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UNIVERSITY OF TORONTO

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About IMFG

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Abstract

This report reviews alternative sources of revenue to support new infrastructure and other development projects for which municipal funds are not readily available. We review two such instruments: Tax Increment Financing (TIF) and Land Value Capture (LVC). We found more frequent use of TIF than LVC. TIF has largely been used to fund small-scale projects, often not exceeding one or two hundred million dollars in capital costs. We could find only two TIF implementations that aimed to generate over a billion dollars in TIF revenue, and those projects fell short of meeting the revenue targets. The evidence for TIF efficacy is mixed and depends, to some extent, on the type of methods used in the analysis. Some studies found the TIF districts reported higher rates of development and greater real estate price appreciation than comparable non-TIF districts. Other studies reached different conclusions. Three key elements were repeatedly found to contribute to TIF success. (1) Mixed land use developments often met their intended TIF objectives. (2) The timing of TIF implementation mattered; TIFs initiated during recessions met with limited success. (3) Smaller TIFs were more successful in meeting revenue targets than larger ones. We simulate a 30-year TIF implementation along the Sheppard East corridor in Toronto, the route for the Sheppard subway line that started operations in 2002, and offer insights for local and higher tiers of government interested in implementing TIF. Our analysis of the Sheppard East corridor found that the net present value of the simulated TIF revenue covered only a small portion of the capital costs of extending the subway line.

Keywords: tax increment financing, land value capture, value capture, infrastructure

JEL codes: H27, H76, R42

Can Tax Increment Financing Support Transportation Infrastructure Investment?

1. Introduction

Rapidly growing cities in Canada, such as those in the Greater Toronto Area (GTA), are struggling to reduce traffic congestion. Toronto, the largest urban centre in Canada, also has the dubious distinction of being the Canadian city with the longest average commute times. Estimates for annual economic losses resulting from traffic congestion exceed $11 billion (Ionova, 2013).

Most urban experts believe that efficient and reliable public transit is needed to mitigate traffic congestion. At present, however, the quantity and quality of public transit is inadequate to provide a viable alternative to the automobile for most commuters. Billions of dollars in investment are needed to expand transit.

Public transit is often owned and managed by municipal governments. Since in most urban jurisdictions, fare box revenue is not sufficient to cover operating costs, most municipalities subsidize transit operations using transfers and targeted subsidies from other levels of government. At the same time, municipal governments do not generate sufficient own-source revenue to finance the capital costs of new infrastructure projects. Recently, a three-way equal splitting of costs to fund new public transit projects has become common such that the three tiers of government each contribute one-third toward the capital costs.

Municipal governments are searching for new revenue tools to maintain municipal services and invest in new infrastructure. Land Value Capture (LVC) and Tax Increment Financing (TIF) have been cited as possible sources of revenue to fund new projects, such as public transit.

This paper reviews these potential revenue tools as ways to fund new urban and transit development. We present a detailed discussion of TIF implementation, drawing on academic literature. We also estimate the size and scope of possible revenues from TIF designation of the Sheppard East corridor, the most recent subway extension in Toronto. The analysis compares the size and the pace of new residential development and the change in housing prices over time in the corridor with those in comparable corridors without subways.

The paper concludes by highlighting the benefits and the unexpected shortfalls that might result from relying on TIF to fund public transit developments. We identify scenarios that might limit the TIF revenues and highlight the need to include LVC as an option, in addition to TIF, to support new public transit developments.

2. Literature Review

Although the primary focus of this report is on TIF, we will also briefly explain the workings of LVC and consider its relevance as a potential revenue-generating tool to support new transit infrastructure in Toronto.

2.1 Defining Land Value Capture (LVC) and Tax Increment Financing (TIF)

In *Principles of Political Economy* (1848: 219–220), John Stuart Mill establishes the case for why instruments such as land value capture should be considered for the larger public good.

> Suppose that there is a kind of income which constantly tends to increase, without any exertion or sacrifice on the part of the owners: those owners constituting a class in the community, whom the natural course of things progressively enriches, consistently with complete passiveness on their own part. In such a case, it would be no violation of the principles on which private property is grounded, if the state should appropriate this increase of wealth, or part of it, as it arises.
>
> This would not properly be taking anything from anybody; it would merely be applying an accession of wealth, created by circumstances, to the benefit of society, instead of allowing it to become an unearned appendage to the riches of a particular class.

When land values improve as a direct result of new public-sector investments in an area, a tax can be imposed on the incremental increase in land value in addition to the tax on the base land value. The principle behind LVC is that the increase in land values is the result of investments by the public sector. The state is therefore justified in claiming a share in the increased land value. We illustrate this with an example from Walters (2012).

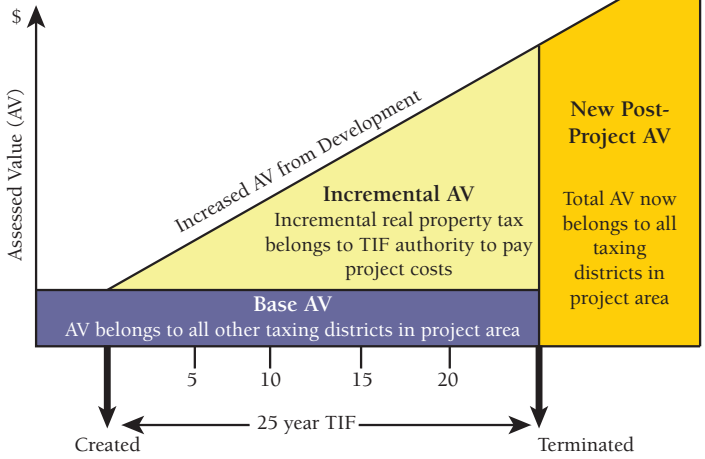
Assume that the base-year value for a large parcel of land is $420 million. Each year, the value of the land appreciates, so that the current-year land value is $441 million or 5 percent higher than it was in the base year. A 1 percent tax on the base land value of $420 million will generate $4.2 million in property taxes. A 40 percent tax on the incremental land value increase of $21 million (the difference between $441 and $420 million) will generate another $8.4 million. Thus, the total tax using LVC will be the sum of $4.2 million and $8.4 million, or $12.6 million.

TIF is a type of value capture that was originally conceived as a funding mechanism to help rehabilitate distressed urban areas. TIF works on the principle that infrastructure and public-space improvements usually attract private investment and stimulate development, resulting in an increase in property taxes that could contribute to the capital cost of such interventions (Carroll, 2008).

A municipality initiates a TIF agreement by designating a specific geographic area as a Tax Increment Financing District (TID). Before TIF designation, overlapping taxing jurisdictions collect property taxes in the area. Once a TID is established, property taxes are frozen at a base rate, which coincides with the total property valuation in the area at the time of designation (Smith, 2009). While the TID is active, taxing authorities continue to collect property taxes at the base assessment value, while the municipality issues general obligation or revenue bonds to pay for improvements within the area such as land acquisition, streetscape enhancements, or water and sewer lines (Byrne, 2010).

As land and properties are developed, the assessed value of properties in the TID increases, creating an incremental increase in property tax revenue above the base value. The municipality uses this increase, which is equal to the total property tax assessment of the TID minus the base assessment value, to pay off the bonds that funded the improvements (Merriman, Skidmore, and Kashian, 2011). When the TIF agreement expires and the debt is repaid, all property tax revenue (base and incremental) will once again be collected by all overlapping taxing jurisdictions at the new, higher level (Byrne, 2010). Figure 1 illustrates this process.

Figure 1: TIF Assessed Value (AV) Over Project Life (National Association of Realtors)



TIF differs from a one-time LVC levy in one fundamental way. While TIF provides a reasonably reliable and steady stream of funding over the course of several years or even decades, other forms of value capture, especially LVC, are designed to capture benefits only from the one-time gain in land values associated with the decision to locate improvements in and around the development in question. Because of this one-time gain, revenues from a one-time LVC levy are not viewed as sustainable over the long term (AECOM, 2012).

2.2 Tax Increment Financing Legislation and Administration

TIF implementation differs across regions and within regions over time. In some jurisdictions, municipalities exercise complete control over TIF design and administration, while in others, regional and state governments provide regulation. Standards for TIF initiation and termination, duration, and revenue collection

and disbursement also vary (Merriman et al., 2011). The National Association of Realtors has identified five stages of the TIF development process: initiation, formulation, adoption, implementation, and evaluation and termination (Johnson and Robinson and Cole Law Firm, 2002). We describe the five stages below.

