Private Road to Sustainable Mobility?

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A Private Road to Sustainable Mobility?

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ABSTRACT
This paper examines possibilities for harmonizing the objectives of two metropolitan transportation infrastructure policy trends: sustainability and privatization. The paper links these trends through the theory of fiscal federalism, hypothesizing that metropolitan highway PPPs can reinforce sustainability if supported by a fiscal federalist institutional environment. Case studies from seven different countries reveal a primary challenge for metropolitan highway PPPs: balancing objectives for market efficiency at the project level with sustainability concerns at the metropolitan level, especially network spillovers and social equity. Ultimately, the analytical approach inhibits discerning whether fiscal federalism is the cause or result of a “good” project. A project’s physical form apparently matters in reconciling market and sustainability objectives.

INTRODUCTION
In ongoing efforts to deliver metropolitan mobility, two policy trends have emerged, sustainability and privatization. Sustainability emphasizes the public good: a more collectivist, inter- and intra-generationally focused, systems-conscious, and integrated policy and investment approach. Privatization, partly associated with decentralization and liberalization of traditionally government-owned and operated public goods and services, focuses on the private good, leading to increased private sector involvement in financing and delivering transportation infrastructure and services.

The sustainability and privatization perspectives may seem contradictory and often precipitate heated debate. Yet, they respond to similar challenges regarding aligning incentives to better allocate scarce resources. Sustainability, not a new concept in metropolitan mobility (1), brings an explicit ecology and equity perspective to the development challenge, aiming to meet cross-generational human needs in the face of local and global resource constraints. Privatization – which aims to improve efficiency, performance, etc., through market incentives – reflects centuries of experience with public-private partnerships for delivering transportation services and infrastructures (2). Might sustainable privatized mobility be possible?

This paper explores this question through seven metropolitan highway public-private partnerships (PPPs). Metropolitan areas exemplify the complex institutional settings challenging sustainable mobility. They are also relatively recent entrants into the highway PPP realm. Reviewing the metropolitan highway PPP market is, thus, timely. The cases are assessed according to a sustainable metropolitan mobility (SMM) evaluative framework based on principles of efficient pricing and supply, system integration, public acceptability, and technology use. The cases represent ranges in project geographic scale and network scope, illustrating various challenges to SMM and highway PPPs within complex metropolitan contexts.

The following section describes the SMM framework, justifies a possible role for PPPs, and introduces the research questions. The third section presents the cases – metropolitan highway PPPs from the Americas, Europe, and Australia. The fourth section synthesizes the cases. The final section concludes.

BACKGROUND
Sustainable development aims to balance three oft-competing development dimensions: economy, environment, and social equity. Mobility systems factor critically in sustainable economic and social development but produce a range of environmental, health, and other adverse effects. Operationalizing sustainable mobility faces a number of practical challenges.
related to complex institutional contexts, inter-system interactions, and measurement and analytical tools (1).

The SMM Framework and PPPs
In today’s urbanizing world, the need for sustainable metropolitan transportation seems self-evident. But how can we know we are moving towards SMM? Banister (3) suggests combining the “best use” of technology, pricing and regulation, integrated transportation and land development, and public acceptability. Table 1 presents a qualitative framework, reinterpreting Banister’s elements into principles guiding theoretically justified objectives (Table 1).

The objectives follow public finance theory (4), scaling from productive efficiency to allocative efficiency of use (pricing), systems-level dynamic allocative efficiency (integration), and the broader social and political context (public acceptability). SMM’s efficiency-related objectives derive from infrastructure economics theory, which suggests that marginal social cost pricing (MSCP) of highway infrastructure, under certain assumptions, can minimize congestion’s social costs while achieving full cost recovery (5). First-best MSCP often breaks down in practice due to demand-side impacts (e.g., network spillovers, heterogeneous users, imperfect markets; 6, 7) and supply-side constraints (e.g., imperfect information, lumpy investments; e.g.; 8). SMM’s integration principle finds support in Coasian transaction cost theory. Integration can lower metropolitan system costs (9) by enabling institutional arrangements that capitalize on policy and program synergies: within and across system components (10); among traditionally separate policy domains, including land use (11); and across political jurisdictions (12). The public acceptability principle draws from political economy theories regarding the possibility for improving social equity by, for example, compensating “losers” of an otherwise net-positive social investment (13). Here, public acceptability represents a measure of societal value and a crude proxy for the complex, difficult-to-measure concepts of distributive justice and equity (14). Innovation represents a cross-cutting element, not a singular objective.

