Flexible-Term Highway Concessions

How Can They Work Better?

José Manuel Vassallo

Highway concessions are becoming popular around the world. One of the main issues in adequately designing concession contracts is how best to allocate traffic risk. Many concession contracts, therefore, are incorporating traffic risk mitigation mechanisms to limit the amount of traffic risk ultimately taken on by the concessionaire. One of the most interesting approaches in the mitigation of traffic risk is the design of flexible-term concessions (FTCs) that end automatically when a certain level of accumulated traffic or revenues is reached. The concession duration may be extended if real traffic becomes lower than expected and shortened when real traffic is higher than expected. The aim of this paper is to survey and assess the implementation of FTCs to explore why these mechanisms have so seldom been adopted. The author found that the main reason for the scarce implementation of these mechanisms lies in the strong opposition of the private sector to FTCs because of the asymmetric risk profile that FTCs present. This risk profile means that the potential gains for the concessionaire are substantially limited, while potential losses are not limited to nearly the same degree. The paper ends with some recommendations for improving the acceptability of FTCs.

Investment in public infrastructure is a key factor for promoting economic growth (*1, 2*). Many countries around the world are seeking new ways of involving the private sector in the management and financing of infrastructure through public–private partnerships (PPPs). Three reasons lie behind this trend: first, the growing budgetary constraints experienced by many economies in the world, which have led them to look for resources outside the public budget; second, the search for greater productive efficiency in the provision of public goods; and third, the improvement of quality through better allocation of risks and incentives (*3*).

One of the most common ways of implementing private participation in managing infrastructure is through the concession approach, which consists basically of transferring responsibility for the construction, maintenance, and operation of the infrastructure to a private consortium. In exchange, the consortium receives the right to charge a user fee for a period of time, fixed or variable, as contractually agreed on in advance. Infrastructure concessions incorporate some features that distinguish them from other construction and maintenance contracts, and also from the basic asset privatization procedure (*4*).

One of the major concerns regarding infrastructure concessions in the past few years has been that of calculating how best to allocate traffic risk. On the one hand, traffic seems to depend to a great extent on factors that are beyond the control of both the concessionaire and the government. On the other hand, forecasting traffic accurately has proved to be a real challenge for both government planners and private companies (*5, 6*). Because of those reasons, many governments around the world are introducing mechanisms to mitigate traffic risk in highway concessions.

One of the most interesting ways to mitigate traffic risk is the establishment of flexible-term concessions (FTCs). The main characteristic of this approach is that the contract will end when a predetermined amount of accumulated revenues, as fixed by the terms of the contract, is ultimately reached. The most sophisticated approach within the range of flexible-term mechanisms is the least present value of the revenues (LPVR) mechanism, which has been developed and studied in detail by Engel et al. (*7, 8*). Even though FTC approaches have been very well received by academics, its practical implementation has been infrequent, mostly because of the strong opposition to FTCs by concessionaires (*9*).

This paper has five objectives: first, to describe the way in which FTCs work; second, to evaluate the advantages and drawbacks of these mechanisms compared with other traffic risk mitigation mechanisms for both the government and the concessionaire; third, to describe their practical implementation around the world; fourth, to identify the reasons why these mechanisms have not been implemented more often up to now; and fifth, to propose some measures to increase the acceptability, and hence the use, of these mechanisms.

The first section (after the introduction) analyzes the problems of correctly managing traffic risk, evaluates the accuracy of the concessionaires in their traffic estimates, and provides some reflections on traffic risk allocation in concession contracts. The second section describes the characteristics of FTC contracts from both theoretical and practical standpoints, analyzes the most relevant experiences in several countries, and compares FTCs with other traffic risk mitigation mechanisms. The third section evaluates, on the basis of those experiences, the reasons FTC contracts have not been implemented more often. In this analysis, the author found that the main reason FTCs have infrequently been implemented lies in the asymmetrical risk profile that this mechanism presents for the concessionaire. Finally, the fourth section provides lessons and recommendations for improving the acceptability of these mechanisms among concessionaires while preserving their main original advantages.

TRAFFIC RISK ALLOCATION IN CONCESSION CONTRACTS

Accuracy of Traffic Estimates

The accuracy of traffic estimates is essential for the financial feasibility of a concession because most of the concession revenues come from traffic. It is necessary, however, to make a distinction between

Transport Department, Universidad Politécnica de Madrid, Departamento de Transportes, ETSI de Caminos, Canales y Puertos, 28040 Madrid, Spain. jvassallo@caminos.upm.es.

Transportation Research Record: Journal of the Transportation Research Board, No. 2187, Transportation Research Board of the National Academies, Washington, D.C., 2010, pp. 22–28.
DOI: 10.3141/2187-04

brownfield projects (those projects based on an already existing facility) and greenfield projects (those projects that have to be built from scratch). Estimating traffic in brownfield projects is much easier than in greenfield projects because the former have a track record of traffic on which to base new estimates.

