minimal damage to the environment, detractors have documented instances of contamination and harm that are in all likelihood linked to fracking. A major concern is the potential for chemicals used in the hydraulic fracturing process to contaminate sources of drinking water. This issue suffers from a systemic lack of transparency; drillers have secured an exemption to the Safe Drinking Water Act, and as such do not have to report the chemical composition of the fracking fluid that is pumped underground (Phillips, 2011). Nevertheless, there have been confirmed cases in which fluid from wells has seeped through layers of rock and into aquifers (Ehrenberg, 2012, p. 25). But even after the wastewater has been pumped out of the ground, its disposal has created serious environmental problems.

There are several stages and possibilities in the wastewater disposal process, which are summarized in Figure 5. Wastewater will be temporarily stored in an on-site tank or holding pond. After that there are a number of options, all of which involve either treating the fluid and discharging it into surface water, or injecting the fluid into a disposal well deep underground (Hammer & VanBriesen, 2012, p. 3). Both courses of action pose environmental risks. In the early years of the fracking boom, wastewater was sometimes sent directly to municipal treatment plants. Unable to treat the chemicals used in the fracking process, these facilities would discharge contaminants into the local water system. Though drillers mostly avoided sending wastewater to public treatment plants, the EPA did not ban the practice until 2016 (Hurdle, 2016). Wastewater from fracking
can be more effectively treated at specialized private facilities, though the process still does not remove all pollutants (Hammer & VanBriesen, 2012, p. 4).

Figure 5

Injecting fracking fluid underground is also problematic; the practice carries a known risk of causing nearby earthquakes\(^5\) (Rubinstein & Mahani, 2015, p. 4). In short, there is no entirely safe option for managing wastewater. Furthermore, it should be noted that wastewater is not always handled properly. There are examples of wastewater either

\(^5\) In Pennsylvania, DEP found that a series of earthquakes in Lawrence County in 2016 was caused by the hydraulic fracturing process itself (Frazier, 2017).
being spilled or dumped intentionally, thereby exposing citizens and the environment to toxic chemicals (Ehrenberg, 2012, pp. 24–25). Through March 2015, DEP has issued more than 4,000 violations to drillers, many of which have been related to the mismanagement of wastewater (Amico, DeBelius, Detrow, & Stiles, 2015). Whether or not drilling companies follow best practices for disposing of fracking wastewater, the substance imposes a host of risks upon those living near drilling sites.

The fracking process also creates the risk of methane leaking into the water supply. The piping that is inserted into the well does not always form a perfect seal, and methane that had previously been trapped underground can travel upwards along the sides of the pipe (Alley & Alley, 2017, p. 221). Scientists have debated the plausibility of this scenario, but the most recent chemical analysis has found cases in which drinking water is contaminated with the same natural gas that was present at drilling sites (2017, p. 223). In the widely viewed documentary Gasland, filmmaker Josh Fox captured footage of flammable tap water in homes near fracking sites. Fox also interviewed a number of individuals who had experienced debilitating illnesses, likely as a result of contamination from methane or wastewater leaks (Fox, 2010). Methane has been reported to cause explosions in affected homes, and is a potent greenhouse gas if it escapes into the atmosphere (Ehrenberg, 2012, p. 24).

In all, environmental concerns have prompted three states to ban fracking entirely: New York, Vermont, and Maryland (Hurdle, 2017a). The Delaware River Basin Commission has also proposed a fracking ban in the basin, which includes parts of Eastern Pennsylvania (Hurdle, 2017b). Meanwhile, although officials in Pennsylvania
continue to support fracking, the impact fee was intended to be a first step towards remediating the environmental risks it has engendered.

In addition to its environmental consequences, the fracking boom has also affected housing affordability near drilling sites. In 2011, PHFA commissioned a study of the impact of Marcellus Shale drilling on housing markets. The authors found that the influx of gas industry employees around drilling sites has increased demand, leading to higher prices for housing. And the more intensive the drilling activity, the greater the resulting pressure on the housing market (Williamson & Kolb, 2011, p. 1). In many cases, demand for housing has surpassed supply, forcing low-income households into homelessness (Williamson & Kolb, 2011, p. 5). Demand-side programs, such as housing vouchers for low-income households, have proven ineffective at resolving this crisis (Williamson & Kolb, 2011, p. 15). After all, households cannot use their vouchers when all existing housing is already occupied.

For areas that have experienced rapid population growth because of to the fracking boom, the only solution is increasing the housing supply. In theory, developers should be producing this additional housing without a need for a government intervention. But due to predictions for a boom and bust pattern in the future of Marcellus Shale development, developers have been hesitant to build new housing that may not be needed a few years later (Williamson & Kolb, 2011, p. 38). Although the authors of the study state their belief that the market will eventually begin to produce new housing (Williamson & Kolb, 2011, p. 51), their findings would justify the allocation of government funds to build affordable housing in areas affected by the fracking boom. As
discussed in the following sections, the Pennsylvania General Assembly did allocate such funds, but in a rather convoluted manner.

*An Impact Fee, Not a Severance Tax*

Pennsylvania is far from the only state to address the environmental and social costs of natural gas drilling. Every other state has passed some form of severance tax, in which drillers are charged based on the amount of gas they “sever” from the ground (Cusick, 2017). Pennsylvania is the sole exception. The state’s alternate system, the impact fee, was passed as Act 13 of 2012. The impact fee is assessed for every well drilled, and unlike the severance tax, it is not affected by the amount of gas extracted. Pennsylvania’s system was designed to be more favorable to the gas industry than the severance taxes enacted by other states, and as such Republicans provided most of its political support. Nevertheless, it received both criticism and assistance from unexpected sources. The administration of Republican governor Tom Corbett was a vocal proponent of the impact fee, helping to draft the law in its early stages (Detrow, 2011a). The bill also had 21 co-sponsors in the General Assembly, 18 Republicans and three Democrats. 13 of these co-sponsors represented parts of the Marcellus Shale region (“Bill Information (History) - House Bill 1950,” 2012). This may reflect enthusiasm for provisions of the bill that would allocate the majority of the revenue for counties in which drilling is taking place. The distribution of impact fee revenue is discussed in greater detail at the end of this section.