Initiation

The initiation stage involves determining the overall project feasibility. Whereas the public sector most often initiates TIF projects, the private or non-profit sectors could also initiate a project. Public- and private-sector stakeholders determine project area eligibility, financial feasibility, and potential economic and social benefits.

Formulation

The formulation stage involves creating a redevelopment plan, which specifies the geographic boundaries of the TID along with project objectives, costs, and timelines. At the same time, tax base, revenue increment, and debt financing policies are established. In many jurisdictions, it is necessary to make a case for the TIF project, highlighting the fact that the developments would not have occurred *but for* TIF. The "But For" test requires municipalities to demonstrate that a specific area would not develop to its "highest and best use" in the absence of public assistance. In other words, failing to provide public improvements would result in stasis or continued decline (Weber and O'Neil-Kohl, 2013).

Adoption

The plan adoption stage involves public hearings and stakeholder participation as required by provincial or state legislation to ensure that input from citizens and taxing districts is considered in the decision-making process. Political and legal approvals in the form of enabling legislation, establishment of administrative organizations, and drafting of public-private partnership agreements also take place in the adoption stage.

Implementation

The implementation stage involves managing construction and project finances. Construction entails obtaining land, preparing the site, building improvements on the site, and post-construction management. This is the stage at which the tax base and tax rates are established, debt instruments are issued, and tax increments are generated and distributed.

Evaluation and Termination

The evaluation and termination stage involves assessing project outcomes against expected results, and dissolving the TID once all debt has been repaid. Project termination is generally regulated by TIF enabling legislation at the state or provincial level (Das, Larson, and Zhao, 2010). At this point, the total assessed value of the TID, which includes base and incremental property tax revenues, reverts to overlapping tax districts.

2.3 A History of Tax Increment Financing in North America

Sluggish economic growth in North America of recent years has exposed governments to fiscal constraints, municipal governments in particular. In response, local governments have explored new financing mechanisms to attract private investment and encourage development. TIF was first legislated in California in 1952 (Man and Rosentraub, 1998). However, most states did not implement TIF until the 1970s. More followed suit in the 1980s.

Before TIF, municipalities usually financed urban development projects through a combination of federal development grants and municipal general operating funds (Mollenkopf, 1983). Cities also had the option of selling general obligation bonds, which were considered secure as they were backed by the United States government (Hackworth, 2007). In the 1970s, U.S. federal development grant funding declined, placing new financial pressures on municipal governments. Consequently, TIF spread rapidly across the country from California to the Midwest in the 1970s and to other parts of the country in subsequent years (Pacewicz, 2013). In 1970, only seven states had adopted TIF. However, this number increased to 33 by 1987 and to 48 by the late 1990s (Carroll, 2008).

The City of Chicago, Illinois, has made extensive use of TIF. The Community Development Corporation of Chicago proposes TIF projects to the City Council. A recent review of TIF implementation found that 173 TIDs had been implemented in Chicago since 1984. At least 165 of these districts were active in 2014; in 2008, total TIF revenue from the 165 active districts equalled $570 million. Altogether, TIF has generated $7 billion in Chicago alone (City of Chicago, 2014). City estimates suggest that every dollar invested in TIF has a multiplier effect, attracting six dollars in private-sector investment.

Although TIF has mainly been used to fund smaller projects, some large-scale TIF investments amounting to over $1 billion do exist. The Beltline Tax Allocation District in Atlanta, Georgia, is a unique project spread over 6,500 acres that will take 25 years to complete (AECOM, 2012). The project includes 5,600 affordable housing units and is estimated to cost $2.8 billion. Earlier estimates suggested that TIF would generate $1.7 billion for the project. However, reports suggest that the project is over budget and that expected revenues from TIF will fall short of projections (Dale, 2014).

TIF has not been used as extensively in Canada. A TIF pioneer in Canada is the Calgary Municipal Land Corporation, which has implemented a Community Revitalization Levy that bears similarities to TIF. The city reports high returns on investments for the levy (City of Calgary, 2015). The Corporation's annual report (2015) notes that it has raised $3 million from the levy, and another $9 million from land sales.

The Shift to Tax Increment Financing

Some observers attribute the rapid rise of TIF, at least partly, to industry consultants who have promoted TIF, thus creating demand for their skills and

financial acumen. Weber and O'Neil-Kohl (2013) provide unique insights into the "outsize" role of real estate and related private-sector consultants in deepening and expanding the use of TIF as an economic development instrument. They reviewed TIF implementation in Illinois, where the use of this tool has been most frequent.

They disagree with those who attribute the increasing use of such tools over the last half century to the shift towards neoliberalism. Instead, they apply a "historical social network analytical" approach, using legislative and media reviews and interviews with private- and public-sector actors involved in urban development. This approach traces how real estate consultants have exploited established institutional paths in times of structural change to embed the use of TIFs in urban policy.

When TIF was first introduced in the 1950s in California, federal funding supported urban renewal. TIF was initially intended to address blight and implementation was conditional on passing the "But For" test, although the definitions used in this test were open to interpretation. The withdrawal of federal support and rapid deindustrialization during the 1970s is characterized as a critical juncture during which alternative development paths emerged. For example, several groups pushed for industrial retention through incentives, such as local investments in process modernization.

However, TIF emerged as the most popular of the proposed alternatives during the 1970s, translated into enabling legislation in 1977. During this period, as Weber and O'Neil-Kohl (2013) point out, real estate consultants were uniquely positioned to offer expertise on an instrument that would benefit their clients (developers). Fiscally constrained local governments could not retain permanent staff to find other innovative local economic development options. Many of these consultants had moved from the public sector to the private sector after federal development funding disappeared in the 1960s and 1970s.

In the 1980s, the same consultants pitched TIF as a tool to arrest industrial decline and aggressively promoted it to municipalities that were initially hesitant to adopt the tool. The period between 1987 and 2002 saw 635 new TIF districts created in the United States with little public scrutiny.

The consultants formed a new professional organization, the Illinois Tax Increment Association (ITIA), to exchange ideas and lobby for the use of TIF (Weber and O'Neill-Kohl, 2013). This resulted in an expansion of TIF via legislative amendments in the 1990s, to the point at which even golf courses were deemed deserving of TIF designation. In addition, the use of property (and sales) tax increments as security to borrow for redevelopment and infrastructure improvements meant greater reliance on the same consultants to provide the financial expertise needed for such complex transactions.

Some state leaders were unconvinced of TIF's efficacy, and California, Arizona (AECOM, 2012), and Washington, D.C. (Stapleton, 2009) suspended TIF implementation during this period.

Greenbaum and Landers (2014) conducted a thorough review of the recent empirical literature on the effectiveness of TIF and administered a survey to analyze the factors influencing local governments to adopt TIF across the country. They discovered commonalities in research methodology, including the use of the Heckman Selection Model (two-stage estimation procedure) and propensity scoring to resolve the selection bias.[1] They also highlighted differences in research methodologies, units of measurements, and the timing of analysis as the reasons behind the lack of consensus on TIF's impact on property development, employment generation, and increases in property values.

Their subsequent survey of what factors drive local governments to adopt TIF revealed that municipalities with higher economic development budgets but lower average income and property taxes are more likely to adopt TIF. Locational variations show that TIF adoption is most pronounced in the north-central United States.

Greenbaum and Landers (2014) identified the need for more disaggregate (block-level) analysis and additional controls for coexisting economic incentives (such as tax abatements) to account for unknown biases. They further recommended consulting with all overlapping jurisdictions in TIF approval processes.

Impact on Growth and Outcomes in Practice

Researchers have assessed the impact of TIF on property value appreciation, on growth in equalized assessed value (EAV) and employment, and on economic development outcomes. Most studies, however, focus on how TIF influences property values at the municipal and district levels.

A pioneering study by Anderson (1990) concluded that municipalities in Michigan that adopted TIF experienced more property value growth than municipalities that did not. However, the study did not establish whether TIF was merely capturing growth or stimulating it. Similarly, a large study of 151 cities in Indiana by Man and Rosentraub (1998) investigated the effect of TIF on property values. The study found that TIF adoption resulted in an 11.4 percent increase in municipal-level property value growth, compared with growth rates in municipalities without TIF. TIF began influencing property value growth in the second year of the TID and its surrounding neighbourhoods; its effect peaked in the fifth year.