PPPs rest on value for money (VfM): delivering a desired social benefit at the lowest financial cost. For transportation, VfM potential comes from economies of scope or “bundling” tasks (e.g., construction and operations), adequately assessing and allocating risks, and providing appropriate incentives (7). Since transportation infrastructure exhibits scale economies, contract theory generally supports the notion of competition for the market – auctioning exclusive rights to build, operate, and generate revenues from infrastructure – but for a limited time period to mitigate market power (15). Property rights theory suggests a socially optimal outcome from transferring “residual” ownership rights and associated risks and incentives to the private sector during the concession period (16). Therefore, the private entity in a PPP should accept most commercial risks, including demand (i.e., traffic) risk, provided the public sector accepts policy-related and other risks clearly in the public domain (e.g., network risk) and justly compensates unanticipated changes (17, 18).

PPPs need the right institutional framework. Evidence reveals numerous market imperfections towards this end (19). Nonetheless, Gómez-Ibáñez (20) suggests that market-oriented contract solutions are almost always more socially beneficial than government service. Recognizing the impossibility of writing a “complete contract” accounting for all possible factors affecting a project over time, Gómez-Ibáñez argues public and private interests can be upheld through contract and regulatory strategy design. “Good” contracts require strong ex-ante public sector capability. PPPs do not divest government of the responsibility to uphold the public good;
conditional upon this capability existing, a situation-appropriate, reasonably flexible contract should be feasible.

Research Objectives
Many may consider metropolitan highway PPPs anathema to sustainability. Rather than weigh highways versus other metropolitan transportation options, this paper starts from the premise that some amount of highways is necessary. This paper also does not compare metropolitan highway PPPs to traditional highway development approaches. Instead it uses PPPs as a window on the relationships between institutional structures and SMM. In theory, bi-directional causality may exist: better institutional structures lead to “better” PPPs which, in turn, could enhance SMM; alternatively, PPPs could lead to better institutional structures, which then improve SMM. A key institutional dimension theoretically tying PPPs and SMM is fiscal federalism, particularly the concept of fiscal equivalence. Under fiscal equivalence, “those who receive the benefits of a collective [public] good [are matched with] those who pay for it (21; p. 483),” with revenues geographically matching costs.

Done correctly, PPPs create a vested private ownership structure to serve the market, maintain project stability through a contract, enhance innovation (management and technological), and deliver highest social value at lowest cost. PPPs may also serve as a “Trojan Horse” for introducing road pricing and, therefore, some degree of fiscal equivalence in metropolitan mobility systems. In this way, PPPs could offer authorities a partial “outsourcing” to the private sector of road pricing’s political pain and support fiscal equivalence and efficiency-related SMM objectives. However, prevailing institutional structures also influence PPP outcomes (i.e., impacts on SMM). Metropolitan highway PPPs affect more than direct users and private concessionaires, impacting the broader mobility and urban systems. Maximizing social welfare must consider impacts on the metropolitan economy, land systems, and the environment, and fulfill normative social equity objectives. In theory, fiscal federalism places a benefit boundary (21) around metropolitan sub-systems, endogenizing benefits and costs and enabling the proper balance of trade-offs among sub-systems. In this context, project-level market efficiency may collide with metropolitan-level sustainability, a challenge likely requiring appropriate ex-ante institutionality consistent with fiscal federalism. A single contract for a single system link agreed to outside of a metropolitan system context cannot easily account for all network externalities or broader social objectives, which might require wider corridor management or even entire metropolitan roadway management contracts (22, 23). The following cases aim to reveal how the theoretical relationships between PPPs, the broader institutional setting, and SMM play out in practice.