In attempting to pass their bill through the General Assembly, the proponents of the impact fee faced opposition from both ends of the political spectrum. Although
Corbett argued that the impact fee did not constitute a tax on the natural gas industry, the influential anti-tax activist Grover Norquist disagreed (Detrow, 2011b). As the vote on the impact fee drew near, Norquist’s lobbyists pressured Republican lawmakers to oppose the bill (Detrow, 2012a). Meanwhile, Democrats in the General Assembly largely opposed the bill as written. They argued that any bill addressing fracking should impose a higher effective tax on the gas industry, and contain stronger environmental protections (“Senator Hughes Says Republican Marcellus Shale Plan Gives Industry a Pass,” 2011). The impact fee appeared destined for a close vote in the General Assembly, as a few Republican defectors joined virtually all Democrats in opposition. Hoping to gain a semblance of bipartisan support for the bill, Republican leaders in the State Senate coerced Philadelphia Democrats into voting in favor, by threatening to decrease Philadelphia’s share of impact fee revenue if they did not (Detrow, 2012b). Ultimately, these hardball tactics solidified an 11-vote majority in the House and a 12-vote majority in the Senate. With Corbett’s signature, Pennsylvania’s impact fee became law on February 14, 2012 (“Bill Information (History) - House Bill 1950,” 2012).

Under the impact fee, drillers are charged for the first 15 years of a well’s operation. The amount of fee that is assessed rises and falls with the price of gas, and the fee is reduced the longer a well has been operating. For example, the fee can range from $40,000 to $60,000 in year one, and from $5,000 to $10,000 in year 15 (Ellis et al., 2012). Thus far, the impact fee has brought in roughly $200 million each year in revenues (“Disbursements and Impact Fees,” 2016). This may seem like a large sum, but in fact it is small relative to the amount that would be collected under a severance tax. In order to judge the size of the impact fee against other states’ severance taxes, Pennsylvania’s
Independent Fiscal Office produced a report comparing the effective tax rates paid by the gas industry across states with similarly high levels of gas production. Of the 11 states included in the report, Pennsylvania charges the lowest effective tax rate, regardless of the price of gas or the quantity produced (Pennsylvania Independent Fiscal Office, 2014). For this reason, calls for a severance tax in Pennsylvania have not died down, especially after Democrat Tom Wolf was elected governor in 2014. To date, Pennsylvania remains without a severance tax, although the General Assembly is considering a bill that would implement one. Efforts to pass a severance tax in Pennsylvania are described in further detail in Chapter 4.

While the potential still remains for Pennsylvania to enact a more stringent severance tax in the future, the focus of this paper is on how the revenues from the existing impact fee are distributed. A small portion of the receipts goes directly to various state agencies. The remainder of the revenue is split into two main categories. 40% is available statewide, for conservation, environmental remediation, and infrastructure projects not necessarily related to fracking. The other 60% is only available in counties with active unconventional gas wells. Of that portion, most is distributed to county and municipal governments, which have broad discretion in how to spend the money. The rest goes into the Pennsylvania Housing Affordability and Rehabilitation Enhancement (PHARE) Fund, and is available both to support affordable housing projects and to provide rental assistance to households earning below the area median income. PHARE receives a minimum of $5 million each year, plus additional funds if the amounts
allocated to municipalities exceed certain thresholds\(^6\) (Ellis et al., 2012). Thus far, PHARE has received an average of $7.9 million per year in impact fee revenues ("PHARE Program," 2017). Just like the funds that are given directly to county and municipal governments, that money is only available in the Marcellus Shale region of the state. $7.9 million is a small amount compared to the $200 million in impact fee revenues collected each year, or the $300-$400 million that PHFA awards in 9% tax credits each year ("Multifamily Housing Professionals: News," 2017). However, the following section explains how PHARE has had an outsized impact on the geographic distribution of LIHTC funding in Pennsylvania.

**The Impact Fee and Affordable Housing**

The Pennsylvania Housing Affordability and Rehabilitation Enhancement Fund was originally created in 2010, as a mechanism to finance projects to improve housing affordability in the state. However, no funds were allocated to PHARE at the time. The Fund remained inactive until 2012, when Act 13 created its first source of revenue. State Senator Gene Yaw explained that PHARE was included in Act 13 in order to help people experiencing rising rents as a result of the surge in natural gas drilling (Conti, 2016). Since 2012, awards from the PHARE Fund have been made on an annual basis by the same agency that makes LIHTC awards: PHFA. Each year, the agency publishes a Request For Proposals (RFP), inviting the submission of applications for that year’s pot of money. PHFA then reviews the applications and decides how to allocate the funding;

\(^6\) If a municipality is allocated more than the greater of $500,000 and 50% of its budget from the previous year (adjusted for inflation), the excess money goes to the PHARE Fund.
thus far it has made awards for the years 2012 through 2016 (“PHARE Program,” 2017). Applicants can be private developers as well as county and municipal governments, and projects may include rental assistance programs, the rehabilitation of existing housing stock, and the construction of new affordable housing. The latest PHARE RFP does not state a preference for projects in localities affected by the drilling boom. It does, however, state PHFA’s goal of maximizing the leveraging of other public and private sources of funding (“Pennsylvania Housing Affordability and Rehabilitation Enhancement Fund (PHARE) 2017 Request for Proposals,” 2017, p. 2). By this criterion, the use of PHARE to fund LIHTC projects is just about the ideal option.

Recall that the LIHTC program by itself does not provide all of the funding necessary to build affordable housing. Even the more lucrative 9% tax credit only pays for about 70% of construction costs; developers have to piece together other sources of funding to make up the difference. PHARE can be used for that purpose. Hence, a small amount of money from PHARE can help to secure a much larger set of funds in the form of tax credits. And crucially, PHARE funding is only available in Marcellus Shale counties. Thus, PHARE gives developers in that part of the state an advantage in assembling attractive financing packages in their applications for LIHTC. It would be reasonable to expect that projects in the Marcellus Shale region would be more likely to receive awards in the competitive 9% LIHTC application process, due to the availability of PHARE money. That hypothesis is tested quantitatively in Chapter 3.

