

**FINANCING MUNICIPAL INFRASTRUCTURE:
ALTERNATIVE METHODS**

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Informetrica

June 1992

Cette publication est aussi disponible en français
sous le titre " Mécanismes de financement de l'infrastructure municipale"

The views expressed in this document are those of the authors and do not necessarily reflect those of Canada Mortgage and Housing Corporation, the Canadian Home Builders' Association or the University of Western Ontario.

1 INTRODUCTION

In the view of many observers, the stock of infrastructure has consistently deteriorated over the last two decades. A corollary to this is the opinion that no level of government is able to adequately finance new facilities nor the maintenance of existing facilities.

There was a three-fold increase in annual real expenditures in infrastructure by all levels of government from 1955 through to the first-half of the 1970s. This was followed by a pause, or reduction, in capital expenditures through to the late 1980s. Recently, real expenditures at the all-government, and municipal, levels have increased again, but financing has included very substantial increases in property taxes.

Studies suggest that the reduced expenditure levels of 1975 to the late 1980s have left the legacy of a badly deteriorated set of facilities requiring expensive upgrading, as has been argued by the Federation of Canadian Municipalities since 1984. Further, the "environmental" agenda, including a focus on clean water systems, implies substantial additional expenditures for municipalities. Our own review of the Federal Green Plan suggests additional investment expenditure for the economy as a whole of \$70 billion, of which approximately \$20 billion would be faced by municipal governments, since they operate water and sewage systems. Sonnen (1991) points out that if the "real" price of water services is doubled over the next decade, this generates \$20 billion, which may or may not be used to finance new facilities. Presumably, usage would also be diminished of course. Given recent large increases in property taxes, which are commonly described as "regressive", and are politically difficult to implement, the legacy and new agenda signal that the need for a search for financing alternatives has become important.

This paper provides an overview of alternative financing mechanisms. They range from development charge and special district financing to user charges and trust funds. For each, we provide a definition of the instrument, and indicate the circumstances for which it is best suited. Each instrument is also assessed in relation to six criteria. These are:

- o **Efficiency** - one of the main sources of economic benefit which potentially can be realized from various infrastructure funding instruments. In economic terms, efficiency relates to the "optimum allocation" or use of "factor inputs", resources which include labour, materials and capital. In practice, the efficiency objective is achieved by way of charging infrastructure users on the basis of the costs they impose on the system. This ensures that the resources applied in providing services are not wasted by promoting either more or less use than warranted by the cost of delivery. While in many instances, the efficiency objective may be achieved by setting infrastructure user fees on the basis of economic costs ("marginal cost" pricing), in other



cases efficiency may call for the use of "lump sum" charges or other levies to avoid resource waste.

- o **Equity** - While equity can mean different things to different people and groups, in the context of this paper equity refers to "fairness" and the relative cost burden infrastructure users face for the services they receive. With regard to infrastructure, equity is often a concern as it relates to user's "ability to pay" for so-called "basic" services, i.e., whether persons with income deficiencies should be deprived of community services, such as water or police protection, on the basis that they cannot afford to pay for them. In these circumstances, the "equity" of infrastructure charges is typically decided on moralistic grounds.

Equity is also important with regard to the distribution of infrastructure financing costs between different generations of users. Financing instruments which attempt to distribute costs over the useful life of an infrastructure facility, as opposed to those which impose disproportionately high costs on specific generations, represent one way of resolving inter-generational equity problems. It is important to note that while direct measures to address equity concerns in infrastructure financing often mean compromising other objectives i.e., efficiency, some innovative "second best" techniques do exist which serve multiple objectives.

- o **Effectiveness** - Like equity, effectiveness can have a range of different meanings. In relation to infrastructure financing, however, effectiveness normally refers to the ability of a measure to ensure sufficient revenues are collected to cover service costs. In other words, effectiveness means a balanced budget. Though this objective may seem obvious to some, it is not always guaranteed by way of other objectives, such as efficiency. In special cases, efficient financing instruments may result in revenue surplus or short-fall. Again, second-best measures do exist with which to achieve effectiveness in concert with other objectives.
- o **Environmental Sensitivity** - In recent years, considerable attention has been awarded to developing infrastructure financing instruments which take into account the environmental costs (or benefits) of infrastructure use. A prime example is user fees for water and wastewater services which reflect, not only the private cost of providing services, but also the "social" costs related to the depletion and degradation of water and other natural resources. While some financing alternatives can be designed to serve environmental objectives, like user fees, others have limited potential.
- o **Innovation** - In terms of infrastructure financing, innovation relates to the degree to which financing instruments are "tried and true" methods or novel concepts. For the purpose of this paper, it is important to assess previous experience with alternative financing mechanisms both in Canada and in other countries. Innovation should also be measured in terms of the

potential of different financing instruments in relation to legal, institutional, and technological constraints. While some financing alternatives may appear to be quite similar to others already in use in Canada, in practice their applicability may be limited by legislation, a lack of industry expertise in some fields (e.g., "economic" pricing), or related technology requirements (e.g., water meters or sewage content diagnostic equipment).

- o **Impact on Housing** - An other focus of this paper deals with the impact of alternative financing mechanisms, either intentional or otherwise, on the housing sector, especially affordability and also choice and quality of housing supplies. While emphasis will be placed on housing impacts from the point of view of existing or potential home owners and tenants, it is necessary to assess such impacts on the activities of both private and public home builders.

2 THE STATUS QUO - WHO PAYS NOW

Alternatives to financing infrastructure spending include a "no change" option. Accordingly, before proceeding to a review of alternative forms of financing, we provide a sense of the current state of affairs. Further, since the suitability of financing methods varies from one type of spending to the next, we start with an overview of which order of government spends on what type of infrastructure. Tables 1-3 report on capital spending of the last two decades.

The federal government spends little on its own-account for the major infrastructure systems. Having responsibility for park facilities, facilities on Indian reserves and the Territories does lead to charges for highways and other engineering construction (which include sewage systems, water mains, electric power generation, dams and reservoirs, etc...), but the sums spent in recent years have typically amounted to less than \$500 million annually. A slightly larger amount is spent on construction of mainly federal office buildings, air and other transportation terminals, schools and training facilities, and laboratories. Repair expenditures typically are equivalent to 30 per cent of total construction spending.