Correctly estimating traffic risk in highway concession has proven to be quite an issue. The most complete study dealing with traffic forecasting accuracy in toll road concessions is the study conducted by Bain and Polakovic (*6*), which was based on 104 toll roads. This study revealed that, unlike the government in forecasting traffic for public roads (*5*), toll road concessionaires show an average bias toward overestimating first year traffic by 20% to 30%. This study also identified that bank-commissioned forecasts consistently appear to be less prone to large errors than those commissioned by bidders.

Traffic Risk Allocation and Renegotiation

The report conducted by Silva and published by the World Bank (*10*) points out that one of the reasons some concession contracts ultimately fail and often have to be renegotiated lies in traffic overestimation. Moreover, Athias and Nuñez (*11*) show that bidders tend to bid more aggressively and strategically in institutional frameworks in which renegotiating is easier. Consequently, the willingness to renegotiate by the government is crucial for the bidders in their decision to commit strategic errors.

According to Ping Ho (*12*), if the government is willing to renegotiate, it implicitly encourages aggressive bidding. This situation may cause a vicious cycle in the concession tender because competition for concession contracts is fierce. This vicious cycle means that if governments show a historical track record of renegotiation, bidders will be encouraged to inflate their forecast to justify aggressive offers to increase their chances of winning the tender. Once the contract is secured, the concessionaire assumes that the government will renegotiate the agreement. Unfortunately, the government often agrees to renegotiate to preserve its reputation, which, in turn, sets a bad precedent and encourages future low-ball offers.

Renegotiations are undesirable but often necessary in incomplete long-term contracts because events occur that are unpredictable when the contract is written. However, renegotiations stemming from bids that prove too aggressive should be avoided. This kind of renegotiation, which is inefficient per se, ends up being very costly for either the users or the taxpayers. Very often, the renegotiations imply subsidies by the government or changes in the concession contract that lead to toll increases or extensions in the duration of the contracts (*13*).

Debate on How to Allocate Traffic Risk

There is a controversy regarding the stakeholder to whom traffic risk should be allocated in concession contracts. On the one hand, traffic seems to be hardly manageable by the concessionaire because traffic depends mostly on variables that are outside the control of the concessionaire. These variables include economic growth, urban development, competition with other transport modes, and so on. Moreover, allocating traffic risk to the concessionaire substantially increases the financial cost of the project, which hinders the financial feasibility of the concession. These reasons have led some governments to look for mechanisms to untie completely the revenues of the concessionaire from the ultimate traffic in the highway concession. The United Kingdom, for instance, in its last generation of design, build, finance, and operate contracts, has completely delinked the traffic outcome from the revenues obtained by the concessionaire. The revenues depend instead on such performance-based indicators as safety and availability (*14*).

On the other hand, it is true that most of the businesses run by the private sector naturally bear demand risk, so why not toll highways? In addition, there are several reasons to support the allocation of traffic risk to the concessionaire. First, maintenance and operation costs depend substantially on traffic—particularly heavy traffic. Second, the allocation of traffic risk to the concessionaire will encourage it to adjust things in its control to attract more traffic—by designing a good pricing policy, improving the quality of service in the road, and so on. In spite of that, it is true that toll highways have different characteristics compared with other industries. For instance, sunk irreversible costs are quite high in highways, and tolls are often regulated so the concessionaire cannot adjust them to collect greater revenues. These reasons imply that the consequences of traffic overestimation on the financial performance of the concessionaire are more significant than in other industries.

For this reason, some countries, such as Spain, Germany, Portugal, and many in Latin America, which traditionally tended to allocate traffic risk completely to the private sector (*15*) while maintaining the allocation of traffic risk to the concessionaire, have decided to implement mechanisms to mitigate traffic risk without fully decoupling the revenues ultimately obtained by the concessionaire from traffic. Those mechanisms include, for example, minimum income guarantees and profitability caps (*9*).

FLEXIBLE-TERM CONCESSION CONTRACTS

Theoretical Foundation

The theoretical foundation of FTC contracts is quite straightforward. The idea is to link the duration of the concession contract to the attainment of a specified goal set in the contract. One approach is to tie the concession duration to the number of users or to the accumulated revenues obtained by the concessionaire. In other words, the concession contract will end when a certain number of vehicles have used the highway, or when the concessionaire has received a certain amount of revenue from the users. Consequently, if traffic ultimately turns out to be higher than expected, the duration of the concession contract will be reduced from what had originally been estimated. And the reverse is also true. In cases in which the actual traffic turns out to be lower than what had been estimated, the concession contract will be extended.