Through 2016, $39.3 million in impact fee receipts has been awarded through the PHARE Fund. $9 million has been awarded directly to 9% LIHTC projects, helping to fund 11 different developments and 431 units of affordable housing. Most of the rest has
gone to county and municipal governments, either for specific projects aimed at improving housing affordability, or for funds to help low-income residents pay for housing (“PHARE Program,” 2017). It would be impossible to track down where all of that funding has ultimately gone. However, it is quite possible that some of it has attracted additional LIHTC investment, for example, by helping very low-income households afford LIHTC rents. And because there is a fixed, limited pool of 9% LIHTC funding, any increase in the amount received by the Marcellus Shale region means less funding for the rest of the state. In this way, the PHARE provision of Act 13, which was created to address increased housing need in the Marcellus Shale region as a result of the fracking boom, has actually caused the rest of the state to lose funding for affordable housing. Chapter 3 attempts to quantify just how many units, and just how many dollars, have shifted between the regions since 2012 on account of the impact fee.
Chapter 3: Comparing the Geographic Distribution of 9% LIHTC Awards in Pennsylvania, Before and After the Impact Fee

Previous chapters have established the theoretical basis for the hypothesis that the availability of impact fee receipts through the PHARE Fund has altered the geographic distribution of PHFA’s 9% LIHTC awards. This chapter presents quantitative evidence to support that hypothesis, using data on all 9% developments in Pennsylvania since the beginning of the LIHTC program in 1986. The chapter begins with an overview of methodology and the sources of data. Then the findings are presented and analyzed. At a surface level, the numbers show that in the period of 2012-2016, a greater proportion of units were awarded to counties eligible for impact fee receipts compared to the period 1986-2011. Still, there have been significant variations in the geographic distribution within those time periods, and that merits further explanation. The chapter concludes with a discussion of potential confounding variables: factors besides the passage of Act 13 that may have influenced the geographic distribution of LIHTC funding. The analysis is confined to three factors that could reasonably have had an impact: changes in population, changes in need (as measured by poverty rate and median gross rent), and changes in the market for low-income housing tax credits. While these additional variables make it difficult to quantify precisely the effect of Act 13, the discussion in this chapter confirms that the data are consistent with the original hypothesis. Impact fee receipts have altered the geographic balance of 9% LIHTC awards in Pennsylvania, resulting in a greater proportion of units being located in the Marcellus Shale region.
Methodology and Sources

For the purposes of this analysis, I focus on the number of units of housing built, rather than the number of projects awarded or the amount of funding provided. I have made this choice for two reasons. First, varying construction costs across the state could potentially skew the results if I focused on funding amounts. And second, the ultimate reason for studying changes in affordable housing provision is in the impact it has on the low-income population that the housing serves. Measuring by units translates the observed changes into human terms. This approach does have its limitations; there is no way to know whether a given unit is serving one person or a large family. Nevertheless, it is reasonable to conclude that every unit gained or lost corresponds to a household that will be affected.

This analysis also focuses exclusively on 9% credit awards. Unlike the 4% tax credit, which is non-competitive, funds for the more lucrative 9% tax credit are limited and highly sought after. Thus, while PHFA has very little say in where 4% credits go, it plays a determinative role in the geographic distribution of 9% credits. My focus on the 9% awards will isolate the decisions of PHFA, to determine whether they have changed after the passage of Act 13.

The data covering all 9% LIHTC awards in Pennsylvania come from two sources. The Pennsylvania Housing Finance Agency’s website provides yearly lists of the awards it has made, covering the period 2010-2016 (“Multifamily Housing Professionals: News,” 2017). I have obtained the remainder of the data from Novogradac & Company LLP, a national real estate consulting firm that specializes in affordable housing and maintains extensive historical records of LIHTC projects. Novogradac does not list the year in
which the credits were awarded. Instead, for each project it gives the allocation year, i.e., the first of the ten years in which the investor receives the tax credit. Novogradac’s list includes all LIHTC properties in Pennsylvania for which credits were allocated in 2014 or earlier (“Pennsylvania - LIHTC Properties through 2013,” 2015).

Having amassed as complete a list as possible of Pennsylvania’s 9% LIHTC awards, the next step is to classify each property by whether it is in a county that is eligible for the PHARE portion of impact fee receipts. This is more complicated than it may seem, because the status of each county can vary year-to-year, as new wells may be drilled or old ones may cease to operate. The Pennsylvania Public Utility Commission (PUC) reports the total amount of money disbursed from the impact fee, by year, to each of Pennsylvania’s 67 counties. This information is broken down by the 40% that is available to all counties, and the 60% that is only available to counties with wells (“Act 13 County and Municipality Disbursement,” 2016). According to PUC’s data, 37 counties were eligible to receive the impact fee’s PHARE funding in 2012 and 2013. Three of those counties became ineligible in 2014 and 2015, and another two counties became ineligible in 2016. Nevertheless, for the purposes of this study, the original 37 counties will all be considered eligible. I have made this decision because in some cases, a development received PHARE money in one year and a LIHTC award in a later year. Therefore, a county that was eligible for impact fee receipts in 2012, but later became ineligible, ought to have retained an advantage in securing LIHTC funding. This study

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7 There are typically at least two years in between the award and the allocation of credits, during which time an investor is selected and construction takes place. It is possible that a few projects were awarded before 2010, but received an allocation of credit after 2014, and thus are not included in my dataset. I do not expect their absence to significantly impact my conclusions.
examines how the proportion of LIHTC units awarded to the full list of 37 counties has changed over time. A map of those counties, which cover much of Western and Northern Pennsylvania, is given in Figure 1 in the Introduction.

I conclude this section with a note on statistics. Because there are available data for all (or nearly all, as explained above) LIHTC projects in Pennsylvania, methods of statistical inference are not needed to answer the question posed in this chapter. Rather, descriptive statistics suffice to show how the distribution of LIHTC awards has changed over time. Nevertheless, it is important not to overstate the conclusiveness of the results. It is often repeated that correlation is not the same as causation. Taken alone, the numbers do not prove that Act 13 has caused a greater share of affordable units to be built in Marcellus Shale counties. It has only been five years since Pennsylvania instituted the impact fee, and there is a significant amount of year-to-year variability in the data. Furthermore, the presence of potential confounding variables complicates the analysis. It is only with a discussion of the effects of these confounding variables, combined with both the empirical data and the theoretical reasoning for why the geographic distribution would be expected to change, that I conclude that Act 13 has altered where affordable housing is being built in the state of Pennsylvania.

Analysis

At a surface level, before digging deeper into year-to-year and county-to-county changes, the numbers show that the Marcellus Shale region has been awarded a greater share of LIHTC units after the impact fee was enacted. Table 1 gives the total number of
9% LIHTC units awarded in Pennsylvania, broken down between Marcellus Shale and non-Marcellus Shale counties, both before and after the passage of the impact fee.