In the Chicago Metropolitan Area, properties within a TID exhibited higher rates of appreciation relative to properties outside the TID and properties that had

1. The Heckman Selection Model accounts for the possibility that the differences observed for an outcome between two or more groups might be an artefact of the initial choice between the groups. For instance, if wages are found to differ between unionized and non-unionized workers, the wage difference might not be a result of union membership, but of the fact that those who opted to join the union were different in behaviours, attitudes, or aptitudes relative to non-unionized workers, and that these differences affected their productivity and resulted in different wages.

sold within the TID boundaries prior to TIF designation (Smith, 2006). Using parcel-level data and focusing on multifamily housing in Chicago, the author questioned whether TIF was targeted at more attractive sites because of their potential for higher appreciation of property values, a phenomenon others have tried to capture using Heckman sample selection models.

Conversely, municipalities using TIF in Cook County, Illinois, were found to have equalized assessed value growth rates 0.79 percent *lower* than those of municipalities that did not adopt TIF (Dye and Merriman, 2000). In addition, non-TIF districts in municipalities using TIF experienced a greater decline in equalized assessed value than overall municipal growth rates. This suggests that TIF may have reallocated capital to TIDs at the expense of other districts in the same jurisdiction.

A review of 89 TIF districts in 67 municipalities in Illinois revealed that before intervention, TIF districts were often distressed, with higher vacancy rates, lower median incomes, and older buildings (Byrne, 2006). However, in a quarter of the examples studied, TIF was targeted at districts with higher average incomes than the average in the municipality as a whole. The use of TIF in lower-density neighbourhoods with fewer visible minorities led to higher growth rates than those in non-TIF districts in the same municipalities.

Carroll and Sachse (2005) analysed 2,640 multifamily dwellings in Milwaukee TIDs and found that residential property prices declined by 16.8 percent in these districts. However, when TIDs were zoned for residential and mixed-use development, residential property values increased by 37.8 percent.

A subsequent study in Milwaukee used parcel-level data to assess how TIF affected the assessed value of commercial, mixed-use, and manufacturing business properties (Carroll, 2009). The author found the assessed value of business properties to be 33 percent higher in TIDs over time than in other comparable districts.

The findings from a study in Wisconsin reached different conclusions from the one in Milwaukee. Merriman, Skidmore, and Kashian (2011) examined the impact of TIF on residential, commercial, and industrial property values at the municipal level between 1990 and 2003. The authors observed that TIF did not contribute to an increase in property values at the aggregate level. Furthermore, communities lost revenue in residential and industrial TIDs, whereas commercial TIDs stimulated commercial activity in the non-TIF parts of the municipality.

The spatial spillover effects of TIDs have also been observed. Weber, Bhatta, and Merriman (2007) investigated whether residential property values vary with proximity to TIDs. They analyzed single-family homes sold more than once between 1993 and 1999 in Chicago and found a statistically significant relationship between TIDs and the appreciation in neighbouring residential properties. While

proximity to commercial and industrial TIDs reduced the appreciation of housing values, proximity to mixed-use TIDs was associated with a rapid increase in housing values.

Research on commercial properties in Chicago found that property values appreciated faster in TIDs than in non-TIDs (Smith, 2009). In addition, commercial property values within the TID increased soon after designation, demonstrating the strength of the instrument's signalling effect.

A study of TIDs in Chicago suggested that vacant and industrial parcels within TIDs experienced similar or lower price appreciation than similar properties in non-TIDs (Bhatta, Merriman, and Weber, 2003). At the same time, mixed-use TIDs reported higher appreciation rates than comparable properties in non-TIDs, confirming similar positive outcomes observed in other jurisdictions for mixed-use TIDs.

In recent years, researchers have investigated TIF's effect on employment outcomes. For instance, Lester (2014), using block-level data, measured the impact of TID designation on job growth, business development, and real estate activity in Chicago. After comparing block groups within TIDs to block groups outside TIDs, Lester concluded that TIF failed to produce positive economic development outcomes beyond what would have occurred without TIF. Byrne (2010) also found that there was no statistically significant relationship between TIF adoption and employment growth at the municipal level in Illinois. When differentiated by type of TIF, industrial TIDs showed a positive effect on municipal employment growth, while commercial TIDs had a negative effect, perhaps because industrial TIDs created new employment for the municipality while commercial TIDs shifted employment around within the municipality.

Greenbaum and Landers (2014) observed that the literature on fiscal outcomes, which is scarcer, tends to show gains in revenues for TIF districts, often at the expense of municipal and other local government coffers, prompting some to suggest that TIF might be a zero-sum game. Furthermore, the self-financing characteristics of TIF – one of its primary perceived benefits – are consistently questioned. Notably, as Greenbaum and Landers (2014: 671) have recommended, it "is also important to measure whether any increases in growth are large enough to justify the redirection of incremental tax revenues into TIF projects."

Given the interest in linkages between TIF and property values, most research focuses on this relationship, the results of which often, but not always, tend to show a positive correlation. The impacts of TIF are mixed with respect to economic development because of various factors such as land use type and location, which differ between jurisdictions. The literature on whether TIF is an effective way to finance large infrastructure projects is lacking. Table 1 summarizes the literature review.

Table 1: A summary of literature on TIF impacts		
Author (Year)	**Study Area**	**Conclusion**
Anderson (1990)	Michigan municipalities	Municipalities adopting TIF had greater property growth than those that did not.
Man and Rosentraub (1998)	Indiana municipalities	Municipalities adopting TIF had 11.4% increase in property value growth compared with estimated rates had they not adopted TIF.
Dye and Merriman (2000)	Cook County, Illinois municipalities	Municipalities adopting TIF had EAV growth rates 0.79% less than non-TIF adopting municipalities.
Bhatta, Merriman, and Weber (2003)	Chicago	Within TIDs, industrial parcels experienced lower price appreciation; mixed-use parcels showed higher price appreciation compared with other districts.
Carroll and Sachse (2005)	Milwaukee	Residential property values declined by 16.8% in Milwaukee TIDs, but increased by 37.8% in mixed-use TIDs.
Smith (2006)	Chicago Metropolitan Area	Properties in TIDs had higher appreciation rates compared with properties outside TIDs.
Byrne (2006)	Illinois municipalities	1 in 4 TIFs studied were initiated in districts with incomes higher than the municipal average.
Weber, Bhatta, and Merriman (2007)	Chicago	There was a statistically significant relationship between TIDs and the appreciation of residential properties in adjacent neighbourhoods.
Carroll (2008)	Milwaukee	Business properties were valued 33% higher in TIDs than in other districts; TIF had a greater influence on property values than did location.
Smith (2009)	Chicago	Property values in TIDs appreciate faster than in other districts.
Byrne (2010)	Illinois municipalities	Industrial TIDs had a positive effect and commercial TIDs a negative effect on municipal-level employment growth.
Merriman, Skidmore, and Kashian (2011)	Wisconsin municipalities	TIFs did not increase property values at the aggregate level.
Lester (2014)	Chicago	TIDs did not experience increases in job growth, business development, or real estate activity compared with other districts.

2.4 Transport TIF: The Hudson Yards Example

Studies reviewed in the previous section primarily focused on TIF to support real estate development. In this section, we present a review of TIF projects, the primary purpose of which was to invest in transport infrastructure, including public transit, focusing particularly on the example of the Hudson Yards in New York City.

Smith and Gihring (2006) conducted a review of 76 studies on the use of land value capture to fund public transit, including Hong Kong, London, and Washington, D.C. The authors characterize landowners as potential free riders who benefit from the increase in land values resulting from public investments in infrastructure. They argue for the use of land value capture to allow the state to recoup a portion of the increase in land values made possible by public-sector investments in infrastructure.

McIntosh, Newman, and Trubka (2015) examined Transit-Oriented Development (TOD) along a 72-km railway corridor in Perth, Australia. The authors recommend analysing the willingness to pay for TOD and improvement in accessibility from new transit infrastructure and suggest that willingness to pay could be determined from the change in property values.

A 145-acre development close to a transit station near downtown Boston is another example of TIF being used to facilitate transit-related real property development. In this instance, TIF generated 20 percent of the infrastructure costs (AECOM, 2012).

The Hudson Yards development in Manhattan is the largest (in monetary terms) TIF project involving public transit development. In 2002, Mayor Michael Bloomberg announced plans to expand Midtown Manhattan's central business district along the island's west side. After three years of public consultation and deliberation, New York City Council approved the redevelopment plan for Hudson Yards in 2005.