This approach means a substantial mitigation of the traffic risk that is actually allocated to the concessionaire compared with fixed-term contracts. However, traffic risk is not fully mitigated by using this approach, for two reasons. First, the maintenance and operation costs accumulated throughout the life of the contract become larger for the concessionaire when the concession contract becomes longer and vice versa. Second, the revenues obtained at the beginning of the contract will have a higher value for the concessionaire than those obtained at the end of the contract. As a consequence of both, if in the end the actual traffic is higher than expected, the return obtained by the concessionaire will be a little bit higher than the return that would have been obtained with a fixed-duration contract. In the opposite case, when the actual traffic turns out to be lower than expected, the return obtained by the concessionaire will be a little bit lower. This means that the ultimate return will go up and down with traffic fluctuations, but not as much as it would have, in

either direction, if a fixed-term contract had been implemented. This traffic risk allocation profile makes sense from the standpoint of the theory of incentives, because the concessionaire will still have an incentive to bring more traffic to the concession.

Engel et al. made two substantial contributions to the approach outlined above (*7, 8*). First, they suggested discounting the revenues using a rate established in the contract (present value of the revenues) to reflect the different value that revenues have for the concessionaire at different times. Second, and perhaps more important, they proposed using the present value of the revenues (PVR), not only as a means of mitigating traffic risk, but also as the key variable in the tender of the concession contract. This way, the bidder that in the end requires the least preset value of the revenues will be granted the concession contract. This is what Engel et al. called the LPVR mechanism.

Following is an explanation in greater detail of how this mechanism works. Equation 1 shows the net present value estimated by one bidder attending the tender in terms of the most relevant variables that determine the economic balance of a concession contract.

$$\mathrm{NPV}_0 = -I_0 + \sum_{i=0}^{i=n} \frac{p_i \cdot q_i(p_i) - m_i}{(1+r)^i} \tag{1}$$

where

NPV_0 = net present value calculated in year 0,
I_0 = initial investment estimated by the bidder (capital cost),
r = weighted average cost of capital (WACC),
n = concession term,
p_i = price or toll in year i,
$q_i(p_i)$ = actual traffic estimated by the bidder in year i depending on p_i, and
m_i = maintenance and operation costs estimated by the bidder in year i.

Each bidder will try to make its bid as competitive as possible to have the greatest chance of being awarded the concession. The most competitive bid under this restriction is always made when $\mathrm{NPV}_0 = 0$. Making Equation 1 equal to zero, and restating its terms, results in Equation 2.

$$I_0 + \sum_{i=1}^{i=n} \frac{m_i}{(1+r)^i} = \sum_{i=0}^{i=n} \frac{p_i \cdot q_i(p_i)}{(1+r)^i} \tag{2}$$

The left side of this equation shows the cumulative discounted costs or present value of the costs (PVC) that the bidder expects to bear in operating and constructing the concession, and the right side shows the cumulative discounted revenues or PVR that the bidder expects to obtain along the contract duration. Figure 1 shows the evolution of the PVC and PVR curves along the time. The point at which the two curves converge means that the concession has covered all its costs—according to a cost of capital equal to r. This is the equilibrium point E (see Figure 1), which gives the expected duration of the contract T_0.

The auction mechanism based on the LPVR consists of granting the concession to the bidder that requires the lowest PVR to recover its costs, because it is supposed to be the most efficient bidder. The concession will end when the real discounted flow of revenues reaches the level required by the concessionaire. If the real traffic is ultimately lower or higher than expected, the ultimate duration of the concession will be either extended or reduced. This effect is shown in Figure 2. If real traffic turns out to be lower than expected, the PVR curve will be less steep than expected, so the ultimate duration will be T_2 instead of T_0. Similarly, if real traffic turns out to be higher than expected, the PVR curve will be steeper than expected, so the ultimate duration will be T_1 instead of T_0. This profile substantially mitigates traffic risk.

In the past few years, some academics have proposed slight modifications of the LPVR mechanisms. Nombela and de Rus (*16*) proposed using the least present value of the net revenues (LPVNR) instead of the LPVR to procure concession contracts. This mechanism has two problems. First, using this mechanism, no traffic risk is ultimately allocated to the concessionaire so in the end the concessionaire does not have an incentive to bring more traffic to the highway. And second, the concessionaire does not have an incentive to reduce its operation costs because those costs are deducted from the LPVNR that ultimately determines the length of the concession. Vassallo (*17*) suggested the possibility of using short-term concession contracts of fixed duration awarded under the LPVR