Table 1

<table>
<thead>
<tr>
<th>Time Awarded</th>
<th>Units in Marcellus Shale Counties</th>
<th>Units in Non-Marcellus Shale Counties</th>
<th>Marcellus Shale County Units As % of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before Impact Fee</td>
<td>6505</td>
<td>12608</td>
<td>34.0%</td>
</tr>
<tr>
<td>After Impact Fee</td>
<td>3868</td>
<td>5380</td>
<td>41.8%</td>
</tr>
</tbody>
</table>

Produced by the author

The data show that after the passage of the impact fee, counties with drilling were awarded 41.8% of the total affordable units, compared to 34.0% before the passage of the impact fee. That 7.8% change has meant that over the five years since PHARE funds became available, counties in the Marcellus Shale region have received approximately 720 more affordable housing units than they would have if the distribution had stayed the same. That corresponds to a significant amount of funding shifted between regions of the state. Over the period 2012-2016, the average cost of LIHTC funding per unit was $197,521, spread over 10 years. Therefore, if the entirety of the distribution shift were attributable to the impact fee, one would conclude that the $39 million awarded through PHARE has leveraged an additional $142 million through the LIHTC program for the Marcellus Shale region.

The changes to the geographic distribution of LIHTC awards have not been uniform across Pennsylvania’s counties. The map in Figure 6 depicts these changes,
showing the number of units each county has received since 2012 above or below what it would have received if the prior distribution had remained the same. Blue counties on the map have gained units, while red counties have lost units. For example, before 2012, Philadelphia County received 25.1% of Pennsylvania’s LIHTC units. Had Philadelphia gotten that same share after 2012, it would have received 2,322 units. Instead, Philadelphia received just 1,987 units, amounting to a reduction of 335 units. This is the largest decline of any county in the state. The bold lines in Figure 6 mark the boundaries of the Marcellus Shale region.

Figure 6

![Map Chart](https://example.com/map.png)

Produced by the author, using Map Chart
Figure 6 shows that the shift in funds from non-fracking counties to fracking counties has not been the only change. Some of the counties that make up suburban Philadelphia have seen an increase in their share of affordable units, and large portions of Central Pennsylvania have seen a decrease. However, note that nearly all of the counties with the greatest increases are in the Marcellus Shale region, and all of the counties with the greatest decreases are not. In the case of the Philadelphia region, the losses of units in Philadelphia County, and to a lesser extent, suburban Delaware County, more than cancel out the gains in the other Philadelphia suburbs. Across the five counties that make up the Philadelphia metro area, there has been a deficit of 80 units compared to the pre-impact fee distribution.

Finally, I present two plots of the year-to-year proportion of LIHTC units going to Marcellus Shale counties. Figure 7 is based on allocation year, and contains only projects that were awarded before 2012. The dashed red line in Figure 7 represents the pre-impact fee average of 34.0%, and the solid blue line represents the post-impact fee average of 41.8%. Because allocation year depends on each project’s construction timeline, the yearly data points are quite volatile. Nevertheless, there are very few years when the Marcellus Shale region received a greater share than the post-impact fee average. The only time period when this occurred consistently was 2008-2010; during those years Marcellus Shale counties received an even greater proportion of units than

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8 These are Bucks, Chester, Delaware, Montgomery, and Philadelphia Counties.
9 Because projects typically receive an allocation of tax credits several years after the credits were awarded, there are a number of projects that were awarded tax credits in the pre-impact fee era, but have an allocation year of 2012 or later. The allocation year information from Novogradac goes up to 2014. The data point for 2015 represents projects that received tax credit awards before 2012, but did not receive an allocation until after 2014.
than they have in the post-impact fee era. That spike merits further discussion. The following section explains how changes to the market for low-income tax credits brought on by the 2008 financial crisis caused an unusually high proportion of LIHTC units to be built in rural Pennsylvania counties, which are also mostly located in the Marcellus Shale region.

Figure 7

% of Units in Marcellus Shale Counties by Allocation Year
Projects Awarded before 2012

Produced by the author
The plot in Figure 8 covers the years 2012-2016, after the impact fee came into effect, and is based on the year that the tax credits were awarded by PHFA. Again, there is a dashed red line at the pre-impact fee average of 34.0%, and a solid blue line at the post-impact fee average of 41.8%. In four of the five years since the impact fee was enacted, Marcellus Shale counties received a greater share of LIHTC units than the pre-

Figure 8

% of Units in Marcellus Shale Counties by Award Year
Projects Awarded 2012-2016

Produced by the author
impact fee average of 34.0%. This occurred in only nine of the 28 years\textsuperscript{10} before the impact fee came into effect. In other words, most of the data points in Figure 7 are below the red dashed line, while most of the data points in Figure 8 are above it. Year-to-year variation notwithstanding, the evidence suggests that Act 13 has caused the geographic distribution of LIHTC awards to shift in favor of the Marcellus Shale region.

\textit{Potential Confounding Variables}

In addition to the funds that the impact fee has made available, a number of other factors may have influenced the geographic distribution of LIHTC units over time. Changes in population, changes in need, and changes in the tax credit market could all be reasonably considered as possible confounding variables in analyzing PHFA’s award-making patterns. This section will address all three. When examining demographic data in this section, I use the 2000 U.S. Census to represent the pre-impact fee era of 1986-2011, and the 2015 American Community Survey 5-Year Estimates to represent the post-impact fee era of 2012-2016.\textsuperscript{11}

It would be logical for PHFA to alter the distribution of LIHTC awards in response to population changes, simply on the basis of fairness. Additionally, because of the political influences on the process of awarding tax credits, there may be an incentive to direct a greater proportion of resources towards counties that have grown in population. Figure 9 shows the percentage change in population by county, comparing the 2015 population (U.S. Census Bureau, 2015c) to the 2000 population (U.S. Census Bureau, 2015c).

\textsuperscript{10} Here I am referring to allocation year, rather than award year.
\textsuperscript{11} The years 2000 and 2015 are the closest to median years for the two time periods for which the Census provides adequate data.
2000c). Again, the bold lines on the map demarcate the boundaries of the Marcellus Shale region.

**Figure 9**

Population growth accounts for some of the changes in LIHTC unit distribution that the impact fee receipts do not explain. The growing population of the Philadelphia suburbs corresponds to an increased share of LIHTC units, while the declining population in Central Pennsylvania has received fewer LIHTC units. To control for population changes, I have broken the data into two groups. Table 2 covers counties that have gained population, and Table 3 covers counties that have lost population. Both tables compare
the proportion of units going to the Marcellus Shale region before and after 2012. And within both subsets of counties, the Marcellus Shale region has increased its share of units since the passage of the impact fee.