Hudson Yards has been touted as the largest private development project in the history of the United States and the largest development project of any kind in New York City since the Rockefeller Center (Hudson Yards, 2015). Once completed, the 28-acre site will include over 17 million square feet of residential and commercial space, with over 100 shops and restaurants and 5,000 residences. Hudson Yards will also include a 200-room luxury hotel and a public school for 750 students. 14 of the 28 acres will be public open space (Hudson Yards, 2015).

To facilitate this effort, the city has used payments in lieu of taxes (PILOT) financing, a form of TIF. Although these two financing mechanisms have similar legal, risk, and policy considerations, PILOT financing and TIF differ in certain respects. Most notably, in a TIF agreement, private developers own the land. Under the NY PILOT implementation, the City's Industrial Development Agency (IDA) owns the land until the PILOT expires. For TIF projects, all incremental tax revenue from the TID is accumulated in a special fund maintained by the redevelopment agency. However, for the PILOT financing, "only payments made under PILOT agreements will go into a special fund. All taxes collected on non-PILOT properties will continue to go to the City's general fund" (Cerciello, 2004, p.127).

The New York City Department of City Planning concluded that Hudson Yards was experiencing a lack of growth and investment due to inappropriate zoning, a lack of green space, and infrastructure deficiencies (New York City Department of City Planning, 2003). Hudson Yards was formerly zoned for commercial and

light industrial uses, including garages and parking lots, along with about 12,000 residences (Manhattan Community Board 4, 2014). Pennsylvania Station (also known as New York Penn Station), the Port Authority Bus Terminal, and the Metropolitan Transportation Authority rail yards are also located in the area. The Department of City Planning described Hudson Yards before redevelopment as an isolated, bleak, gritty, and underutilized area (New York City Department of City Planning, 2014).

To address the lack of development, the Hudson Yards Infrastructure Corporation was created in 2005 by the City of New York to finance property acquisition and infrastructure improvements, including an extension of the No. 7 subway line (Fisher, 2015). The site was rezoned that same year from mostly manufacturing to commercial and residential. On December 21, 2006, the Hudson Yards Infrastructure Corporation issued $2 billion in PILOT bonds to finance redevelopment. The Corporation issued another $1 billion in PILOT bonds on October 19, 2011 (Hudson Yards Infrastructure Corporation, 2013).

The risks inherent in TIF and PILOT bonds are cost overruns and revenue shortfalls. Hudson Yards is experiencing both. In 2004, the cost of the No. 7 subway extension was estimated at $2 billion. By 2013, it had increased to $2.4 billion. The City of New York usually pays only 5 percent of subway construction costs, with New York State paying 15 percent and the federal government paying the remaining 80 percent (Kiernan, 2007). However, to proceed with the Hudson Yards project, the City agreed to pay for the entire cost of subway construction, as the state-owned Metropolitan Transportation Authority did not view the extension as a funding priority (Kiernan, 2007). Furthermore, issuing bonds through the Hudson Yards Infrastructure Corporation rather than through general obligation bonds entailed an additional liability of $1.32 billion, because such bonds carry extra risk and charge higher interest rates (New York City Council, 2004).

The Great Recession that began in late 2007 delayed the construction and halted the real estate growth needed to generate higher property tax revenues. The New York City Independent Budget Office reported that between 2006 and 2012, revenues were 40 percent less than projected, with the redevelopment netting $170 million out of a projected $283 million. As a result, the City contributed an additional $374 million to the project over that period (Turetsky, 2013).

In 2015, however, Hudson Yards generated an additional $183 million in program revenue relative to the previous year, thanks in part to the collection of more district improvement bonuses as development progressed. This revenue has resulted in a positive change in net position of about $51 million. However, the project still has a net deficit of approximately $2.5 billion (Hudson Yards Infrastructure Corporation, 2015).

2.5 Conclusions from the Literature

Despite its widespread use, TIF is not a panacea for a lack of investment in communities and infrastructure. The studies reviewed here highlight several possible shortcomings in implementing TIF.

Since TIF revenue largely relies on an increase in property values over time, the assessed values in the base year matter to the future revenue-generating abilities of TIF. When TIF is used in distressed neighbourhoods, where property values are low in the base year, TIF investments essentially provide the impetus for the growth in property values over time (Lester, 2014). But when TIF is used in non-distressed districts, where property values are not as low relative to the rest of the city, the increase in property values in TIF districts is more limited.

Another related concern is the timing of TIF implementation relative to the business cycle. TIF projects launched during or at the onset of an economic recession are unlikely to experience a strong increase in property values. Since the success of TIF depends upon an aggregate increase in property values, the role of business cycles is thus critical (Das, Larson, and Zhao, 2010).

The size and scope of TIF projects reviewed here suggest that TIF is frequently used to raise amounts ranging from tens of millions of dollars to a few hundred million dollars. Examples of amounts exceeding $1 billion or more are rare (Table 2). Furthermore, large TIF projects, such as the Atlanta Beltline and Hudson Yards in New York City, have fallen short of generating projected revenue. In fact, the National Round Table on Sustainable Infrastructure (2013) observed that in Canada, TIF might not be suitable for funding large-scale projects.

The location of TIF districts has been the subject of several studies. It has been argued that a location selection bias could influence outcomes. For instance, if TIFs are strategically located at favourable sites that are likely to lead to greater property value appreciation, it would be more difficult to determine the true impact of TIFs (Smith, 2006) since the increase in property values might have occurred in the absence of TIF.

Similar concerns apply to the pace of development in TIF districts. It is essential to determine whether the new developments resulted because of TIF or whether those developments would have been realized without TIF.

Selection bias poses a methodological challenge. Since numerous studies have relied on regression-type models to determine the impact of TIF on property values or growth rates in employment or real estate development, selection biases pose an inherent problem that should be addressed by using appropriate statistical tools, such as the Heckman Selection Model.

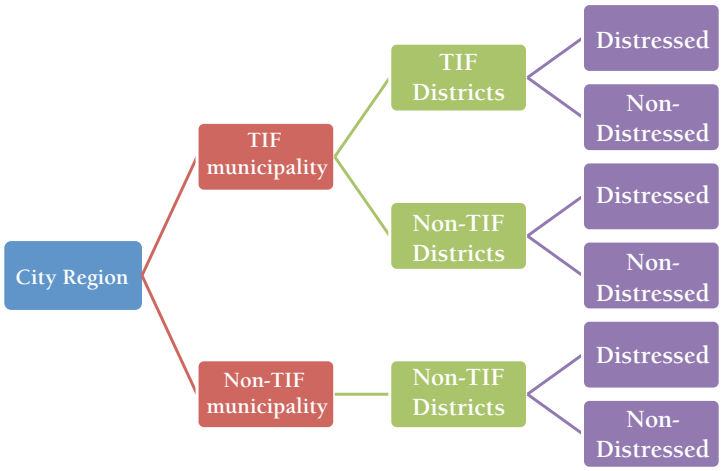
Many studies reviewed in this report have relied on econometric tools to control for the possible selection biases that would influence the results (Smith, 2009; Bhatta, 2003; Carroll, 2008). However, not all studies found evidence for selection bias or endogeneity (Dye, 2000).

While analyzing TIF effectiveness, it is also important to select the comparables for TIF districts with care. Figure 2 illustrates the range of possibilities for comparing TIF outcomes in a TID with a non-TID in a municipality that uses TIF versus a municipality that does not use TIF. Similarly, the outcomes observed in a TID with distressed economic conditions could be compared with a TID in a

Table 2: The size and scope of TIF bonds

Tax Increment Financing District (TID)	Location	Date Established	Size (Acres)	Total TIF Bonds Issued	Length of TIF
Burlington Waterfront	Burlington, Vermont	January 1996	70	$16,810,350	20 years
River District	Portland, Oregon	June 1998	351	$224,780,350	20 years
North Macadam	Portland, Oregon	June 1999	402	$288,562,000	20 years
Arundel Mills Mall (Route 100 TID)	Hanover, Maryland	November 1999	394	$28,000,000	10 years
Parole Towne Centre	Annapolis, Maryland	December 1999	1,500	$8,300,000	10 years
Sullivan Center	Chicago, Illinois	2000	2.35	$24,400,000	10 years
Interstate Corridor	Portland, Oregon	August 2000	3,990	$335,000,000	20 years
Lewiston Walmart Distribution Center	Lewiston, Maine	January 2002	13	$5,800,000	25 years
Beltline Tax Allocation District	Atlanta, Georgia	2005	6,500	$1,660,000,000	25 years
Hudson Yards	New York City, New York	2005	28	$2,400,000,000	30 years
East Village	Calgary, Alberta	Spring 2007	49	$357,000,000	N/A
Downtown Berlin	Berlin, Wisconsin	September 2008	21.3	$14,589,661	27 years
Sports, Hospitality and Entertainment District	Winnipeg, Manitoba	April 2012	11 blocks in downtown Winnipeg	$25,000,000	5 years
Investors Group Field	Winnipeg, Manitoba	June 2013	2 properties	$75,000,000	25 years
University of Winnipeg Commons Housing Complex	Winnipeg, Manitoba	February 2015	1 property designated	$2,550,000	15 years

Figure 2: Comparing TIF outcomes in different scenarios



non-distressed district within a TIF municipality or with one located in a non-TIF municipality.