Provinces have a principal responsibility for maintaining the inter-city, and rural highway system, which expenditures in the last half of the 1990s averaged \$2,500 million annually. Provinces that provide water and waste treatment services in rural areas and to small communities also face other, but modest, engineering investments. Construction of provincial offices and other institutional buildings cost an average \$1,450 million in the second half of the 1990s. Spending for repairs has typically been equivalent to a little more than one-quarter of total construction expenditures.

Municipal expenditures are allocated principally to maintenance of local streets, and other transport facilities, and for development and maintenance of water and sewage systems. Combined, spending for these engineering forms of construction averaged about \$3,900 million in the second half of the 1990s, an amount that matches total provincial spending and was 3.5 times the total spending of the federal government. Spending on buildings, which averaged \$1,250, was allocated in roughly equal portions to office buildings, recreational and amusement facilities, other institutional buildings (e.g., school and training facilities), and other types of buildings. Spending for repair typically accounts for one-tenth to one-sixth of total construction spending.

TABLE 1
TOTAL VALUE OF NEW CONSTRUCTION BY LEVEL OF GOVERNMENT
(IN MILLIONS OF NOMINAL DOLLARS)

	1970-75	1976-80	1981-85	1986-90
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	Average			
Federal Government				
Total value of construction	478.17	558.40	905.20	1079.80
Highways	82.33	97.20	160.60	168.80
Other engineering	145.33	156.20	240.40	302.60
Buildings	250.50	305.00	504.20	608.40
Provincial Government				
Total value of construction	1573.50	2466.60	3461.20	3956.20
Highways	1059.50	1543.40	2226.00	2507.00
Other engineering	177.33	339.20	366.40	298.80
Buildings	336.67	584.00	868.80	1150.40
Local Government				
Total value of construction	1646.83	2785.00	4032.20	5644.60
Highways	492.83	963.80	1356.60	2164.40
Other engineering	499.50	1091.60	1588.80	1731.20
Waterwork and sewage systems	480.69	1034.50	1435.01	1623.21
Buildings	654.50	729.60	1086.80	1749.00
Hospitals				
Total value of construction	184.50	270.00	534.20	662.80
Highways	0.00	0.40	2.20	2.40
Other engineering	0.17	1.00	1.20	8.60
Buildings	184.33	268.60	530.80	651.80

Sources: Statistics Canada and Informetrica Limited

Finally, it should be recognized that funding facilities for the hospital system is also a public-sector charge. Spending for new buildings has averaged about \$650 million in recent years. Spending for repairs has been equivalent to about one-sixth of total construction expenditures.

Across all elements of the public sector, spending on the highway and road system takes up about two-fifths of total new spending, one-fifth is allocated to water, sewage and other engineering works, and the remaining two-fifths is allocated to construction of buildings.

As will be likely well known to most readers, public spending on infrastructure has been notably reduced since the early 1970s. This is reflected both in the decreased proportion of total domestic spending of the economy, and by comparison to private investment.

TABLE 2
VALUE OF NEW CONSTRUCTION BY LEVEL OF GOVERNMENT
(PER CENT OF NOMINAL GDP)

	1970-75	1976-80	1981-85	1986-90
	Average			
Federal Government				
Total value of construction	0.384	0.237	0.214	0.182
Highways	0.064	0.041	0.039	0.028
Other engineering	0.121	0.065	0.057	0.051
Buildings	0.199	0.131	0.118	0.103
Provincial Government				
Total value of construction	1.263	0.997	0.846	0.665
Highways	0.858	0.625	0.540	0.423
Other engineering	0.134	0.140	0.091	0.050
Buildings	0.271	0.233	0.215	0.192
Local Government				
Total value of construction	1.339	1.129	0.986	0.942
Highways	0.398	0.387	0.332	0.360
Other engineering	0.391	0.442	0.386	0.291
Waterwork and sewage systems	0.379	0.420	0.348	0.273
Buildings	0.550	0.299	0.267	0.290
Hospitals				
Total value of construction	0.154	0.109	0.130	0.112
Highways	0.000	0.000	0.001	0.000
Other engineering	0.000	0.000	0.000	0.002
Buildings	0.153	0.109	0.129	0.110

Sources: Statistics Canada and Informetrica Limited

TABLE 3
VALUE OF NEW CONSTRUCTION BY LEVEL OF GOVERNMENT
PER CENT OF TOTAL NOMINAL INVESTMENT IN STRUCTURES AND EQUIPMENT)

	1970-75	1976-80	1981-85	1986-90
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	Average			
Federal Government				
Total value of construction	2.972	1.757	1.709	1.520
Highways	0.498	0.300	0.304	0.237
Other engineering	0.939	0.483	0.456	0.429
Buildings	1.535	0.974	0.948	0.854
Provincial Government				
Total value of construction	9.780	7.291	6.506	5.543
Highways	6.656	4.574	4.183	3.527
Other engineering	1.028	1.025	0.692	0.415
Buildings	2.096	1.692	1.631	1.601
Local Government				
Total value of construction	10.368	8.249	7.589	7.827
Highways	3.082	2.821	2.549	2.992
Other engineering	3.013	3.234	2.992	2.431
Waterwork and sewage systems	2.921	3.077	2.696	2.272
Buildings	4.272	2.194	2.049	2.404
Hospitals				
Total value of construction	1.193	0.799	1.015	0.932
Highways	0.000	0.001	0.004	0.003
Other engineering	0.001	0.003	0.002	0.014
Buildings	1.192	0.795	1.008	0.915

Sources: Statistics Canada and Informetrica Limited

3 A REVIEW OF FINANCING ALTERNATIVES

This section reviews alternative financing instruments for urban infrastructure. Each instrument is described in terms of how it works and for what type of infrastructure it is best suited. The instruments are assessed in relation to the six criteria presented above.

3.1 Development Charges

This type of financing mechanism is used to finance infrastructure facilities that are needed to accommodate growth. In some provinces, Ontario for example, development charges can also be applied for re-zoning or when a building permit is issued. Development charges were first introduced by provincial governments to provide for private funding of "hard services", such as roads, water systems, and sewage collecting in rural areas. They now have been extended to building infrastructure in urban areas. This means of financing is often used instead of property taxes, which apply to the whole community, so that new residents who are the principal, direct beneficiaries of the infrastructure will incur the costs of service.