### Table 2: Counties with Increased Population

<table>
<thead>
<tr>
<th>Time Awarded</th>
<th>Marcellus Shale County Units As % of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before Impact Fee</td>
<td>8.3%</td>
</tr>
<tr>
<td>After Impact Fee</td>
<td>15.3%</td>
</tr>
</tbody>
</table>

Produced by the author

### Table 3: Counties with Decreased Population

<table>
<thead>
<tr>
<th>Time Awarded</th>
<th>Marcellus Shale County Units As % of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before Impact Fee</td>
<td>86.7%</td>
</tr>
<tr>
<td>After Impact Fee</td>
<td>89.3%</td>
</tr>
</tbody>
</table>

Produced by the author

It is also reasonable to suspect that PHFA might have altered how it distributed LIHTC awards based on shifting needs in different regions of the state. Counties that experienced increases in poverty rates or the cost of renting might have expected to receive more affordable housing. The following maps show county-level changes in the percentage of the population below the poverty line (Figure 10), and the percentage change to the median gross rent (Figure 11), again comparing 2000 (U.S. Census Bureau,
Figure 10

% Change in Poverty Rate, 2000-2015
- 2% or Less
- 2% to -1%
- -1% to 0%
- 0% to 1%
- 1% to 2%
- 2% to 3%
- 3% or More

Produced by the author, using Map Chart

Figure 11

% Change in Median Gross Rent, 2000-2015
- 0% or Less
- 0% to 1%
- 1% to 10%
- 10% to 20%
- 20% to 30%

Produced by the author, using Map Chart
(U.S. Census Bureau, 2015a & 2015b). The median rents from 2000 are adjusted for inflation.

Almost uniformly across Pennsylvania, poverty rates have increased while median rents have gone up between 2000 and 2015. Yet for the most part, the counties that have been most severely affected have not been eligible for impact fee PHARE funds. Most of the counties that have seen poverty rates rise by 3% or more, including Philadelphia County, are in the southeastern portion of the state. Meanwhile, most of the counties that have escaped the largest increases in median rent are in the Marcellus Shale region. This runs counter to the justification for dedicating impact fee revenues to affordable housing. While housing need has increased in the Marcellus Shale region, it has increased by just as much in the rest of the state. In Chapter 4, an examination of the current state of housing affordability across Pennsylvania shows that the areas of greatest need are actually outside of the Marcellus Shale region.

This section concludes with a discussion of how the financial crisis in 2008 affected the market for Low Income Housing Tax Credits. The recession that followed is responsible for the high proportion of affordable units receiving credit allocations in the Marcellus Shale region between 2008 and 2010. As discussed in Chapter 1, the onset of the recession caused the value of the LIHTC to plummet, as tax credits became less attractive to investors whose future incomes were uncertain. The federal government responded by passing the Housing and Economic Recovery Act of 2008, which pumped more funding into the LIHTC program (Schwartz, 2011, p. 137). Still, in areas with high land and construction costs, individual projects were nearly impossible to finance. For example, Philadelphia County received 25.1% of Pennsylvania’s LIHTC units before the
impact fee came into effect. However, of the projects that received allocations between 2008 and 2010, only 3.7% of the units were in Philadelphia. During that time period, it was more feasible to develop affordable housing in cheaper, rural counties, which also happen to be largely in the Marcellus Shale region. This explains the two outliers in Figure 7, when in 2008 and 2010 more than 80% percent of the LIHTC units were built in Marcellus Shale counties.

Because of the disruption caused by the financial crisis, it is more applicable to compare the distribution of LIHTC units since 2012 with the distribution before the recession. By this measure, there has been a marked shift in where 9% LIHTC projects are awarded since the passage of the impact fee. More units have been built in the Marcellus Shale region of Pennsylvania, at the expense of the rest of the state. I go on to argue in Chapter 4 that not only has Act 13 caused a substantial change in funding patterns, but it has also hurt the regions of Pennsylvania that are most in need of affordable housing.
Chapter 4: Evaluating the Impact Fee as a Tool for Funding Affordable Housing in Pennsylvania

Having established in Chapter 3 that the PHARE Fund has shifted LIHTC resources to the Marcellus Shale region of Pennsylvania, this chapter questions the merits of the new system. I evaluate the PHARE mechanism by two metrics: efficiency and equity. In considering efficiency, one must consider how much the PHARE Fund has increased the supply of affordable housing, both in the Marcellus Shale region and in Pennsylvania overall. I argue that when PHARE money is coupled with LIHTC funding, it does not produce a net increase in affordable housing statewide. The second measure, equity, questions whether the new distribution of affordable housing is serving the areas of greatest need. I contend that it is not. This chapter concludes with a consideration of the future of the impact fee and the PHARE funding stream, as Democrats in Harrisburg continue to push for its replacement with a severance tax.

Efficiency

While LIHTC developments represent the most potent application of PHARE funds, they are not the most common way in which the funds are used. Through 2016, the bulk of PHARE money has gone towards either rental assistance programs or housing rehabilitation projects (“PHARE Program,” 2017). Thus, before discussing the more impactful LIHTC projects, it is worth touching upon these other uses of PHARE funding. Rental assistance programs that have gotten PHARE money are administered at the county or local level, and give subsidies to low-income households so they can afford
decent housing that would otherwise be too expensive for them. However, as discussed in Chapter 2, these types of programs are ineffective if the supply of housing is insufficient to meet growing demand, which is the case in many areas affected by the drilling boom (Williamson & Kolb, 2011, p. 15). In the absence of new construction or rehab projects, rental assistance programs merely drive up the prices of existing housing. Even if some low-income households are able to afford housing with the subsidy, the inadequate housing supply will mean that other households get left out. The increased demand may spur developers to build more market rate housing in the long term, but in the short term, rental assistance programs are not a particularly efficient use of funds.

Rehabilitation projects, by contrast, are more efficient. These include safety improvements, roof repairs, and accessibility updates, and may or may not be targeted towards low-income households. Either way, rehab projects improve the longevity and livability of the housing stock, thereby relieving pressure from increased housing demand and fostering affordability. Rehab can be a cost-effective option; a study specific to Pennsylvania found that compared to new construction, rehabilitation produces greater dollar-for-dollar economic benefits (Econsult Corporation, 2009, p. 6). Presaging PHARE’s inclusion in Act 13, the 2011 study of the Marcellus Shale region’s housing needs recommended that public funds be made available to rehabilitate older housing stock in areas affected by fracking (Williamson & Kolb, 2011, p. 53). In addition to rehab projects, governments have gotten creative in finding other efficient uses of PHARE funding. For example, in 2016 Susquehanna County received funding to provide transitional housing for ex-offenders suffering from addiction. The program includes addiction treatment and assistance for reentering the workforce (“PHARE Program,”
While less common than rental assistance and rehab initiatives, these types of projects have the potential to deliver benefits far exceeding their costs.