The type of proposed land use change also has a bearing on the success of TIF. Several projects reviewed earlier suggest that single-purpose land use developments, such as industrial or commercial, did not result in higher appreciation of property values or growth rates. Repeatedly, it was found that mixed-use developments that allowed for new residential developments in combination with other land uses were more likely to be successful in meeting the intended objectives (Bhatta, 2003; Carroll, 2005).

The property tax regime is also important. TIF is structured such that property taxes imposed on increases in assessed values are used to pay back the funds borrowed to build new infrastructure. The local municipalities charge property tax on the assessed value of the property, which remains frozen at the base-year level until TIF is in place. If property tax rates are not raised over time, or provisions are not made for an increase in property tax revenue commensurate with inflation, the funds available for regular municipal expenses, such as policing, schools, water supply, waste disposal, and parks management remain fixed at the base-year levels. This makes TIF a zero-sum game, because TIF essentially takes away funds from other public uses (Fisher, 2011).

Finally, TIF is also known to contribute to the gentrification of neighbourhoods (Weber, 2007). The increase in residential property values could create housing affordability challenges for low-income households living in formerly distressed neighbourhoods. Unless TIF investments provide for new affordable housing as

part of development, housing affordability could worsen for very low-income households.

3. Sheppard Corridor Study

We have simulated TIF and property tax revenues to determine TIF's potential to help fund new transit infrastructure in the GTA. In particular, we are interested in answering the following two questions:

1. What impact does new transit infrastructure have on the pace of residential real estate development in a transit corridor?
2. Does new transit infrastructure result in a higher growth rate of property values along the corridor compared with other areas?

Our choice to study the 5.4-km Sheppard corridor from Yonge Street to Don Mills Road was motivated by the fact that it is the only new subway line to have been built in the GTA over the past several decades. It provides an opportunity to determine the pace and scope of new residential development in the corridor and to determine the change in residential real estate values over time.

We begin with a brief history of the Sheppard Subway Line from its initial proposition in 1985 through the planning and development phases in the late 1990s and early 2000s and its performance today. We then assess the impact of the subway line on residential development and property values along Sheppard Avenue by comparing three similar east-west corridors that experienced no subway development: Steeles Avenue, Finch Avenue, and York Mills Road. Finally, we simulate a 30-year TIF implementation scenario to test whether TIF revenue from new residential development would have been sufficient to finance the capital cost of the Sheppard East Subway Extension.

3.1 A History of the Sheppard Subway Line

In 1985, the Toronto Transit Commission (TTC) issued *Network 2011*, a rapid transit plan for Metro Toronto that included a proposed subway line along Sheppard Avenue between Yonge Street and Victoria Park Avenue (Levy, 2015). The Sheppard Subway Line was part of a larger strategy to increase transportation network capacity in Toronto where building more expressways had been met with growing political opposition and public outcry. The Council of Metro Toronto approved the $2.7 billion *Network 2011* plan in 1986.

In 1990, the provincial government announced the $6.2 billion *Let's Move* transit plan for the Greater Toronto Area, which built upon the existing *Network 2011* framework. Under this new plan, the Sheppard Subway Line was deprioritized and was to be constructed only if the private sector funded a significant portion of the cost (Byers, 1990).

The transit plan met a setback in 1990 with a change in government at Queen's Park (Tahirali, 2015). The provincial government in 1993 announced yet another transit plan for the region, the *Rapid Transit Expansion Program*. The Sheppard

Subway Line once again emerged as a top priority in the plan. Groundbreaking for the Sheppard Subway Line took place in 1994.

Before any real progress could be made, elections in 1995 resulted in a further change in the provincial government (Toronto Star, 2014). The new government, after negotiations with Metro Toronto and the City of North York, reduced the length of the Sheppard Subway Line by moving the eastern terminus from Victoria Park Avenue to Don Mills Road. This decision was reached after projected capital costs were re-estimated at over $1 billion (Levy, 2015).

In 1998, the provincial government amalgamated Metro Toronto's six constituent municipalities to create a single-tier municipality, the City of Toronto. Mel Lastman, who had earlier served as the mayor of North York from 1973 until 1997, won the first mayoral election for the new City of Toronto (Dale, 2014). Lastman was a staunch advocate for development in the former city of North York. As mayor of the amalgamated city, he championed the Sheppard Subway Line and is credited with keeping the project alive during this period (Grange, 1996).

Critics have argued that the Sheppard Subway Line was promoted using a combination of false promises and overly optimistic financial and ridership projections (Barber, 2002). The vision for a subway line filled to capacity in the former municipality of North York has indeed failed to materialize. Since its opening in November 2002, the 5.4-km long, five-station line has attracted an average weekday ridership of 50,000 (Toronto Transit Commission, 2013). By comparison, the average weekday ridership for the Yonge-University Line is 730,000 and for the Bloor-Danforth Line 510,000 (Toronto Transit Commission, 2013).

Some transportation experts believe that the Sheppard Subway Line is too expensive to abandon or extend (Morrow, 2012). Nevertheless, political leaders remain interested in plans to extend the line in the hopes of improving ridership levels. Various extensions, both east from Don Mills Station and west from Sheppard-Yonge Station, have been proposed since the line opened in 2002. The most recent is the 13-km Sheppard East Light Rail Transit (LRT) line from Don Mills Station to Morningside Avenue (Metrolinx, 2015). The project has been approved and rejected several times by City Council and was originally set for completion in 2024 (Toronto Transit Commission, 2015). At current ridership levels, each trip on the Sheppard subway carries an estimated subsidy of $10 (Kalinowski, 2015). Table 3 highlights the important developments in the Sheppard East corridor.

3.2 Finding Comparables

The Sheppard East corridor is located 13-km from downtown Toronto. We considered three additional similar suburban corridors to compare residential

Table 3: Public transit development timeline for the Sheppard East corridor	
Year	**Developments**
1960s–1970s	With increasing sustained population growth and political opposition to constructing highways, calls for more public transit options gain traction and lead to formalized plans by the 1980s.
1985	TTC delivers *Network 2011* Transit Plan to Metro Toronto ($2.7 billion project including Downtown Relief Line, Eglinton West, and $1 billion for Sheppard Subway extending to Victoria Park).
1986	Metro Council approves *Network 2011* plan (Province to pay 75% of cost).
1990	Provincial government announces $6.2 billion *Let's Move* Transit Plan for the GTA, adding new components to *Network 2011*. Sheppard Subway deprioritized because of high cost projections.
1992	Sheppard Subway Environmental Assessment published as part of *Let's Move* initiative.
1993	Provincial government announces new *Transit Plan: Rapid Transit Expansion Program*. Sheppard Subway is included and made a priority along with Eglinton West.
1994	Groundbreaking for Sheppard Subway takes place.
1995	Construction of Sheppard Subway continues, but other transit projects are cancelled.
1996	Sheppard Subway shortened to Don Mills.
2002	Construction completed at approximately $1 billion (5.4-km of track).
2007	Transit City plan released – LRT proposed for Sheppard East.
2010	Mayor Rob Ford announces scrapping Transit City Plan.*