The level of development charges is established according to the value of the development, and is used when the beneficiaries of the new infrastructure are identifiable. A simple example involves the addition of a road in a new development. Since, in this instance, the road is being built because of the new development, the new property owners bear the cost of its construction. Development charges are generally paid at the issuance of the building permit.

This instrument is thus best suited to financing "hard services" such as water supply, sewage collection and roads. Development charges are less attractive in the case of "soft services", like education, because such services benefit not only the new property owners, but also other residents in the community. It is thus unfair to charge only the new home owners for such services. Even so, British Columbia has started using development charges to finance soft services such as day-care centres (see Urban Development Institute, 1990).

From an efficiency point of view, development charges are attractive in that new infrastructure will only be built if there is a demand, implying that the money will be spent efficiently. The major concern with development charges is that charges cover construction but not maintenance costs. The maintenance costs are met from either general revenues or user fees.

Since development charges are usually passed on to the consumer, this may have an effect on the ability to pay of certain individuals, thus affecting the equity criteria. There also is concern about double taxation. Not only will new property owners have to pay development charges for the new facilities, but they will also have to pay for maintenance of existing facilities through property taxes, and typically, development of land services elsewhere in the community. As an example, consider a new development where an addition to the police station is required. The developer will pay for the cost of the addition through development charges. If in subsequent years, some alterations have to be made to the old part of the police station, all the community, including the property owners in the new development, will pay for the repairs through community property taxes.

Development charges can be very effective when there is strong growth in the municipality. Imposing a development charge, however, could limit growth in a community, which could reduce future tax revenues. Growth will help the community raise taxes from a larger number of tax payers and puts less burden on each individual to pay for public services and facilities.

To date, environmental costs have not been incorporated into development charges, but there is no fundamental reason why this cannot be done, especially in the case where the developer is asked to build a water or sewage system, or other environmental action that results in a benefit mainly for those paying the charge.

Development charges resemble the private market as the developer pays for the construction of new infrastructure. But the maintenance costs are still managed by the community.

Development charges have been used in various cities across Canada for approximately 30 years, but have become a prominent form of financing only in the past couple of years. In British Columbia, where development charges are widely used, there is legislation to govern their use. In this legislation, municipalities are entitled to apply development charges in order to pay for services in a specific development. Further they may only apply to specific types of infrastructure such as expanding or altering sewer, water, drainage and highway facilities, and the acquisition of park land. In Ontario, development charges have been used since the 1950s; initially, they were called lot levies. In 1989, the Ontario Government passed the Development Charges Act under which municipalities and school boards can impose development charges for all types of development that increase the need for municipal or school facilities. Many regional municipalities in Ontario apply development charges for residential, commercial and industrial units.

Some controversy has surrounded this situation, such as in the Ottawa-Carleton region, where School Boards want to apply development charges for commercial/industrial developments. The Building Owners and Managers Association (BOMA) stipulates that since there is no connection between new commercial/industrial development and the needs for school, these new developments should not be required to pay



development charges to school boards. However, one member of a public school board replied that the 90s concept of live-where-you-work will increase the demand for schools if there is a new commercial/industrial development.

In the United States, development charges are very popular in Colorado, California and Florida, where growth has been robust.

Development charges can have an impact on housing affordability, since in most cases, the development charge will be passed on to the new home purchaser or renter. They will not necessarily be the sole beneficiaries of the facility in question. In the case of new infrastructure, a road for example, initial home owners or property owners will in fact be paying for the cost of the facility, while future home owners will also benefit from the road, but will not have to pay the same share for it. They will have to pay for the maintenance, and some share of the capital cost of the facility that gets passed on through housing prices. Development charges will consequently increase the value of the house implying higher property taxes to pay.

Also mortgage payments will be higher as development charges are passed on to the consumer. A study by the Urban Development Institute, Pacific Region (1990) confirms that a \$10,000 development charge, which is paid over the term of the mortgage, can cost a new home owner approximately \$29,500 more in additional interest payments for a 25 year mortgage financed at 13 per cent. This will certainly have an effect on first-time home buyers. Comparing this with the use of property taxes, it can be assessed that with development charges, the homeowner has to pay the infrastructure through his mortgage, implying a higher interest rate than if municipalities pay for the infrastructure and apply property taxes.

Since development charges are applied only on new dwellings, this could have an indirect effect on prices of existing dwellings. If development charges increase the price of new dwellings, prices of existing ones will respond. The fact of who ultimately bears the burden of the development depends on market conditions. In a sector where housing demand is fairly inelastic - demand is insensitive to price variations - it is easier for the developer to pass on the charge to new home owners but in a sector where housing is fairly price sensitive, developers may not be able to pass on the charge to new home owners, especially in a stagnant market.

There could also be development contracts between municipalities and builders, where the builder has to build the new infrastructure in order to meet the demand of the new homeowners. These types of contracts have similar effects as development charges.

3.2 Special District Financing

Special District Financing, like development charges, is mainly used to finance infrastructure that will benefit a specific number of home owners, and again, is mainly used to finance hard services. This mechanism of financing infrastructure involves the creation of a designated urban district, consisting of a specific number of beneficiaries. A special district can also be referred to as Local Improvement Areas, Community Facilities Districts or Community Rehabilitation Districts. This is typically used in combination with other financing mechanisms, namely development charges, to facilitate the recovery of costs for the construction of new infrastructure facilities. Like development charges, this type of financing is applied when the beneficiaries of the new infrastructure are easily identifiable.

As an alternative to imposing the costs on the whole community, a special district is created, the only purpose of which is to finance new infrastructure. In Canada, as in most states in the U.S., there must be approval when a special district is created. This kind of mechanism can be compared to the creation of a small government entity. This entity can assess taxes in order to pay for the infrastructure, although the home owners have their say on how to finance it.

The main advantage of special district financing over development charges is that development charges can have a greater effect on new home owners since they represent an up-front cost while special district financing can be financed over the life of the new infrastructure.

In the United States, many types of special districts are created, such as special improvement districts, general improvement districts, recreational facilities districts, regional library districts, sewer districts, storm sewer districts and redevelopment districts. Some of these are formed for capital financing while others are formed to finance the maintenance of the infrastructure.