LIHTC developments have received a comparatively small portion of PHARE funding. Through 2016, of the $39.3 million that has been awarded through PHARE, just $9.0 million has gone towards 9% LIHTC developments (“PHARE Program,” 2017). Nevertheless, it is not difficult to argue that LIHTC developments are the most impactful uses of PHARE money. The aforementioned $9 million has gone towards 11 projects, helping to fund 431 new units of affordable housing. Furthermore, these projects will ultimately receive a total of $87.2 million in LIHTC funds, in addition to the other sources that may contribute to their financing (“Multifamily Housing Professionals: News,” 2017). In this way, the combination of PHARE and LIHTC has been a powerful tool for funding affordable housing in the Marcellus Shale region. Housing advocates have praised tax credit developments as a particularly efficient use of PHARE money (Housing Alliance of Pennsylvania, 2015, p. 5). As the $9 million in impact fee receipts has leveraged more than $87 million in tax credits, it is no hyperbole to say that the use of PHARE funds for LIHTC developments has been far more consequential than any other use.

Looking at the Marcellus Shale region in isolation, PHARE has been incredibly efficient at securing major investments in affordable housing. But shifting the focus to the

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12 This is only including PHARE money originating from the impact fee. Since 2012, additional sources of PHARE funding have become available. The new funding, arriving via Pennsylvania’s Realty Transfer Tax and the National Housing Trust Fund, is available in all counties statewide (“PHARE Program,” 2017). Still, the impact fee funding remains restricted to Marcellus Shale counties, and continues to aid those counties in securing LIHTC funding.

13 Some 4% LIHTC developments have also received funding through PHARE. However, because 4% LIHTC awards are noncompetitive, they are not relevant to this analysis.
state of Pennsylvania, one finds that the use of PHARE funding for 9% LIHTC projects has not produced additional affordable housing. This conclusion follows from two features of the LIHTC system. First, Pennsylvania has a limited amount of 9% credits to award each year. This makes the LIHTC program a zero-sum affair; one region’s gain must be another region’s loss. And second, applications for 9% tax credits are highly competitive. As noted in Chapter 1, PHFA is only able to award credits to a third of the developers that apply each year. Therefore, while PHARE has made certain developments in the Marcellus Shale region possible, it has not increased the total amount of LIHTC funding in Pennsylvania. In the absence of the impact fee, PHFA would still be able to choose from plenty of other viable LIHTC applications, with other sources of funding besides PHARE to complement the tax credits. The effect of PHARE has been to shift a disproportionate amount of LIHTC funding to the Marcellus Shale region, without increasing the total amount of low income housing being built. This is not an efficient use of funds; it is merely a geographic redistribution favoring Western and Northern Pennsylvania. The new pattern of LIHTC funding can only be justified if it is serving the areas that are most in need of affordable housing.

Equity

There is no obvious definition of what constitutes an equitable distribution of affordable housing. The PHARE program delivers mixed results by the equity metric, depending on how one chooses to measure equity. The first question one might ask is whether the distribution of 9% tax credit awards matches the distribution of
Pennsylvania’s population. At the time of the 2000 U.S. Census,\textsuperscript{14} Marcellus Shale counties contained 36.3\% of the state population (U.S. Census Bureau, 2000c). This is in line with the 34.0\% of 9\% LIHTC units those counties received from 1986 to 2011. But by 2015, the Marcellus Shale region had lost population; its share of Pennsylvania’s total dropped to 34.1\% (U.S. Census Bureau, 2015c). Nonetheless, since the passage of the impact fee, these counties have increased their share of 9\% LIHTC units to 41.8\%. Table 4 summarizes these figures. In short, the impact fee has allowed the Marcellus Shale region to receive a greater proportion of affordable housing than it deserves by population alone.

\begin{table}[h]
\centering
\begin{tabular}{|l|c|c|}
\hline
Marcellus Shale Counties & Share of Population & Share of 9\% LIHTC Units Awarded \\
\hline
Before Impact Fee & 36.3\% & 34.0\% \\
\hline
After Impact Fee & 34.1\% & 41.8\% \\
\hline
\end{tabular}
\caption{Table 4}
\end{table}

Produced by the author

However, impact fee funds were not dedicated to affordable housing on the basis of population shifts. That provision was included in Act 13 due to the rising housing costs associated with natural gas drilling, a phenomenon identified in the 2011 study commissioned by PHFA and cited in Chapter 2. In 2015, PHFA commissioned a follow-up study by the same researchers to assess how the housing market had evolved in the

\textsuperscript{14} As in Chapter 3, I use figures from the 2000 Census as a proxy for the period of 1986-2011.
intervening years. To a large degree, the problems identified in 2011 have persisted. One complicating factor is the changing demand for natural gas. By 2015, demand had fallen from its peak a few years earlier, resulting in diminished drilling activity (Williamson & Kolb, 2015, p. 3). Nevertheless, while rental prices increased by as much as 300% during the surge in drilling, they have fallen by no more than 50% since. In all cases, prices remain higher than they were before the fracking boom. In interviews with the authors, landlords explained that they preferred to keep units vacant rather than lowering rents, in anticipation of a future increase in drilling activity and related housing demand (Williamson & Kolb, 2015, p. 11).

The study also found that Act 13 has had success in improving housing affordability in Marcellus Shale counties. Developers in the region have made use of PHARE funds in conjunction with LIHTC, and the availability of PHARE funds has attracted new developers as well (Williamson & Kolb, 2015, p. 18). There are also examples of local governments using PHARE money to incentivize rehabilitation projects targeted to low-income renters (Williamson & Kolb, 2015, p. 17). And to a lesser extent, some counties and municipalities have addressed local housing needs with Act 13 receipts that they received directly, outside of PHARE (Williamson & Kolb, 2015, p. 28). As discussed in the last section, the different uses of PHARE funds are effective to varying degrees. The combination of PHARE with LIHTC is most impactful, but once again, non-Marcellus Shale counties lose as much in tax credits as Marcellus Shale counties gain. The study’s authors, focused narrowly on impacts to the Marcellus Shale region, recommend that PHARE money continue to be bundled with LIHTC funding.
(Williamson & Kolb, 2015, p. 31). This approach has been successful at alleviating housing needs in places that have received such funding.