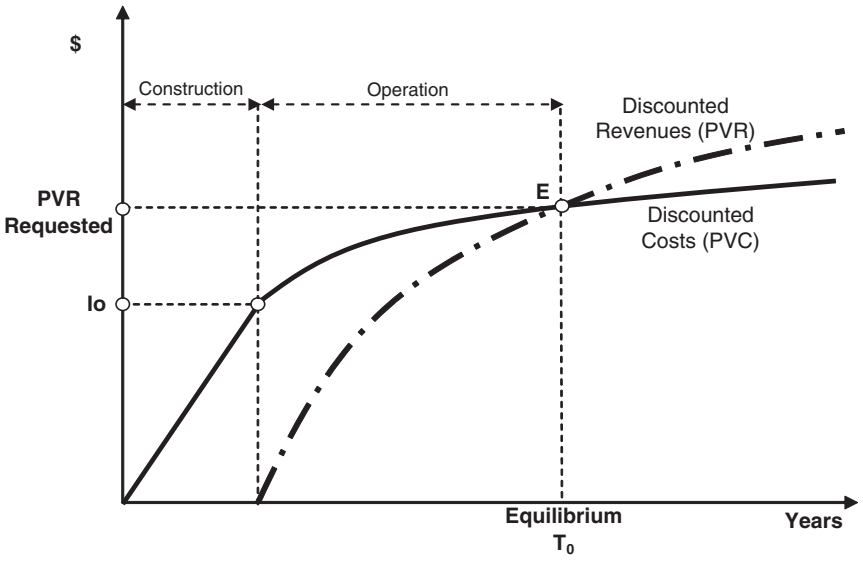

FIGURE 1 Economic balance of concession contract.

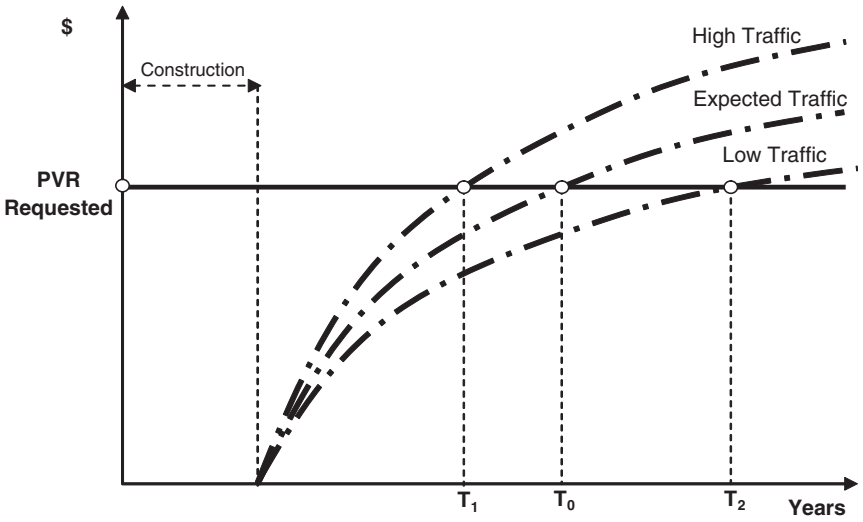

FIGURE 2 Concession duration for various traffic scenarios.

approach. Once the contract has expired, the government will pay to the concessionaire the difference between the LPVR requested and the PVR obtained at the end of the contract. This mechanism, however, introduces a certain uncertainty, at the end of the concession, on the government side.

Practical Experience Around the World

The use of FTCs was reported for the first time for the Second Severn Bridge in the United Kingdom, which was awarded in 1990. The length of the concession was pegged to a fixed target of "required cumulative real revenue" (*18*). A figure was established in 1989 prices that, once collected from toll income, would end the concession. A similar experience is that of the Lusoponte concession in Portugal, awarded at the end of the 1990s. The concession agreement was designed so that the concession would expire no later than March 2028 or once a total cumulative traffic flow of 2,250 million vehicles had been reached (*19*).

Other countries have also implemented FTC approaches. The government of Colombia decided to move from fixed to FTC contracts at the end of the past decade. The first project to be awarded under this approach was the "Malla Vial del Valle del Cauca," which will expire when the concessionaire reaches the accumulated revenues—not discounted—requested in the tender, subject to a maximum duration (*20*). The accumulated revenues required were also used as one of the key variables in the tender phase of the concession. From then on, many concession contracts have been awarded using this approach, particularly in the past few years. It is still too early to properly assess how this mechanism actually works, because most of the contracts are either in the construction phase or in the first few years of operation.

In the past few years, due to budgetary constraints, Portugal has moved from shadow toll concessions to real toll concessions. This shift has encouraged the government to implement traffic risk mitigation mechanisms. For this reason, the Litoral Centro Highway in Portugal was awarded in 2003 under the LPVR approach. The concession will come to an end when the net present value of the total revenues reaches €784 million, subject to a minimum period of 22 years and a maximum period of 30 years. The concession ends after 30 years, regardless of whether the consortium reaches the PVR initially requested or not. Since the award of this concession, however, use of the LPVR has been discontinued in Portugal because of the opposition of potential concessionaires.

Spain has a long experience in the development of concession contracts, especially for highways. In the past few years, however, the concession approach has also been used for funding other kinds of infrastructure. An example is intermodal exchange stations in urban areas, such as Madrid, Spain, which facilitate modal changes for commuters. The revenues of these concessions are derived mostly from a fee paid by the regional buses. In the concession contracts for these stations, a flexible-term mechanism to mitigate demand risk was implemented. The concession contracts will finish when the cash flow discounted to a certain rate established in the contract equals the original investment. In any case, the contract can be no shorter than the original duration minus 5 years and no longer than the original duration plus 5 years (*21*).