Like development charges, special district financing is efficient in the sense that the principal beneficiaries pay the cost of the infrastructure. Special districts will only be formed when there is a demand for infrastructure. There are, however, some concerns because special district financing do add a new layer of administration costs. In the United States, some states monitor special districts because they have encountered management problems.

As opposed to development charges, special district financing has more intergenerational equity as the new infrastructure is usually financed over its extended, normal life. The home owners, who form the special district, are willing to pay for the infrastructure so revenues are generally assured. Accordingly, this form of financing is usually deemed effective in generating revenues.

Environmental costs have not, to date, been incorporated into special district financing. In the future however, environmental costs could easily be incorporated in the cost of infrastructure such as in the case of water and waste services.

In the United States, special district financing is very common. Some states have used the incremental property tax increase in special districts, called a tax increment district, as a means of financing capital improvements. Additional property taxes generated by the new development in the special district will be allocated to finance the improvements that are necessary in the new development.

One other example is school financing under a special district. Broward County in Florida developed an innovative financing system for new developments. It covers roads, parks and school costs. In the case of school costs, they are imposed depending on the type of residential unit, more specifically on the number of bedrooms in each unit.

Some coordination problems have occurred, as in Orange County, California. There, the main problem is with the community of Villa Park, which is completely surrounded by the City of Orange. The roads in Villa Park are poorly maintained as the residents are unwilling to make improvements because they value low taxes. This situation greatly affects the residents of the City of Orange who have to travel through Villa Park to get to work. The City of Orange has not been able to create a special district including the residents of Villa Park.

Although special district financing usually implies that the home owner will pay for the infrastructure, the impact on housing can be less severe since with the creation of a special district the infrastructure is usually financed over the life of the infrastructure while with development charges it is usually an up-front cost.

3.3 User Fees

This type of financing is mainly used for financing infrastructure in which the principal concern is that people who directly benefit from it are financially responsible for paying for it. It is usually referred to "pay-as-you-go". User fees necessarily imply that certain people are excluded from using the facility. The best example of user fees is the public transport system, which is financed mainly by transit fees.

There have been many innovations in the application of user charges. In the public transit sector, for example, some public transit commissions apply varying rates during the day, i.e. charging higher tariffs at peak hours. The main reasons for applying this

tariff scheme is that people using the public transport during peak hours are imposing a bigger cost to the system than those using the public transit service at non-peak hours. This tariff regime is presently being applied by the City of Ottawa. This technique may encourage people to use the transit system during off-peak hours. However, if rates are too high during peak hours, people may return to using their cars which could have many consequences. Public transit is usually in place to reduce congestion and pollution. If people use their cars again, congestion and pollution will resurge.

A study by Lamonde (1990) suggests taxing non-users of the public transit, such as motorists, who benefit from the reduction in traffic congestion. This is fairly efficient because it represents taxing the substitute to public transit, the motorist. Other initiatives for public transit financing include charging more for parking to discourage people from using their cars.

Another example of peak-load pricing is employed by the City of Los Angeles where the city charges are higher for water in the dry season. This type of user fee could be applied in Canada for electricity use, charging more for electricity during the evening and/or during winter.

There is also the case of multi-use facilities, which is getting more attention. Representative of this is building a school to which could be attached a gym, a swimming pool, an arena and a library used by the students during the day and by community members during the night, the week-ends and the summer. To finance the multi-use facility, the municipal authorities can ease some burden on property tax payers by levying user charges for the people, other than students, using the facility. This is more equitable than charging the community the whole cost of the facility since not every one will benefit from the multi-use complex implying an inefficient allocation of resources.

One concern about user fees, expressed by many, is that user fees may not always generate a constant revenue stream. As an example, using toll roads to finance a highway could divert traffic to other non-tolled roads, thus affecting expected revenues.

We report three types of user fees.

3.3.1 Marginal Cost Pricing

To charge the real price for the use of a facility, price should equal marginal cost to ensure that resources are allocated efficiently. The principal reason for pricing infrastructure according to marginal cost is that if price is below marginal cost, demand for use of the facility will be excessive. Resources will be

diverted from the production of other goods.

In the case of marginal pricing, the authority is essentially charging the full cost of the facility where these may include costs that "spill over" to the rest of the economy. Thus marginal cost pricing is very efficient. The problem is that some costs are difficult to calculate such as costs associated with pollution or congestion.

Marginal-cost pricing can bring some equity problems when applied to facilities that are considered a necessity, such as police stations, fire stations and sewage and water treatment plants. Some cannot afford to pay the full-cost of building and maintaining these facilities. It thus can be appropriate to charge community members less than the marginal cost.

It may also be appropriate to charge less than the marginal cost for the public transit system when authorities are trying to divert people from using the car. In this case, the subsidy for the system should be tied specifically to the value of the spillover effect (i.e., reduction of environmental stress). The effectiveness criteria may not always be achieved since charging the full cost may divert some people from using the facility, which may result in lower revenues.

When pricing using marginal cost, environmental costs may be incorporated in the total cost. The main problem is that it is usually difficult to measure the environmental costs, such as the extra pollution that comes out of cars when using a toll-road.

There could be some negative effects on the housing market, depending on how other municipalities charge for similar facilities.

Private sector involvement is best suited for this type of infrastructure financing because facilities financed by the private sector and attributed marginal cost pricing are facilities for which people are willing to pay. In the case of the public, the situation is different since some facilities must serve the whole community and pricing according to marginal cost may imply costs that are too high for some users.

3.3.2 Block Pricing

This mechanism of financing infrastructure is mainly used for facilities such as water systems and other utilities. There are basically two different types of block rating; decreasing block rates and increasing block rates. In the case of water systems, decreasing block rates see the charge per unit of water decline with increasing water use, while increasing block rates see the charge per unit of water increase with increasing water use.

A survey done by Environment Canada in 1987, from a sample of 470 Canadian municipalities, reveals that for water services, flat rates applied to consumers were used in 37 per cent of the cases. The next most widely used rate was the decreasing block-rate with 34 per cent followed by the fixed rate at 27 per cent and finally the increasing block rate at only two per cent. These numbers confirm that not much is done in order to encourage water conservation. In the United States, a study by The Congressional Budget Office (1987) reveals that most public and private water facilities use a two-tariff rate structure, which implies a monthly or annual flat fee plus a fee per unit of consumption, while very few charge increasing block rates. In Japan, however, increasing-block rates are widely used and contribute significantly to encourage an efficient allocation of the water resource.