Even so, only 11 developments have received the combination of 9% tax credits and PHARE funding from the impact fee through 2016. Furthermore, the text of Act 13 only requires that PHARE money be awarded in counties with at least one active well. As discussed in Chapter 2, wells are not equally distributed across the Marcellus Shale region. But when it comes to PHARE, counties with a few wells are just as eligible as counties with over a thousand, and localities with many wells in close proximity have no advantage over localities with none. Indeed, some PHARE money has made its way to municipalities with no wells nearby (Conti, 2016). Nevertheless, PHFA has largely stayed true to the intent of the law, particularly when making awards to developments receiving LIHTC funding. Of the 11 developments referenced above, nine are located within the top six drilling counties, which account for 72% of active unconventional gas wells (“Wells Drilled by County,” 2017). Additionally, according to the map maintained by DEP, each of the 11 developments is located within five miles of an active well site (“PA Oil and Gas Mapping,” 2017). So in this sense, PHARE funds have for the most part been used in places with housing needs resulting from the fracking boom.

Ultimately though, in order to assess the equity of the PHARE system, one must consider housing needs across the whole of Pennsylvania. And while the fracking boom has harmed affordability in the Marcellus Shale region, other parts of the state are also in need of affordable housing. In this context, the best available metric for measuring need

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across the state is the percentage of homes that are affordable\textsuperscript{16} for a household earning 50\% of Area Median Income. The LIHTC program is targeted towards the 50\% AMI demographic, so the distribution of tax credit awards ought to match the areas of greatest need for this group. The map in Figure 12 shows county-level data for the percentage of homes affordable for a family of four earning 50\% AMI. It uses 2017 data from HUD, as

\textbf{Figure 12}

![Map showing percentage of homes affordable for a 4-person family earning 50\% of AMI in 2015.](image)

\textsuperscript{16} Here, affordability is defined as housing that costs at most 30\% of a household’s income.
well as data from the 2015 American Community Survey. The state of Pennsylvania and
the Marcellus Shale region are outlined on the map.

The map in Figure 12 dispels the notion that Marcellus Shale counties are in
greater need of affordable housing than the rest of the state. In fact, most of the counties
with the smallest proportion of housing affordable to 50% AMI families are not in the
Marcellus Shale region. The three counties that are most in need, Bucks, Montgomery,
and Chester, are all in the Philadelphia suburbs, ineligible for PHARE funding. So while
the fracking boom did create a need for affordable housing, there remains even greater
need in other parts of the state. By favoring the Marcellus Shale region, Act 13 facilitated
a distribution of affordable housing in Pennsylvania that is not aligned with historical
trends, the state’s population, or the areas of greatest need. It is true that the housing
funded through PHARE has served localities with housing markets upended by the
natural gas industry. But Act 13’s preferential treatment can only be justified by ignoring
the housing needs of the rest of the state. For these reasons, I conclude that Act 13 has
contributed to an inequitable distribution of affordable housing funding in Pennsylvania.

*The Future of the Impact Fee*

Having analyzed the effects of Act 13 on affordable housing in Pennsylvania, it is
important to recognize that the future of the impact fee is far from certain. Ever since the
bill was passed, Democrats have criticized Act 13 for being too lenient towards the
natural gas industry. As explained in Chapter 2, the impact fee places a lower effective
tax rate on the industry than the severance taxes employed by all other drilling states.
And while the impact fee is paid on a per-well basis, severance taxes are based upon the
quantity and value of the extracted gas. The debate between impact fee and severance tax was a key issue in Pennsylvania’s 2014 gubernatorial election. Democratic challenger Tom Wolf proposed a 5% severance tax, which he estimated would produce $1 billion per year in revenue compared to $200 million per year under the impact fee. His plan would have continued the flow of revenue to Marcellus Shale counties and municipalities, while providing additional funding for public schools, job training, and the DEP (Wolf, 2014). For his part, incumbent Republican Tom Corbett defended the impact fee, arguing that a more onerous severance tax would push drilling companies out of the state (Corbett, 2014).

Wolf won the election in 2014, seemingly delivering a blow to drillers and their supporters (Phillips, 2014). Yet three years into Wolf’s term, no severance tax has been enacted; Corbett’s impact fee remains state law. The gas industry has influenced the course of events, spending tens of millions of dollars on lobbying and campaign contributions at the state level. Republicans have also remained in control of both branches of the Pennsylvania General Assembly, and blocked Wolf’s attempts to implement a severance tax early in his term (Cusick, 2015). In July of 2017, the State Senate narrowly passed a budget that included a modest severance tax. But in order to win Republican votes, the bill included significant concessions to the gas industry, such as measures to limit DEP’s oversight of drilling activity (McKelvey, 2017). As of this writing, those plans are being debated in the Pennsylvania House of Representatives. And while Governor Wolf hopes to finally strike a deal with Republicans on a severance tax, environmental groups have expressed concern about the potential relaxing of oversight
(Cusick & Meyer, 2017). Even if a severance tax is ultimately passed, it will be much friendlier to the gas industry than the one Wolf proposed in his campaign.

As the latest severance tax proposal is being debated in the General Assembly, it is uncertain whether the funding stream for PHARE will be affected. The bill passed by the Senate is worded in such a way as to imply that the impact fee structure will remain in place, with a small severance tax imposed on top of it. Should revenues from the impact fee fall short of $200 million, money from the severance tax would be used to make up the difference. The remainder of the severance tax revenues would be directed into Pennsylvania’s General Fund (Thomas, Costa, & Miccarelli, 2017, pp. 76–77). This arrangement would likely increase the amount of money subject to the provisions of Act 13, as impact fee revenues have fallen below $200 million in 2015 and 2016 (“Disbursements and Impact Fees,” 2016). That additional money could end up in the PHARE Fund, depending on whether municipalities are already receiving the maximum amount allowed by the law.¹⁷

However, until and unless the severance tax bill passes, its contents will be subject to revision. The General Assembly could choose to allow the PHARE funding derived from the impact fee to be used statewide, or it could rededicate those funds for another purpose. Nevertheless, there seems to be no interest in changing the current policy. In 2015, PHFA Executive Director Brian Hudson testified that his agency would lobby for PHARE’s funding stream to remain unchanged under a new severance tax (Howells, 2015). As the agency responsible for making LIHTC awards in Pennsylvania, PHFA has observed first hand how impact fee revenues have altered the geographic