Undoubtedly, Chile has had the greatest experience in the implementation of the LPVR mechanism in the way that Engel et al. designed it. The Chilean Public Works Concession Law defined the possibility of using the sum of total revenues—discounted or not—to be required by the concessionaire as the main economic variable for tendering concessions. Since then, the LPVR has been used as a procurement mechanism in some highway and airport concessions. The bidding terms of the concessions awarded in Chile on the basis of the LPVR approach allowed the concessionaire to choose a fixed or variable discount rate.

The first concession using LPVR in Chile, and also the most successful, was the Santiago–Valparaiso highway (Route 68). An analysis of the procurement process of this highway can be found in work by Gómez-Lobo and Hinojosa (*22*). The fixed rate was set in the bidding terms as a risk-free rate of 6.5% plus a risk premium of 4%. The variable rate was set as the monthly average real risk-free rate plus a 4% risk premium. Four bidders attended the tender. Three chose the fixed discount rate; only one chose the variable one.

The second attempt to tender a highway concession in Chile under the LPVR mechanism took place at the beginning of 1999. The highway selected was the Costanera-Norte, an urban expressway in Santiago, Chile, which was a very risky project for several reasons. First, it was located in an urban area, thus competing with other

roads and means of transportation. Second, part of the highway was built on a subterranean level. And third, there was public opposition to the project by residents of some city neighborhoods. Only one consortium presented an offer, and it was ultimately disqualified because the guarantee bond offered was below the level established in the bidding documents. This experience proved that the LPVR was not a magic wand that would enable risky projects to get off the ground even without public support.

The economic recession endured by Chile between 1998 and 2002 prompted the government to vary the contracts terms of many concessions in trouble by changing them from fixed-term to flexible-term contracts. The only concessions that were not renegotiated were the ones that had already been awarded under the LPVR approach, demonstrating the LPVR approach as an extremely useful way to mitigate the effects of an economic recession on the profitability of the concession (*9*).

From then on, some road and airport projects have been awarded under the LPVR approach in Chile. However, in spite of the interest in this mechanism, in the past 15 years only four road concessions out of the 28 presently granted were successfully awarded on the basis of this approach.

Comparison with Other Traffic Risk Mitigation Mechanisms

FTC contracts are not the only means of mitigating traffic risk. Other work by the author (*9*) shows a taxonomy of the different traffic risk mitigation mechanisms that have been implemented throughout the world in the past few decades. Apart from flexible-term contracts, the two most popular mechanisms are revenue-sharing limits and clauses to rebalance the economics of the contract.

Revenue-sharing limits consist of establishing in the contract lower and upper thresholds of allocating traffic risk between the concessionaire and the government. If in 1 year the revenues fall below the bottom band, the government will have to pay the concessionaire the difference between the revenues guaranteed and the revenues collected. If the revenues rise above the upper band, the concessionaire has to share a percentage of the extra revenues collected with the government. This mechanism has been implemented in several countries, such as Chile and Korea.

Rebalancing the economics of the contract consists of guaranteeing the "economic balance" of the concession, which is generally interpreted as the expected project internal rate of return (IRR). Generally, the compensation measures to reestablish the economic balance of the contract are not preestablished, but rather negotiated when the IRR falls above or below the target levels. This compensation can include variation of tolls, change of the contract length, or provision of public subsidies. This approach is implemented in countries such as Spain and France.

FTCs have some advantages compared with the mechanisms outlined above. Unlike revenue-sharing mechanism, FTCs do not have any impact on the public budget. In addition, this mechanism helps to reduce renegotiation pressures more than revenue-sharing mechanisms. This fact was demonstrated in Chile, where many contracts with revenue-sharing mechanisms were ultimately renegotiated after the economic recession between 1998 and 2002, whereas the contracts awarded on the basis of LPVR were not renegotiated. Compared with the rebalancing of the economics of the contract, FTCs have the advantage of making unnecessary uncertain renegotiations in the future between the government and the concessionaire.

WHY HAVEN'T FLEXIBLE-TERM CONCESSIONS BEEN IMPLEMENTED MORE OFTEN?

FTCs are conceptually very attractive for several reasons. First, a variable term is a highly effective compensation method that neither commits public resources nor entails tariff increases. Second, LPVR sets up a clear buyout price for the government. Third, LPVR reduces renegotiation expectations so bidders have less incentive to inflate their forecasts. However, FTC contracts have been implemented only a few times in the countries in which this mechanism has been available. The main reason this mechanism has not been implemented more often in Chile, Portugal, Spain, and other countries lies in the strong opposition from the private sponsors to this approach. In interviews conducted by the author, concessionaires revealed three concerns about FTC contracts:

1. FTCs do not improve the ability of the project to meet its yearly payback commitments to the lenders.
2. The variable length of the contract makes both the maintenance and the operation of the concession more difficult to organize because the end of the contract is uncertain.
3. FTCs always limit the upside profitability of the concessionaire but not always the downside, so the mechanism is not symmetric.