3.3.2.1 Increasing Block Rates

Increasing block rate pricing is efficient because users are charged the cost they impose on the system. Further, in the case of water systems, it encourages water conservation since the more that is consumed the more we have to pay for. Also, increasing block rates are equitable because people who use more water will pay more. In the case of water systems, the big users of water are generally the people with higher incomes. Intergenerational equity is maintained as charges are applied over the usual life of the facility.

This mechanism of financing could also be used to finance electric utilities. During the winter, where the demand for electricity is the highest, authorities could charge more for the electricity in order to encourage people in conservation. Thus, the environmental criteria can be easily applied in this case in order to encourage conservation. Even if we consider water as being an abundant resource, we must be careful in the use of water in order for following generations to be able to benefit from it.

There is no major problem in the implication of the private sector for this type of financing. The impact on housing is not straightforward. Much can depend on what surrounding municipalities use as financing mechanism. If some municipalities charge decreasing block rates, home owners might be inclined to move to those municipalities.

3.3.2.2 Decreasing Block Rates

Decreasing block-rate pricing fails the efficiency criteria because users pay less than the real resource costs they impose on the system. This encourages over-consumption, thus resources are not allocated efficiently. This mechanism also fails the equity criteria because fees decrease as consumption increases, implying a bigger burden on low income people who typically exert small demands. Finally it also fails the environmental sensitivity criteria because it encourages users to consume more and more, neglecting conservation.

The effectiveness criteria fails as people are inclined to consume more and more, thus more maintenance costs but proportionately less revenue. As a consequence, the private sector involvement in this type of financing will be practically inexistent because the private sector will only invest where there is a good potential of return.

This type of financing could have an effect on housing affordability in the long run. The over-use of the facility, caused by charging decreasing block rates, will cause an increase in the maintenance cost in the long run as revenues will not be able to meet expenditures. As a consequence, property taxes could go up in the long run in order to pay for maintenance. Although there seems to be an advantage from the consumer in the short run, this may be offset by increasing cost in the long run due to over utilization.

3.3.3 Two-Part Tariffs

This mechanism of financing infrastructure is based on a fee, which is paid usually once a month or annually and does not vary according to consumption, and a flat rate which represents a rate per unit of consumption.

Two-part tariffs are mostly used for water supply and can also be used for electricity consumption and telephone services. The flat rate usually pays for the operating expenses while the flat fee pays for the debt payment if the infrastructure has been financed by bond issue.

In assessing the four principal criteria, efficiency, effectiveness, equity and environmental sensitivity, two-part tariffs are situated between increasing block pricing and decreasing block pricing. While two-part tariffs are more efficient than decreasing block pricing, it is less efficient than the increasing block pricing. The same thing can be said about the equity criteria, as two-part tariffs use a flat rate per unit of consumption. Large users will pay the same rate as people who consume less. Since the rate is flat whatever the level consumed, users are not encouraged to save, thus

the environmental sensitivity criteria fails. As for the effectiveness criteria, revenue streams from the two-tariff rate are secure.

The implication of the private sector for this type of financing is possible while once again, the impact on housing is not straightforward.

3.4 Bond Financing

Bond financing is a common mechanism used to finance capital projects. When a municipality wants to build a new facility, such as a sewage treatment plant, it usually issues bonds to finance the facility. These are secured by either property taxes or user fees. Bond financing is inversely related to interest rates such that in periods of high interest rates, municipalities try to avoid long-term debt financing and issue short-term bonds.

This type of financing is useful for large communities that have good bond ratings implying lower interest rates. In the case of small municipalities, they may have difficulty raising capital through the issue of bonds because they are usually not rated at all. And if a small community can issue bonds, it will be at higher interest rates. To offset this problem of debt issuance, some provinces have created centralized agencies, such as the Municipal Finance Authority of British Columbia.

These centralized agencies can borrow on the capital market at lower interest rates, and, in turn, lend the funds to the municipalities. As a consequence, the use of bond financing for capital projects is important in British Columbia (Kitchen 1990).

There are several types of bonds available for financing infrastructure.

3.4.1 General Bonds

General bonds are secured through general taxes. The type of infrastructure best suited for this type of financing is that which benefits the community as a whole. Examples of this are public school buildings and municipal buildings, as well as police and fire stations. For equity reasons, it is difficult to use a fee system in the case of these types of infrastructure.

There are some problems associated with using general obligation bonds. First, fluctuations in interest rates leave the municipalities vulnerable to high interest costs, as in recent years. Second, some municipalities require a vote approval in order to issue general bond obligations. Finally, the repayment of the debt with general tax revenues may not be economically efficient because arguably, not all people benefit uniformly from the facility. It is thus important when using this type of financing to be assured that the beneficiaries are the community as a whole. In the case of police and fire stations, even though every citizen may not benefit from it every year, there is always the sense of being secure and knowing that if ever there is the need they will be available.

On the equity side, if infrastructure financed with general revenue will benefit the whole community, each citizen pays his/her share of the facility. Also, bond financing typically is applied to the period equal to the usual life of the infrastructure, which implies intergenerational equity.

The effectiveness criteria may fail for this type of financing as bonds are generally for the capital cost of the project while the maintenance cost are usually secured by the property taxes or user fees. Thus there may be a revenue shortfall. Environmental concerns can be easily incorporated in the total cost when issuing general bonds. The private sector can be involved in this type of financing although it could be more difficult for some private firms to acquire funds on the money market, mainly because of lower credit ratings than the large municipalities.

Because the use of general bonds will usually cover only the capital cost of the project, the maintenance will have to come from other revenue sources such as higher property taxes, user fees, etc.... This may affect the longer term housing affordability.

Balance in the use of this financing vehicle is important. The over use of general obligation bonds can lead to increased property taxes, thereby slowing growth in a community. Also, the over use of debt can have an effect on the community's bond rating. A high debt-ratio will result in a lower bond rating, requiring higher interest rates for future borrowing.