¹⁷ A more detailed discussion of the disbursement procedure for impact fee revenues is given in Chapter 2.
distribution of those awards. Since the head of the agency wants to maintain the 2012 system, one can conclude that PHFA has not identified the problems associated with the resulting pattern of affordable housing funding. This paper contends that supporters of the current system are missing the full picture. While PHARE funds derived from the impact fee have facilitated an increase in affordable housing production in the Marcellus Shale region, they have also caused a commensurate decline in the rest of the state. And as argued in this chapter, the new funding paradigm is both inefficient and inequitable.
Conclusion

After this paper’s discussions of history and geography, of statistics and funding systems, one should not lose sight of the fact that housing policy affects people. Households across the state of Pennsylvania are in need of affordable housing. And in parts of the Marcellus Shale region with intensive drilling, certain households have been abruptly faced with housing insecurity. I do not mean to diminish the difficulties caused by the fracking boom. But in designing housing policy, it is essential to examine the bigger picture, and how interrelated programs affect one another. When drafting Act 13, lawmakers sought to mitigate the environmental and social costs of the natural gas drilling. This is a laudable goal. However, the PHARE provision of Act 13 did something else entirely. Rather than providing funds to directly address housing needs in the fracking region, it established a mechanism that has shifted Pennsylvania’s LIHTC awards towards Marcellus Shale counties. Instead of simply paying for new affordable housing projects in areas of need, PHARE has been used to buy an advantage for the Marcellus Shale region in securing LIHTC funding. Two main mistakes were made in the conception of this policy. First, the potential consequences of impact fee revenues interacting with the LIHTC program were not considered. And second, housing needs in the non-Marcellus Shale region of Pennsylvania were ignored.

By combining LIHTC and PHARE without taking into account the mechanics of the two housing programs, Act 13 has produced a result that is contrary to the goal of meeting Pennsylvania’s housing needs. The LIHTC program, while a potent means for creating affordable housing, is subject to outside influences. And the PHARE provision
of the impact fee, while well intentioned, has skewed the LIHTC program to favor one region of the state over the other. In awarding money from the PHARE Fund, PHFA has made it a priority to maximize resource leveraging. But since impact fee revenues are only available to part of the state, this amounts to too narrow of a focus. True, $9 million in PHARE money has leveraged more than $87 million in 9% tax credits. From that perspective, an illusion is created that $87 million has appeared out of thin air. Yet that is not the case; the $87 million in LIHTC funding has also been leveraged away from the non-Marcellus Shale region. Considering the entire state of Pennsylvania, the funds that PHARE is leveraging are not contributing towards providing any additional affordable housing for households in need. If instead all PHARE money were eligible to contribute towards LIHTC projects anywhere in the state, it would be a much more productive use of funds.

Moreover, there is another reason to make all PHARE funding available statewide. There is need for affordable housing throughout Pennsylvania. And while the fracking boom has exacerbated housing needs in the Marcellus Shale region, much of the rest of the state has equal or greater needs. Furthermore, there are no dedicated sources of funds to address housing needs caused by factors besides natural gas drilling. For instance, there is no impact fee for globalization. There is no impact fee for discrimination in the housing market. There is no impact fee for systematic disinvestment in certain neighborhoods, towns, and regions. Act 13 appropriated funds in response to one specific cause of housing need, but it ignored the many other causes of need that manifest other places. Not only has this policy disregarded the non-Marcellus Shale region, it has also taken funding away from that region to give to counties affected by drilling. So while the
PHARE provision of Act 13 has made strides towards its narrowly defined goal of improving housing affordability in the Marcellus Shale region, it has redirected funding from other parts of the state with greater housing needs.

The case of the impact fee and affordable housing is an example of poor policymaking leading to inequitable outcomes. In trying to find a policy solution to a problem, lawmakers should address the problem directly and pragmatically, while considering the secondary impacts that their new policy would have. But when Governor Tom Corbett and the Pennsylvania General Assembly attempted to address the increased housing needs of the Marcellus Shale region due to the fracking boom, they did so through an indirect mechanism that has disturbed the larger LIHTC system. Since the passage of Act 13 in 2012, impact fee revenues passing through the PHARE Fund have facilitated a substantial shift in the geographic distribution of 9% LIHTC awards. That shift has assisted low-income households in the Marcellus Shale region, whom the policy was intended to benefit. Yet in equal measure, it has denied affordable housing to low-income households in the rest of Pennsylvania, where housing needs are in large part more severe. The shift in funds has been consequential, and it has been unjust. Removing the geographic restriction on PHARE funding would be a reasonable fix.
Glossary

**Act 13 of 2012** – A law passed by the Pennsylvania General Assembly imposing an “impact fee” upon drillers of natural gas wells that make use of hydraulic fracturing, otherwise known as fracking

**Affordable Housing** – In this paper, I define affordable housing as housing receiving some form of government subsidy (which may go to the developer, owner, or occupant) in order to serve low-income households. I use the term “housing affordability” when analyzing the extent to which available housing in a given region is affordable.

**AMI** – Area Median Income, as defined by HUD

**DEP** – Pennsylvania’s Department of Environmental Protection

**Fracking** – Technically called hydraulic fracturing, part of the process of extracting natural gas from shale formations such as the Marcellus Shale

**Impact Fee** – A fee paid by natural gas drillers for every well drilled

**LIHTC** – Low Income Housing Tax Credits, the primary program for funding affordable housing in the United States. See Chapter 1 for an explanation of the difference between the 4% tax credit and the more lucrative 9% tax credit.

**Marcellus Shale** – An underground rock formation stretching across much of the Eastern United States, which contains vast reserves of natural gas

**Marcellus Shale Region** – In this paper, I define the Marcellus Shale region as counties in Pennsylvania in which fracking of the Marcellus Shale has taken place, and have thus been eligible for the bulk of impact fee receipts. See Figure 1 in the Introduction for a map of these counties.
Pennsylvania General Assembly – The legislative branch of the state of Pennsylvania, including the State Senate and the State House of Representatives

PHARE – The Pennsylvania Housing Affordability and Rehabilitation Enhancement Fund, through with impact fee revenues dedicated to affordable housing are distributed

PHFA – The Pennsylvania Housing Finance Agency, which is responsible for awarding both LIHTC and PHARE funds in Pennsylvania

Severance Tax – A tax on drillers based on the volume of natural gas they “sever” from the ground

Unconventional Gas Well – A well from which it is only feasible to extract natural gas through fracking
Bibliography