The first concern means that FTCs do not necessarily improve the yearly cash flow of the project. This issue is particularly important during the first years of operation, in which the commitments to the lenders are more demanding. In other words, FTCs do not improve liquidity during the first years of operation of the project. Although this statement is true, it is also true that the extension of the duration of the concession contract will increase the value of the project for the lenders, which would facilitate the rearrangement of the financial contracts in case the traffic turned out ultimately to be lower than expected.

Consequently, even though FTCs do not improve the liquidity of the project, they actually increase the value of the project that backs the loan repayments, so banks involved should regard FTCs more favorably than fixed-term ones. This statement was confirmed empirically. The bond issued in 2002 to fund the Santiago–Valparaiso highway—the first one awarded in Chile under the LPVR approach—was the largest and least expensive infrastructure bond issued in Chile until then. Because of the variability of the concession term, the bond was structured with the requirement of mandatory prepayment in case the concession duration turned out, in the end, to be shorter than the maturity of the bonds originally issued to fund the concession.

The second concern has to do with the uncertainty in the organization of the operation of the concession contract. Practical experience demonstrates that this issue it is not of such great concern as it might appear to be at first, because the concessionaire can—for two reasons—reasonably estimate the end of the concession contract several years in advance. First, LPVR discounts the revenues at a certain rate, so the revenues during the first years have a much greater influence on the ultimate contract duration than the revenues of the last years. And second, the greater uncertainty regarding traffic estimates—especially in greenfield projects—occurs at the outset of the project operation. Later on, the estimating of the evolution of traffic becomes much more predictable. These two reasons explain why the concessionaire can arrive at a good approximation of the end of the concession after only a few years of operation of the concession, and this, in turn, makes easier the organization by the concessionaire of that operation.

The third concern is likely the most important one. FTCs cap the upside, while they do not, at the same time, set a floor to the downside. The downside is caused by concession laws and contracts (such as the ones in Spain, Portugal, and Chile), which tend to establish a maximum duration for concession contracts. Consequently, although the duration of a contract can always be reduced to mitigate the upside, the necessary extension to avoid the downside in the case of a traffic shortfall is not guaranteed beyond the maximum contract duration. As Brealey et al. (*23*) claim, private shareholders expect a large upside that compensates for the possibility of losing all their capital in very risky and highly leveraged projects. The traffic risk profile resulting from reliance on the LPVR approach turns out to be just the opposite of the profile desired by would-be sponsors, because the upside is very small while the downside remains significant.

For this reason, promoters regard this mechanism as asymmetrical. This asymmetry was pointed out by Gómez-Ibáñez (*24*), who observes that whereas the government has a call option on the project for the remaining present value of the contract, the concessionaire does not have a put option whereby it can sell the project to the government at the end of the contract in exchange for the present value remaining.

Figure 3 shows the effect of the asymmetry. The results depicted come from a simulation applied to a case study with average characteristics of highway concessions in Spain. The characteristics of the case study are €300 million capital cost, €10 toll per trip, 3,650 million trips per year, 2% expected annual traffic growth, €3 million annual fixed maintenance cost, €2 per trip annual variable maintenance cost, 7.5% WACC, and 30-year maximum legal duration of the concession contract.

Figure 3 displays the rate of return ultimately attained by the concessionaire in the annual traffic growth deviation (actual traffic growth minus expected traffic growth) for fixed-term contracts and flexible-term contracts based on LPVR with a discount rate equal to the WACC. The continuous line shows the evolution of the rate of return of the project the annual traffic growth deviation for fixed-term concessions, and the broken line shows this relationship for FTCs. For a traffic growth deviation equal to 0%, the ultimate profitability of the concessionaire would be the same for both flexible and fixed-term concessions and equal to the cost of capital of the project because the concessionaire would carry out its calculations to obtain a rate of return equal to the WACC in case its predictions are ultimately fulfilled.

Figure 3 sheds some light on the aspects previously discussed. First, it is noteworthy that the traffic risk allocated to the concessionaire in a fixed-term contract is much higher than it is in a flexible-term contract, since the slope of the curve is much steeper. Second, the risk profile depicted by fixed-term contracts is symmetrical on both the upside and the downside, whereas the risk profile depicted by FTC contracts is notoriously asymmetrical because the downside is much more accentuated than the upside because of the maximum term established in the contract.

CONCLUSIONS AND RECOMMENDATIONS

Two lessons can be drawn and emphasized from the implementation of FTC contracts. The first lesson is that establishing such a mechanism to mitigate traffic risk has been shown to work quite well for the government, even better than other traffic risk mitigation mechanisms, in several ways:

- FTCs reduce the financial cost of the project because the lenders perceive that traffic risk is substantially mitigated.
- FTCs set up a fairer traffic risk allocation approach.
- Unlike revenue-sharing approaches, FTCs provide an easy way to mitigate traffic risk without committing public resources.
- Unlike revenue-sharing approaches, FTCs have been proven effective in reducing the need for renegotiation of concession contracts because traffic estimates made by the bidders are now less significant in the tender.
- Unlike rebalancing the economics of the contract, FTCs establish an automatic way to determine the compensation to the concessionaire. This aspect removes subjectivity and avoids future disputes between the government and the concessionaires.