Water and waste treatment facilities, incinerators and other environmental facilities can be financed with this mechanism as they benefit the community generally. As the bond is usually secured by property taxes, however, application of this financing instrument suffers from the inability to tie the revenue source back to users, thereby promoting excess use of the facility.

3.4.2 Tax Exempt Bonds

Tax-exempt bonds provide an advantage to the holders of the bonds as interest income is not taxable by either the personal or corporate income tax system. This type of financing usually needs the approval of federal and provincial authorities since they forego tax revenues.

The main advantage for the municipality is that it can borrow funds at lower interest rates than regular bonds. An investor with a marginal income tax rate of 40 per cent will be indifferent between a 10 per cent regular bond and a 6 per cent tax-exempt bond. If the interest rate on the tax-exempt bond were 7 per cent it would be more advantageous to choose it.

Like most other bond issues, tax-exempt bonds are used when financing facilities of long-term use, such as sewage treatment plants and water systems, since they can be financed over the usual life of the facility. As with other bond issues, tax-exempt bonds are inefficient because the revenue securing the bond does not lead to a charge that covers the marginal cost of the service.

Also, while tax-exempt bonds are fairly effective for large communities that have access to capital markets, its application to small communities is limited. Again, formation of a central agency that can borrow funds at lower interest rates is an option.

As long as tax-exempt bonds are used to finance facilities that benefit the whole community, equity problems within the community are minimized. Effectively, home owners, residents of a community, who are unlikely to benefit from the services, do subsidize the benefiting municipality. However, the tax incentive of this type of bond is not equitable because more people with higher incomes benefit disproportionately from the tax exemption.

There is no reason why municipalities using tax-exempt bonds to finance facilities cannot incorporate social, environmental and other costs into the total cost. And in the final analysis, property owners must be willing to accept tax increases.

The private sector may be more willing to get involved in the issuing of tax-exempt bonds as it can get funds from the money market at a lesser cost. This type of financing could have a positive effect on housing affordability as lower interest rates to borrow could reduce the total cost of building the facility, which could imply less property taxes.

Among municipalities in the United States, where this form of financing was widespread, tax-exempt bond financing, especially those that were undertaken in cooperation with the private sector, has decreased significantly since the Tax Reform Act of 1986. The reform has restricted the use of tax-exempt bonds for private companies for projects where no more than 10 per cent of the facility is used for private purposes and no more than 10 per cent of the debt service is

paid by the private sector. The previous rate was 25 per cent. Also, much stricter limits were imposed on States and local governments who would borrow with tax-exempt bonds and invest the proceeds in a higher yielding bond. The 1986 Tax Reform also permits governments to refinance tax-exempt loans only once.

3.4.3 Revenue Bonds Financing

This type of instrument is applicable to the types of infrastructure that generate a revenue stream (e.g. public transport). The collateral used for the bonds is the future revenue that will come from the new infrastructure, (e.g. transit systems). Revenue bonds can also be secured by user fees charged to those who use a sewer or water system, or travel on a toll road.

Revenue bonds financing is more efficient than most other bond financing as user fees are usually established as collateral for the bonds. This implies that people paying for the facility will be the ones that benefit from it.

To have a good marketable value, revenue bonds must be secured by revenue streams that are predictable, adequate and can be spread over the entire life of the project. As mentioned earlier, it is difficult to find revenue streams that are very predictable. Increasing user fees too much could reduce the demand, thus reducing the revenue stream. This instrument meets the test of intergenerational equity.

As in the case of user fees, environmental costs can be included in the total cost of the facility when using revenue bond financing.

3.4.4 Public Lease Revenue Bonds

In this form of financing, a public development authority issues bonds secured by installment payments of private sector firms that become the owners of the property. In turn, the firm leases the facility back to the public authorities. At the end of the lease, the public authority can purchase the facility.

In the United States, where they have been used, this instrument is a variant of tax-exempt financing. There, the private firms are eligible for investment tax credits, including special rehabilitation credits, thus this is attractive for the private sector. Experience in the United States suggests that this form of financing can be

questionable from the point of view of municipalities. Associated management and legal costs can be increasingly high because of the number of transactions taking place.

This type of financing mechanism is mainly used for facilities of long term use such as water and sewage systems. As most other bond financing mechanism, public lease revenue bonds are not efficient because they do not tie the cost to the specific users. Also, these bonds do not represent the marginal cost of using the facility.

Equity problems can be minimized if these bonds are used to finance facilities that will benefit the community as a whole. Intergenerational equity can be maintained as the facility will usually be financed over the usual life of the project.

As for environmental concerns, these can be easily incorporated in the cost of the project and property owners must be willing to accept tax increases. Because of the administrative and legal cost are high when public lease revenue bonds are used, this may add to the total cost of the facility which may affect housing affordability.

3.4.5 Bond Banks

Bonds banks are mainly used by small municipalities which cannot issue bonds on the financial market. In this case, the provinces will issue bonds for several municipalities which will allow the municipalities to finance infrastructure at a lesser cost. The major advantages of the use of bond banks are the access to a higher credit rating, the diversification of risk, the reduction of transaction costs and access to the major bond market.

In some provinces, provincial governments have created central agencies which provide the funds to the municipalities. In British Columbia, there is the Municipal Finance Authority and in Nova Scotia, the Municipal Finance Corporation. The Authority or Corporation will issue debentures and lend the proceeds according to the requirements of the municipalities.

In Ontario, the situation is quite different since regional governments have the responsibility for raising the capital for all the municipalities within their boundaries. But for municipalities outside areas with regional government, they have to issue their own debt. This can affect small municipalities which may have to borrow at higher interest rates.

Like most other bonds issues, the efficiency criteria fails as bond financing does not include full marginal cost. This is mostly true in the case of the public sector. In the private sector, the efficiency criteria could pass, if the private firm secures the bonds

by a revenue stream that includes full marginal cost. Also, if the municipality reimburses the bonds with property taxes, the equity criteria will fail unless the benefits are the whole community.

The effectiveness criteria fails because bond issues usually cover only the capital cost and not the maintenance cost. Increases in property taxes or user fees will be needed to pay for maintenance costs. As a consequence, there may be a long term negative effect on housing affordability.

The private sector involvement is less probable in this type of financing as the central authority will usually benefit from lower interest rates than the private sector.