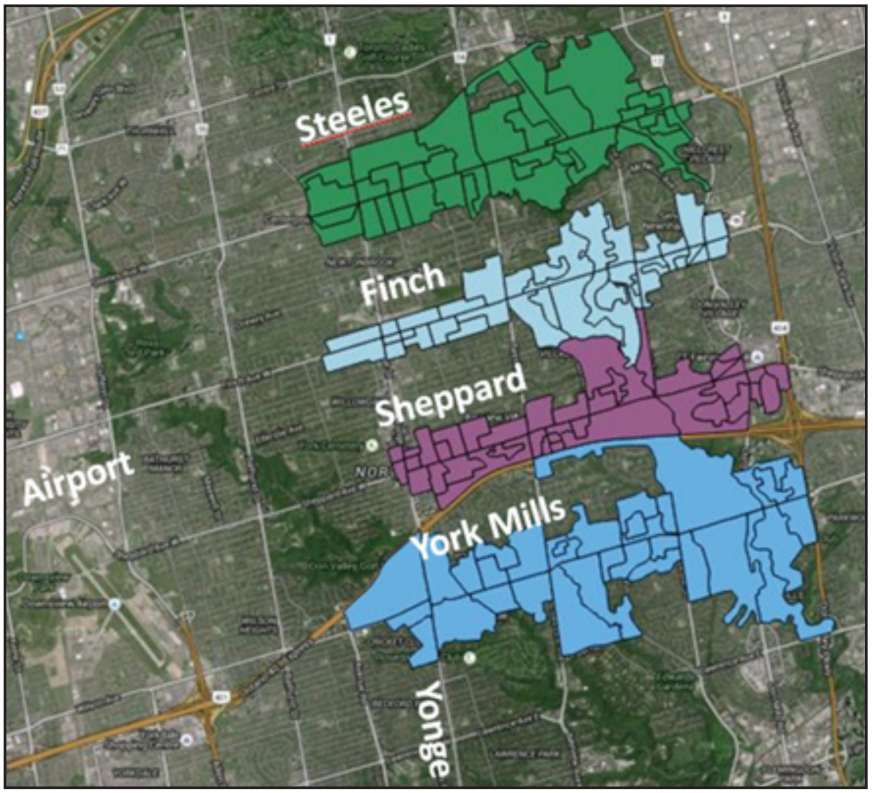
*An earlier version of this paper erroneously mentioned Toronto City Council.

development and related demographics. These east-west arterials run parallel to Sheppard East: the York Mills corridor is 2-km south of Sheppard East; the Finch and Steeles East corridors are 2-km and 4-km north, respectively, of the Sheppard East corridor (Figure 3).

Table 4 presents the demographic and housing characteristics for the four corridors. Results are tabulated from the 2001 Census, a year before the Sheppard Subway Line started operating. The average household and housing size is similar in the four corridors. Housing units are slightly smaller in the Sheppard East corridor. Relative to the other three corridors, Sheppard East reports significantly lower housing ownership rates at 39 percent compared with the other three corridors, which reported almost 80 percent higher housing ownership rates than Sheppard East.

Sheppard East experienced a housing growth spurt during the 1960s, when 39 percent of the housing units existing in 2001 were built. At least 10 percent

Figure 3: Sheppard East and comparable corridors



of the housing units in Sheppard and Finch East were constructed between 1996 and 2001. Steeles and York Mills reported much lower construction rates for the same time period.

Table 4 shows that the housing stock along Sheppard East differs from that in the other three corridors. Sixty percent of the housing stock along Sheppard East in 2001 consisted of condominiums, compared with 33-percent along Finch and 21-percent along Steeles. The high percentage of condominiums along Sheppard is likely the reason for the greater presence of renters.

3.3 Sheppard East Findings

Socioeconomic Data

Table 5 presents data for the Dissemination Areas (DAs) along the four corridors for 2011. DAs are census areas containing approximately 400 households. Because of data quality concerns, Statistics Canada did not release data for DAs for the 2011 National Household Survey (NHS). However, private data vendors

Table 4: Demographic and housing characteristics of the four corridors in 2001				
Corridor	**Sheppard**	**Finch**	**Steeles**	**York Mills**
Average number of children	1.2	1.2	1.3	1.3
Average persons per household	2.7	2.9	3.0	2.8
Average rooms	5.5	6.6	7.1	7.5
Average bedrooms	2.4	2.9	3.2	3.1
Total dwellings by year of construction				
Owned units (%)	39	69	73	67
Constructed before 1946 (%)	2	2	3	11
Constructed 1946–60 (%)	13	14	11	27
Constructed 1961–70 (%)	39	29	25	28
Constructed 1971–80 (%)	23	26	46	15
Constructed 1981–90 (%)	7	14	11	10
Constructed 1991–95 (%)	4	5	2	5
Constructed 1996–01 (%)	11	10	2	4
Total dwellings by Type				
Single family detached (%)	24	43	51	55
Semi detached (%)	2	8	7	4
Row houses (%)	9	11	17	4
Apartments - 5 plus floors (%)	60	33	21	27
Apartments 1 to 4 floors (%)	6	6	3	9
Apartments - Duplexes (%)	0	0	1	1

were able to create data at the DA level for 2011. We obtained this DA-level data from Simply Map (2016).

The Sheppard and Finch East corridors are home to larger populations than Steeles East and York Mills. Despite being nearest to downtown Toronto, the York Mills corridor reported the lowest population density. This is partly because of the affluent characteristics of the neighbourhood. The average household income in York Mills was almost three times that of the Sheppard East corridor, which reported the lowest household income of the four corridors.

Similar to what we observed for 2001, Sheppard East continues to have the lowest share of owner-occupied housing of the four corridors. Slightly more

Table 5: Socio-economic and residential development characteristics for the four corridors				
2011 Data				
Study Area	Sheppard	Finch	Steeles	York Mills
Dissemination areas	39	36	37	33
Total population	35,399	33,733	23,878	21,483
Population average (DA)	845	937	645	632
Distance to CBD (km)	12.8	14.9	16.9	10.8
Total private households	15,266	14,037	8,604	7,895
Private household average (DA)	382	390	233	232
Average household income (average for DAs)	86,429	99,738	135,770	250,089
Employed (average for DAs,%)	89	92	91	91
Dwellings by period of construction: 1981 to 1990 (%)	16	10	15	8
Dwellings by period of construction: 1991 to 2000 (%)	5	10	4	7
Dwellings by period of construction: 2001 to 2005 (%)	10	8	2	5
Dwellings by period of construction: 2006 to 2011 (%)	12	7	1	3
Owner (average for DAs,%)	56	79	82	80
Renter (average for DAs,%)	42	21	18	17
Visible Minority (average for DAs,%)	58	68	59	40
Immigrants (average for DAs,%)	58	64	58	45

than half of the housing units in Sheppard East were owner-occupied in 2011, compared with about 80 percent in the other three corridors.

Housing Construction

Our primary interest is to determine the impact of the Sheppard Subway Line on the pace of new housing development in the corridor. The Sheppard Subway Line started operations in 2002. We compare the pace of new housing construction in the four corridors between 2001 and 2011. The results are shown in Table 5.

In the space of 10 years, mostly after the Sheppard Subway Line started operations, a large number of housing units were constructed in the Sheppard East corridor. Of the 15,266 housing units in the Sheppard East corridor, 22 percent were constructed after 2000. In comparison, 15 percent of the housing units in the Finch East corridor were constructed in the same period. Comparatively, the Steeles East and York Mills corridors experienced significantly lower housing construction.

It is evident from Table 5 that the Sheppard East corridor experienced high levels of housing construction after the Sheppard Subway Line started operating. We see much lower levels of new housing construction in the comparable corridors. However, we cannot conclude from the evidence presented here that the spike in housing construction observed in the Sheppard East corridor was a result of the accessibility premium provided by the new Sheppard Subway Line. It is also possible that builders could have earmarked these locations for new housing construction, irrespective of the subway construction.

Housing Price Appreciation

Since the Finch East corridor most resembles Sheppard East in terms of demographic and housing attributes, we compared housing price appreciation between the Sheppard East and Finch East corridors. We contacted Brookfield RPS for housing sales data along the corridors.[2] The following analysis is thus based on the housing transactions recorded by Brookfield RPS along the two corridors.

The data set includes properties sold within 500 metres each of Sheppard and Finch Avenues stretching between Bathurst Street in the west and Highway 404 in the east (Figure 4). The Brookfield RPS data covers a slightly larger area than the data used earlier. The notable difference is that the study area extends westwards to Bathurst Street. The reason for including properties sold to the west of Yonge Street is to study those housing sales that are essentially not in the Sheppard or Finch East corridors, but because of their proximity to the Sheppard and Yonge subway lines, would experience a premium in housing values because of improved accessibility afforded by rapid public transit.