The second lesson is that concessionaires do not like this mechanism because, even though FTCs reduce traffic risk, FTCs draw an

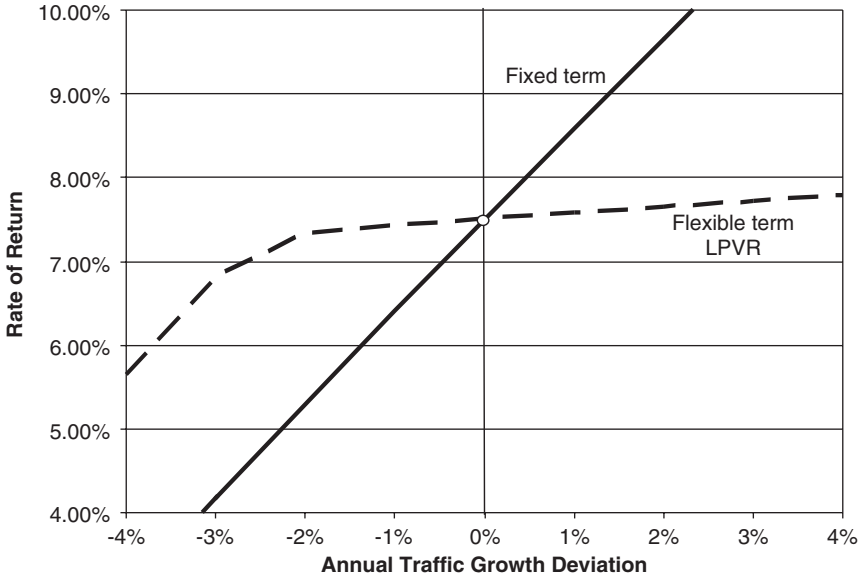

FIGURE 3 Sensitiveness in procurement mechanism adopted.

asymmetric profile that is not convenient for the concessionaire. In other words, the traffic risk reduction does not outweigh the disadvantage of an asymmetric risk profile. This occurs because capping the upside mostly affects the shareholders (the concessionaire), who see how their gains are constrained. However, the downside mostly affects the lenders rather than the shareholders because infrastructure project finance structures are often highly leveraged.

These lessons suggest that although making the concession term flexible is a very attractive mechanism for governments, the level of acceptance of this mechanism among concessionaires still leaves room for improvement. To increase the acceptability of this mechanism among potential concessionaires, some measures, aiming at increasing the potential upside and reducing the potential downside, should be adopted.

The potential upside can be increased by establishing, for example, a minimum duration for the contract in such a way that if the requested LPVR is attained before the minimum duration is reached, the contract still continues until the minimum duration is reached. This way, the concessionaire can enjoy a certain upside if traffic ultimately becomes higher than expected.

Reducing the downside is, however, more complicated. One solution could be for the government to allow an unlimited extension of the contract duration. However, this solution seems to be difficult to implement in practice because the maximum duration is often limited by law. Moreover, even in the case that the law permits an unlimited duration, it is still possible that the PVR curve becomes so flat over the years—because of the effect of the discount rate—that it never reaches the PVR requested. If this happens, the government would not have the right to get the concession back, which for a public asset does not make much sense.

If the maximum duration arrives and the concessionaire by that time has still not reached the LPVR initially requested, the government has the possibility of committing itself to pay the difference between the LPVR requested and the PVR reached at that time. This measure might pose a burden for the government, especially in times of severe budgetary constraints. However, the government might obtain that amount by retendering the concession and requiring the bidders to pay a lump sum to the government equal to the difference between the LPVR requested and the PVR reached at that time. This solution seems to be feasible because at the end of the first concession period, the project will be a very profitable brownfield project with a stable and consolidated traffic flow and few additional works to be conducted by the new concessionaire.

From a practical standpoint, the author would claim that the use of flexible-term contracts as a way of procuring concessions and mitigating traffic risks seems to be an interesting option that should be allowed for by governments implementing highway concessions. However, for this mechanism to be truly effective, it requires the risk profile drawn by the contract to be more attractive for the private sector. The implementation of the measures described here will maintain the main advantages of flexible-term contracts and, at the same time, will make flexible-term mechanisms much more attractive for private promoters. Those measures will undoubtedly increase the practical applicability of FTCs in the future.