3.5 Funds

3.5.1 Trust Funds

Trust funds are usually set up when ear-marked taxation is used. Ear-marked taxation is a specific tax, a gasoline tax for example, where revenues are placed in trust funds whose assets are used for specific types of infrastructure construction or maintenance. In the case of the gasoline tax, the revenues generated are applied to maintaining the road system.

Trust funds are considered to be effective in the sense that the government, as well as the payer, has a knowledge of the specific amounts raised through ear-marked taxation for the specific project. Also, expenditures for a specific type of infrastructure can be easily traced. But, the effectiveness criteria may fail because revenue may not always be consistent. Equity problems could also arise as all users of the facility will pay the same rate (in the case of user fees) independent of what their income is.

In the U.S., at the federal level, there are five trust funds for: airports, highways, aquatic resources, harbors and inland waterways. A current concern is that all five trust funds have been running surpluses. In the case of the Highway Trust Fund, this follows from government restrictions on spending. As well, the U.S. Congress has applied restrictions on the Federal Aviation Administration (FAA) which uses its fund on airports.

The FAA's spending on aviation includes research, engineering and development and also expenditures for operating and maintaining the airway system. Spending from the FAA is also supported by general

revenues. Gramlich (1990) points out that one-half of the spending is financed by general revenues while it represents approximately 15 per cent in the case of the Highway Trust Fund. This mixed-revenue funding diminishes the accountability principle underlying the use of Trust Funds, and abolition of the funds has, accordingly, been called for by some.

Some concerns come from the fact that some of the surpluses of these funds have been loaned to the general fund to finance facilities that benefit the general public. This contradicts what was stated earlier as pricing should be matched to the user of the facility. But if the Trust Fund revenues are used to finance facilities specifically related to the fund, they are very efficient.

Private involvement in this type of financing is possible. It has been seen in the United States where a private company builds a highway, and where the revenues generated from the use of the highway comes from a toll. This is essentially controlled by the private sector, although the government has a say on the rate applied.

Environmental costs can be easily incorporated in the total cost of the facility. As for the impact on housing, it is difficult to assess although we can presume it is the same as in the case of user fees.

3.5.2 Revolving Loan Funds

The money that comes from revolving funds is usually government money and is designed to provide funds to certain municipalities for specific types of infrastructure. These funds can be provided either at lower interest rates or in the form of grants. One of the major advantages is that revolving funds are a reliable source of funds for the municipalities.

In the United States, a revolving fund has been initiated whereby the Environmental Protection Agency (EPA) grants money to a state; the state matches these funds up to 20 per cent, and the total amount constitutes the revolving fund. The communities borrow the funds and repay the amount plus interest. Because of the involvement of the EPA, communities who are provided money from the fund must comply with certain environmental regulations. Thus, this type of financing can easily pass the environmental criteria.

The infrastructure best suited for this type of financing are water and sewage treatment plants. As long as municipalities charges the full cost for the infrastructure, the efficiency criteria will pass.

Some U.S. states have initiated revolving funds. The state of Texas, for example, established a revolving fund in 1957 to finance water resources development. The Washington State Public Works Trust

Fund was established to provide low-interest loans to local governments. These loans finance many infrastructure projects such as roads, bridges, storm and sanitary sewers, and domestic waste systems. The State of Georgia has created an Environmental Facilities Authority in order to give municipalities access to funds to finance the construction of water and sewer facilities. Every year, the state raises \$20 million through General Obligation Bonds and the proceedings are loaned to communities.

3.6 Privatization

Privatization provides a vehicle for linking use to payer, and extending investment financing to private sources. It takes many forms. At one extreme, privatization sees the private company design, build, own, operate and finance the facility. Authorization may include specification to meet public, including special, requirements. Other forms are more on the basis of public-private cooperation. The private company can design and build the facility and then once completed, turn it over to the municipality. Alternatively, a private company can design and build the facility in addition to operating the facility on a short- or long-term lease. Finally, there is the situation where the private company may only service the facility such as in the case of refuse collection, street repair, street lighting, etc...

In a recent study by Price Waterhouse (1991) for the Ontario Ministry of Municipal Affairs, the authors list a series of risks affecting the type of joint-venture approaches between the public and private sectors. First, there is the project risk which is associated with additional costs to build the infrastructure because of delays. Second, there is the operating risk as the facility may not operate as planned. Also, demand for the service may differ from that planned, which could result in lower revenues. Fourth is the regulatory risk where regulations could delay the project, adding to the cost. This is particularly appropriate to financing sewage and water systems. Fifth, there is the financial risk with is associated with changes in the interest rate, exchange rate, etc. The final risk is a public policy risk. This reflects the fact that public attitudes and priorities change.

When the public sector builds, finances and operates infrastructure, it bears most of the risks mentioned above. But if there is public-private cooperation, risks can be divided between the two sectors. Increasing implementation of environmental regulations has made private firms less willing to participate in the building of infrastructure.

As governments become more sensitive to citizen complaints about taxes, the government is shifting some of the infrastructure building to the private sector. As private firms will usually charge the full cost infrastructure imposes on the system, this could have an effect on the demand for certain services.

Privatization is not a popular method of financing infrastructure in Canada, although it is growing. One example is the Pearson Airport Terminal 3 which was handed over by Transport Canada to Airport Development Corporations. This lease may be renewed after a certain period. If everything goes well, Transport Canada may do the same for Terminals 1 and 2. One other example is the fixed link between New Brunswick and Prince Edward Island which will also be built, operated and mostly financed by the private sector.

3.6.1 Pure Privatization

This is the case where the private company designs, builds, owns, operates and finances the facility. Arguments in favor of this option stand on cost savings, private companies being thought to be usually more cost-efficient than public enterprises. Although this advantage seems important, the principal concern is the creation of a monopoly. Protection against this is secured by establishment of an independent regulatory authority, which itself constitutes an additional cost.

For a private company, financing certain facilities can be good for economic development. As an example, consider a private developer who wants to initiate a major business development where local transit (a subway) does not reach. It would be advantageous for the private developer to pay for the subway extension because this will benefit economic prospects of the new development.