The results are presented in Figure 5. We report housing prices in the Sheppard and Finch East corridors for the two dominant housing types: condominiums and single-family detached housing. Figure 5 shows that single-family detached housing is significantly more expensive than condominium housing. The average housing price for single-family detached units was around $520,000 in 2004. By 2015, housing prices for these units appreciated by 129 percent in Finch East and by 135 percent in Sheppard East. Condominium housing prices averaged around $240,000 in 2004 in both corridors. By 2015, condominium prices had appreciated by 53 percent in the Finch East corridor and by 68 percent in the Sheppard East corridor.

2. We first tried to obtain housing price data from the Canadian Real Estate Association (CREA), which provides quarterly average housing prices for Toronto Real Estate Board's (TREB) districts. Once we mapped the boundaries of TREB districts, however, we realized that the Board's district boundaries were too coarse for spatially disaggregated analysis along narrow corridors. District C14, which bordered Sheppard East, stretched all the way to Finch East to the north. This limited our ability to compare housing price appreciation between the two corridors. While CREA possesses disaggregated data, it does not release it at a finer spatial scale than the TREB district level. Therefore we turned to Brookfield RPS for our data.

Figure 4: Housing units sold in Sheppard and Finch East corridors (2004-2015)

Figure 5 also shows slightly higher prices for single-family detached and condominium housing along the Sheppard East corridor. However, starting from a similar base in 2014, one notices a similar price appreciation growth rate for the two corridors.

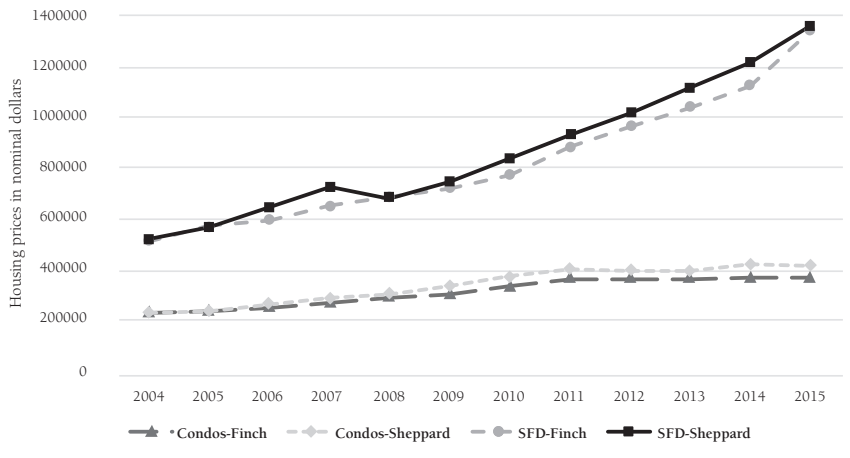
Based on the evidence reported in Figure 5, we conclude that housing price appreciation over the 11-year period starting in 2004 was similar for the two corridors, suggesting that the Sheppard Subway Line did not result in a noticeable increase in housing prices for units in proximity compared with housing sold along the Finch East corridor.

3.4 Simulating TIF Revenue for Sheppard East Corridor

In order to simulate TIF revenue for the Sheppard East corridor, we needed to make several assumptions. Of the 15,266 housing units in the Sheppard East corridor, 3,358 units were constructed between 2001 and 2011. We assume that the TIF revenue is based only on housing units built since 2001. We also assume no increase in the TIF-enabled housing stock during the 30-year TIF implementation. These assumptions can be relaxed in alternative scenarios.

We set the base housing price at $735,417, which was the average housing sale price reported for the corresponding Toronto Real Estate Board district in

Figure 5: Housing prices in Sheppard and Finch East corridors



October 2015. We assumed that the assessed value for property taxes is 85 percent of the actual sales price. This assumption is warranted because the assessed value lags behind the transaction prices. We also assumed a 0.7 percent property tax rate that remains constant over time.

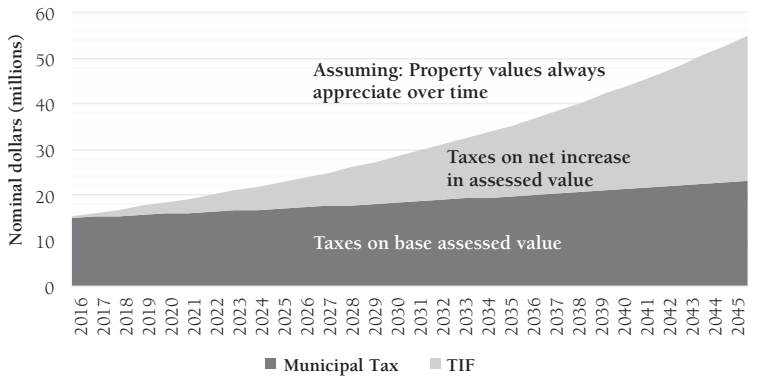
We further assumed that housing prices appreciate at an annual rate of 4.5 percent. This rate might seem conservative, given the rapid increase in Toronto housing prices in recent years. However, concerns about a housing bubble in Toronto suggest that higher price appreciation rates are not sustainable in the long run. Furthermore, we are simulating housing prices over a 30-year period. A sustained annual appreciation rate of 4.5 percent for 30 years is aggressive rather than conservative. We also allowed the property tax revenue to increase at the rate of inflation, which we have assumed to be 1.5 percent. Lastly, we implemented TIF from 2016 to 2045.

Table 6 lists the input parameters for simulation. The results are presented in Figure 6. Calculations are available in the Appendix on page 32.

TIF implementation requires that the assessed property values remain frozen at the base-year level for property tax purposes. Additional tax revenue resulting from an increase in assessed values over time is used to service the debt. In our simulations for the period 2016 to 2045, we have allowed for a nominal increase in property tax revenue at 1.5 percent a year, whereas the TIF revenue generated by the net increase in assessed property values increases from $0.66 million in 2016 to $40.4 million in 2045. The net present value of TIF revenue, using the fixed discount rate of 4 percent, for the entire TIF period is $173 million.

Table 6: Input parameters for Sheppard East simulation	
Sheppard East Corridor	
Total housing units	15,266
Built since 2001	3,358
Average price, Oct. 2015, TREB C14	$ 735,417
Total value (millions)	$ 2,470
Increase in stock per year	0%
Increase in prices	4.50%
Property tax rate	0.70%
Rate of inflation	1.50%
Assessed value ratio	0.85

Figure 6: TIF and property tax revenues for Sheppard East



The Sheppard East subway extension cost approximately $1 billion to build or $2 billion in 2016 dollars.[3] The TIF revenue generated from the new residential development in the corridor at a net present value of $173 million is less than 10 percent of the capital cost of the Sheppard East subway extension (in 2016 dollars).

Given that the TIF revenue has been raised from 3,358 properties, one could argue that higher amounts could be generated if the TIF were applied to all

3. The Sheppard subway construction costs in 2002 were recorded at approximately $1 billion. Since TIF revenues have been quoted in 2016 dollars, the subway construction cost (with a discount rate of 5%) is approximated at $2 billion in 2016 dollars.

properties along the corridor. We ran a simulation to collect TIF revenue from the entire housing stock in the corridor. The Net Present Value of TIF revenue generated from 15,226 units equaled $785 million.

While we see a significant increase in the TIF revenue in the revised simulation, even when the TIF revenue is spread over more than 15,000 housing units, it generates less than 50 percent of the capital costs for the Sheppard East subway extension (in 2016 dollars). Furthermore, for the entire time that TIF is in effect, the municipal services provided to the community of over 15,000 households will be based on the property taxes frozen, or allowed to increase at the rate of inflation, at the base-year level. This could lead to service shortfalls, since any increase in assessed values does not contribute to higher property tax revenue for municipal services.

4. Conclusions

In this paper, we have reviewed two related forms of value capture as alternative sources of revenue to support new infrastructure projects. Our focus has primarily been on Tax Increment Financing (TIF), although we briefly discussed Land Value Capture (LVC) – defined here as a one-time levy to capture the initial land value increase from an infrastructure investment. TIF has been used aggressively in the United States in recent years to fund new developments in economically distressed areas, as originally intended, as well as in more affluent areas. TIF's success as a development financing tool has been mixed. Numerous studies have found that TIF developments have a positive impact on the community such that property values increase more rapidly in TIF districts than otherwise. At the same time, a large number of studies failed to find higher growth rates or appreciation in property values for TIF districts when compared with non-TIF districts.