REFERENCES

1. Aschauer, D. Is Public Expenditure Productive? *Journal of Monetary Economics,* Vol. 23, No. 2, 1989, pp. 177–200.
2. Aghion, P., E. Caroli, and C. García-Peñalosa. Inequality and Economic Growth: The Perspective of the New Growth Theories. *Journal of Economic Literature,* Vol. 37, No. 4, 1999, pp. 1615–1660.
3. *Transport Infrastructure Investment: Options for Efficiency.* International Transport Forum, Organisation for Economic Co-operation and Development, Paris, 2008.
4. Vassallo, J. M., and J. Gallego. Risk Sharing in the New Public Works Concession Law in Spain. In *Transportation Research Record: Journal of the Transportation Research Board, No. 1932,* Transportation Research Board of the National Academies, Washington, D.C., 2005, pp. 1–8.
5. Flyvbjerg, B., M. K. Skamris Holm, and S. L. Buhl. How (In)accurate Are Demand Forecasts in Public Works Projects? The Case of Transportation. *Journal of the American Planning Association,* Vol. 71, No. 2, 2005, pp. 131–146.
6. Bain, R., and L. Polakovic. Traffic Forecasting Risk Study Update 2005 Through Ramp-Up and Beyond. Presented at European Transport Conference. Strasbourg, France, Oct. 2005.
7. Engel, E., R. Fischer, and A. Galetovic. Highway Franchising: Pitfalls and Opportunities. *American Economic Review,* Vol. 87, No. 2, 1997, pp. 68–72.
8. Engel, E., R. Fischer, and A. Galetovic. Least Present Value of Revenue Auctions and Highway Franchising. *Journal of Political Economy,* Vol. 109, No. 5, 2001, pp. 993–1020.
9. Vassallo, J. M. Traffic Risk Mitigation in Highway Concession Projects: The Experience of Chile. *Journal of Transport Economics and Policy,* Vol. 40, No. 3, 2006, pp. 359–381.
10. Silva, G. F. *Toll Roads: Recent Trends in Private Participation.* World Bank, Washington, D.C., 2000.
11. Athias, L., and A. Nuñez. Winner's Curse in Toll Road Concessions. *Economic Letters,* Vol. 101, No. 3, 2008, pp. 172–174.
12. Ping Ho, S. Model for Financial Renegotiation in Public-Private-Partnerships Projects and Its Policy Implications: Game Theoretic View. *Journal of Construction Engineering and Management,* Vol. 132, No. 7, 2006, pp. 678–688.
13. Guasch, J. L. *Granting and Renegotiating Infrastructure Concessions: Doing It Right.* WBI Development Studies. World Bank, Washington, D.C., 2004.
14. Debande, O. Private Financing of Transport Infrastructure: An Assessment of the UK Experience. *Journal of Transport Economics and Policy,* Vol. 36, No. 3, 2002, pp. 355–387.
15. Izquierdo, R., and J. M. Vassallo. *Nuevos sistemas de gestión y financiación de infraestructuras de transporte.* Colegio de Ingenieros de Caminos, Canales y Puertos. Madrid, Spain, 2004.
16. Nombela, G., and G. de Rus. Flexible-Term Contracts for Road Franchising. *Transportation Research Part A,* Vol. 38, 2003, pp. 163–179.
17. Vassallo, J. M. Short-Term Infrastructure Concessions: Conceptual Approach and Recent Applications in Spain. *Public Works Management and Policy,* Vol. 8, No. 4, 2004, pp. 261–270.
18. Foice, D. Second Severn Crossing. *Proc., Seminar PPP Risk Management for Big Transport Projects,* Madrid, Spain, 1998.
19. Lemos, T., D. Eaton, M. Betts, and L. Tadeu de Almeida. Risk Management in the Lusoponte Concession—A Case Study of the Two Bridges in Lisbon, Portugal. *International Journal of Project Management,* Vol. 22, 2004, pp. 63–73.
20. Benavides, J. *Alternativas de adjudicación de proyectos de concesión vial en Colombia.* Ministerio de Hacienda y Crédito Público, Bogotá, Colombia, 2008.
21. Di Ciommo, F., J. M. Vassallo, and A. Oliver. Private Funding of Intermodal Exchange Stations in Urban Areas: Case of Madrid, Spain. In *Transportation Research Record: Journal of the Transportation Research Board, No. 2115,* Transportation Research Board of the National Academies, Washington, D.C., 2009, pp. 20–26.
22. Gómez-Lobo, A., and S. Hinojosa. *Broad Roads in a Thin Country: Infrastructure Concessions in Chile.* Research Paper 2279. World Bank, Washington, D.C., 2000.
23. Brealey, R. A., I. A. Cooper, and M. A. Habib. Using Project Finance to Fund Infrastructure Investment. *Journal of Applied Corporate Finance,* Vol. 9, No. 3, 1996, pp. 25–38.
24. Gómez-Ibáñez, J. A. *Regulation of Private Infrastructure: Monopoly, Contracts, and Discretion.* Harvard University Press, Cambridge, Mass., 2003.

The Taxation and Finance Committee peer-reviewed this paper.