One concern about the private sector building infrastructure is how to come up with initial financing. Since the private sector could have a more difficult time in acquiring money on the bond market, it typically has to pay higher interest rates. Price Waterhouse (1991) calls for the municipalities to guarantee the debt of the private sector firm which could be done by ensuring a fee. The province of Ontario has applied this technique to guarantee the debt of Ontario Hydro. However, governments must be careful because they could incur serious losses if the private firm is unable to repay the debt.

On efficiency grounds, the use of privatization can be very effective because users will essentially bear the full cost of the facility. Private companies will usually set user charges in order to finance some of the cost of the facility. This implies that inter-generational equity will be maintained. As for equity itself, some problems could occur if user fees are charged at fixed rates since low-income people will be paying the same rate as high-income

people.

In the case of privatization, effectiveness can be achieved if the government regulates rate levels and increases the private company can actually levy. There are not many countries where privatization of public infrastructure has been done. Most of the privatization comes from the public transport sector, more precisely urban bus services. In the United States there are some privately-owned water companies, but they are subject to regulations. In the United Kingdom, privatization in water, sewerage, and urban bus services is used.

Typically, with pure privatization, the private sector bears all the risks. The most prominent concern is the regulatory risk, with environmental regulations becoming increasingly important and costly.

Merchant facility is another financing mechanism which resembles pure privatization, the only difference being that the private firm will develop on its own initiative the infrastructure, without the involvement of government. As a consequence, this type of financing will depend greatly on the demand for the service and on the willingness of people to pay for the full cost of the facility plus a return on investment for the private firm. Thus, this financing does not involve the government except in the case of regulations concerning environment and other standards.

3.6.2 Public-Private Cooperation

This is the case where the private company designs and builds the facility, and may, in addition, operate the facility over a contract period. The difference with pure privatization is the involvement of the public sector which can own and operate the infrastructure. The private firm can, for example, build and design a toll road. Once the construction is over, the private firm hands over the facility to the public sector who will operate and own the facility. Aside from the presumed advantage of cost saving, there is also the advantage of risk sharing between the public and the private sector. In the U.S., the federal government has fostered this through tax incentives.

In this case, there is no capital outlay on the part of the government as the private firm raises the capital and builds the facility. The private firm will recover its investment through revenue from the operation of the facility. Thus, the private firm has the power to apply user fees although the government has input on the amount of the user fee.

In this case, most of the risk burden, financing risk, project risk and technology risk, is on the private firm. The market risk can be shared by both the private and public sector because if demand for

the services is less than expected, revenue losses of the private firm could be compensated by the government.

One example of this is the Dulles Toll Road Extension in Virginia which is to be constructed by the private sector only. The debt will be paid by toll fees. Ten years after the debt is repaid, the state government will take possession of the assets of the toll road. One concern is that the government must make sure that when it takes possession of the toll roads, they are not in deteriorated shape. Accordingly, regulations will have to ensure the private company follows proper maintenance practices.

The efficiency criteria is met since in most cases the private sector will operate the facility, thus charging the full cost for the use of the facility. As user charges will usually be applied to pay for the facility, inter-generational equity will be maintained. However, equity problems can arise because user charges are applied at the same rate whatever the amount consumed. As long as the government regulates how much the private firm can increase the rates, the effectiveness criteria can be achieved.

Environmental costs can certainly be included in the total cost of building the infrastructure. The major concern is that private firms are backing away from some projects because the environmental costs and implications are too high.

3.6.3 Contracting

In this case, the private company is only responsible for the servicing of the facility. Examples are refuse collection, street repair, street lighting, etc... Like public-private cooperation, the main advantages are cost-saving and risk-sharing. Past experience in the United States has raised certain problems with this type of financing, however.

Contracting can be cost saving because it can induce competition between the bidders which translate into lower prices. It is thus important that the public authority grants the contract to the lowest bidder for efficiency and fairness. If this is not done, the efficiency and effectiveness criteria will not be achieved.

The major problem that can emerge is that public authorities can award a contract to a certain private company and then once the company has the contract it increases its prices or lowers its services. One example of this is in the privatization of streetlight maintenance in New York City between 1953 and 1978 (see Knox 1988). In 1978, city officials looked at the performance of the contractor, Broadway Maintenance, who had been the lowest bidder. The City Controller said the deal with Broadway Maintenance "smelled to high

heaven". Things did not get better when the city awarded the contract to Welsbach Electric Corp, who underbid Broadway Maintenance. During that year, the city received a record-high 180,000 complaints about lights that did not work. To rectify the problem, the City of New York divided the city into eight areas where no company could contract for more than 2 areas, thus eliminating the possibility of a monopoly.

3.7 Summary Evaluation Of Infrastructure Financing Instruments

This section summarizes all the financing instruments that were outlined in the previous section. One must be aware that some of the financing instruments are not substitute for one and other. One should thus be careful when try to rank each instrument. Some of these instruments are used for certain types of facilities while other or not. Contracting has not been included in the summary evaluation because it involves only the servicing of the facility.

Evaluation criteria	A	B	C	D	E	F	G
<hr/>							
Instruments							
Development charges	XX	X	X	XX	XX	XX	X
Special District	XX	XX	XX	XX	XX	XX	XX
Marginal cost	XXX	X	XX	XX	XXX	X	XX
Increasing block	XXX	XXX	XXX	XXX	XXX	XX	XX
Decreasing block	X	X	XX	?	X	X	XXX
Two-part tariff	XX	XX	XX	XX	XX	XX	XX
General bonds	X	XX	XX	XXX	XX	X	XX
Tax-exempt bonds	X	XX	XX	XXX	XX	X	XXX
Revenue bonds	XX	XX	XX	XXX	XX	XX	XX
Public lease revenue bonds	XX	XX	XX	XX	XX	XX	XX
Bond banks	X	XX	XX	XX	XX	XX	XX
Trust funds	XX	XX	XX	XXX	XX	XX	XX
Revolving loan funds	?	?	?	XX	XXX	XX	?
Pure privatization	XXX	XX	XX	XX	XX	XXX	XX
Public-private coop.	XX	XX	XX	XX	XX	XX	XX

X - limited opportunity, XX - moderate opportunity, XXX - good opportunity, ? - uncertain.

- A - Efficiency
- B - Equity (current)
- C - Equity (intergenerational)
- D - Effectiveness
- E - Environmental sensitivity
- F - Innovation
- G - Housing affordability

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