In our review of the literature we found only two examples of TIF where the amount of debt raised was in excess of $1 billion. In both instances, TIF revenue fell short of the forecasted amounts because of the prevailing market conditions, which affected property values. The ability of TIF to service debt through an increase in property values therefore depends heavily upon whether the economic cycle is in an upswing or in a downturn. As a result, TIF can prove beneficial in strong economic conditions but cause shortfalls in periods of economic recession. The risks associated with funding projects costing $1 billion or more are thus compounded when considering TIF's lack of resilience in the face of economic cycles.

Since municipal service delivery costs increase over time, sometimes at rates exceeding inflation (for example, Toronto policing costs over the years have increased at higher rates than inflation), critics have warned that in the long run, TIF districts might not be able to sustain appropriate levels of municipal services. TIF implementation under these conditions becomes a zero-sum game in which municipal services in the TIF district must be subsidized by the overlapping jurisdictions.

Whereas those who own real estate in the district contribute TIF revenue over time as property taxes, LVC is a one-time levy paid by landowners on the appreciation in land values. Without LVC, the initial increase in land values resulting from public-sector investments in infrastructure cannot be captured by the state. Instead, landowners and developers along the corridor capture the entire increase in land values. Therefore, LVC allows governments to claim a share in increased land values in the larger public interest.

By simulating a 30-year TIF implementation scenario along the Sheppard East Subway corridor, we found that TIF revenue generated from the 3,358 new residential units built since 2001 would cover only a small fraction of the capital costs of subway construction. The conclusions drawn from the simulated TIF revenue along the Sheppard East corridor resemble much of what is found in the existing literature, which suggests that TIF could be a useful tool for partially funding transit initiatives, but that it must be used in conjunction with other financing mechanisms in order to minimize financial risk. Furthermore, on its own, TIF is unlikely to generate 100 percent of the capital costs of a large transit project.

The key takeaway for municipal governments in Canada interested in deploying TIF to support infrastructure development is to realize that TIF could support only partial capital costs of such a project. Municipalities could also implement a one-time LVC levy to share in the land value appreciation resulting from public-sector investments in infrastructure developments. In addition, economic cycles have the potential to affect the expected increase in property values, which in some instances would result in lower-than-expected TIF revenue. Lastly, Canadian municipal authorities should consider TIF mainly for small-scale projects rather than large projects on the scale of a subway.

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Appendix: Calculations

Year	Assessed Value (mil)	Stock	Price	Tax rate	Municipal Tax (mil)	Municipal Tax(mil) +Inflation	TIF (mil)	TIF - Inflated Tax	Tax+TIF	NPV (Tax+TIF)	NPV (TIF)
2015	$ 2,099	3,358	$ 735,417	0.70%	$ 14.7	$ 14.7					$ -
2016	$ 2,194	3,358	768,511	0.70%	$ 14.7	$ 14.9	$ 0.66	$ 0.44	$ 15.38	$ 15.38	$ 0.44
2017	$ 2,292	3,358	803,094	0.70%	$ 14.7	$ 15.2	$ 1.35	$ 0.91	$ 16.07	$ 15.45	$ 0.87
2018	$ 2,395	3,358	839,233	0.70%	$ 14.7	$ 15.4	$ 2.08	$ 1.41	$ 16.79	$ 15.53	$ 1.30
2019	$ 2,503	3,358	876,998	0.70%	$ 14.7	$ 15.6	$ 2.83	$ 1.93	$ 17.55	$ 15.60	$ 1.72
2020	$ 2,616	3,358	916,463	0.70%	$ 14.7	$ 15.9	$ 3.62	$ 2.49	$ 18.34	$ 15.67	$ 2.12
2021	$ 2,734	3,358	957,704	0.70%	$ 14.7	$ 16.1	$ 4.45	$ 3.07	$ 19.16	$ 15.75	$ 2.53
2022	$ 2,857	3,358	1,000,801	0.70%	$ 14.7	$ 16.3	$ 5.31	$ 3.69	$ 20.02	$ 15.83	$ 2.92
2023	$ 2,985	3,358	1,045,837	0.70%	$ 14.7	$ 16.6	$ 6.21	$ 4.35	$ 20.93	$ 15.90	$ 3.31
2024	$ 3,119	3,358	1,092,900	0.70%	$ 14.7	$ 16.8	$ 7.15	$ 5.04	$ 21.87	$ 15.98	$ 3.68
2025	$ 3,260	3,358	1,142,080	0.70%	$ 14.7	$ 17.1	$ 8.14	$ 5.77	$ 22.85	$ 16.06	$ 4.06
2026	$ 3,407	3,358	1,193,474	0.70%	$ 14.7	$ 17.3	$ 9.17	$ 6.55	$ 23.88	$ 16.13	$ 4.42
2027	$ 3,560	3,358	1,247,180	0.70%	$ 14.7	$ 17.6	$ 10.24	$ 7.36	$ 24.95	$ 16.21	$ 4.78
2028	$ 3,720	3,358	1,303,303	0.70%	$ 14.7	$ 17.9	$ 11.36	$ 8.22	$ 26.08	$ 16.29	$ 5.13
2029	$ 3,887	3,358	1,361,952	0.70%	$ 14.7	$ 18.1	$ 12.54	$ 9.13	$ 27.25	$ 16.37	$ 5.48
2030	$ 4,062	3,358	1,423,240	0.70%	$ 14.7	$ 18.4	$ 13.76	$ 10.08	$ 28.48	$ 16.44	$ 5.82
2031	$ 4,245	3,358	1,487,285	0.70%	$ 14.7	$ 18.7	$ 15.04	$ 11.09	$ 29.76	$ 16.52	$ 6.16
2032	$ 4,436	3,358	1,554,213	0.70%	$ 14.7	$ 19.0	$ 16.38	$ 12.14	$ 31.10	$ 16.60	$ 6.48
2033	$ 4,636	3,358	1,624,153	0.70%	$ 14.7	$ 19.2	$ 17.78	$ 13.26	$ 32.50	$ 16.68	$ 6.81
2034	$ 4,844	3,358	1,697,240	0.70%	$ 14.7	$ 19.5	$ 19.24	$ 14.43	$ 33.96	$ 16.76	$ 7.12
2035	$ 5,062	3,358	1,773,615	0.70%	$ 14.7	$ 19.8	$ 20.77	$ 15.67	$ 35.49	$ 16.84	$ 7.44
2036	$ 5,290	3,358	1,853,428	0.70%	$ 14.7	$ 20.1	$ 22.37	$ 16.97	$ 37.08	$ 16.92	$ 7.74
2037	$ 5,528	3,358	1,936,832	0.70%	$ 14.7	$ 20.4	$ 24.04	$ 18.34	$ 38.75	$ 17.01	$ 8.05
2038	$ 5,777	3,358	2,023,990	0.70%	$ 14.7	$ 20.7	$ 25.78	$ 19.77	$ 40.50	$ 17.09	$ 8.34
2039	$ 6,037	3,358	2,115,069	0.70%	$ 14.7	$ 21.0	$ 27.60	$ 21.28	$ 42.32	$ 17.17	$ 8.64
2040	$ 6,309	3,358	2,210,248	0.70%	$ 14.7	$ 21.4	$ 29.51	$ 22.87	$ 44.22	$ 17.25	$ 8.92
2041	$ 6,593	3,358	2,309,709	0.70%	$ 14.7	$ 21.7	$ 31.50	$ 24.54	$ 46.21	$ 17.34	$ 9.21
2042	$ 6,889	3,358	2,413,646	0.70%	$ 14.7	$ 22.0	$ 33.58	$ 26.30	$ 48.29	$ 17.42	$ 9.49
2043	$ 7,199	3,358	2,522,260	0.70%	$ 14.7	$ 22.3	$ 35.75	$ 28.14	$ 50.47	$ 17.50	$ 9.76
2044	$ 7,523	3,358	2,635,761	0.70%	$ 14.7	$ 22.7	$ 38.02	$ 30.08	$ 52.74	$ 17.59	$10.03
2045	$ 7,862	3,358	2,754,371	0.70%	$ 14.7	$ 23.0	$ 40.40	$ 32.11	$ 55.11	$ 17.67	$10.30

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