CASE STUDIES
The case study method is appropriate for investigating contemporary phenomena, understanding how a process works without experimental controls, and dealing with unclear boundaries between context and phenomenon or situations where potentially influencing variables outnumber observations (24). This case universe is metropolitan highway infrastructures with some private sector financial and operational responsibilities. The selected highway PPPs come from seven large metropolitan contexts covering a range of geographies and institutional settings (Table 2). Case information comes from documents available from government agencies, the infrastructure concessionaires, interviews and email exchanges with persons familiar with each PPP, and other sources. Grillo (25) provides details.
Los Angeles: SR91
In 1989, California authorized its Department of Transportation (Caltrans) to pursue four transportation PPP demonstration projects. Six years later, the state entered into a 35-year lease with the California Private Transportation Company (CPTC) to construct, operate, improve, and collect user fees on high-occupancy toll (HOT) lanes on a ten-mile stretch of existing highway (SR91) through Orange County. Drivers could use un-tolled general lanes or pay to enter express lanes. The facility was the first fully electronic and variable-priced (distance- and flow-based) highway in the USA, with express lanes priced to ensure free-flowing traffic (26). The private consortium had toll-setting flexibility with obligations to share revenues with the State should the internal rate of return exceed 17% (27).

SR91 was developed in a region with transportation planning and funding coordinated across jurisdictions by a metropolitan planning body, and project funding coming from a mix of mostly federal and state sources. The tolling structure created a dedicated funding stream for the project, supporting greater fiscal equivalence. Planned at the metropolitan level (27), the project was tendered and negotiated by Caltrans (28).

The SR91 Express Lanes proved immediately profitable and popular in terms of user volumes (26). Still, shortly after implementation, conflicts emerged over tolls and integration with other corridor infrastructure, primarily due to a “no compete clause” prohibiting nearby roadway improvements that might adversely affect project finances (27). The clause, which helped defray policy and network risks (demand and other commercial risks had been entirely transferred to CPTC) constrained authorities’ broader mobility management options (17), at least regarding the road system (transit options were not affected).

Geographically, the SR91 PPP represented new capacity, but within an existing right-of-way already in use, somewhat mitigating “greenfield” risk. The project was, however, constructed in a growing suburban region with uncertain future land-use patterns administered (at the time) by multiple small jurisdictions. The “no compete clause” ultimately stymied land use and transportation administration/integration issues that emerged in time.

With few corridor management alternatives and facing negative public perceptions, in 2003 County authorities purchased the HOT lanes for US$207.5 million (approximately $50 million more than inflation-adjusted construction costs) to regain policy control (29). In sum, state-level highway PPP motivations ultimately conflicted with regional-level mobility management flexibility.

Authorities in the United States have seemingly learned the lessons of SR91, looking again at HOT Lanes as a flexible, incremental solution to the problem of pricing, network spillovers, financing capacity, and congestion management. The State of Virginia is developing new HOT lanes in the median of the Washington DC metro area’s highly congested circumferential highway with a more flexible contract structure (30).

Toronto: 407 ETR
ETR materialized in the opposite ownership direction of SR91. The Province of Ontario initially developed the 68-km toll road. After changing from a Liberal to Conservative government, Ontario entered a long-term (99-year) lease with a private consortium (407 ETR) to finance and develop future expansions and manage, maintain, and operate the entire highway (27). In return, 407 ETR can freely set variable (electronic) tolls, with penalties for not reaching minimum
traffic thresholds (to reduce over-pricing) and requirements to finance expansions if congestion reaches certain thresholds (31).

ETR offered an opportunity to improve fiscal equivalence in a region where urban expansion was undermining historically strong fiscal federalism in local transportation and land use. ETR development coincided with a major reorganization of provincial transport policy aimed at devolving greater power to the growing Toronto Metropolitan Area and initially proceeded with little jurisdictional conflict (prior to tendering). ETR runs through fast-growing suburbs outside the northern boundary of the Metropolitan City of Toronto, paralleling Highway 401. A greenfield project, ETR’s projected finances needed to account for uncertain land and economic development trends, influenced by multiple local governments.

Almost completely trading demand risk to 407 ETR in exchange for little toll regulation has created challenges. George Davies, who chaired the authority overseeing ETR’s original public sector delivery, explained to the authors that traffic growth and revenues under public operation had already exceeded expectations; demand risk had already been mitigated and a reasonably efficient pricing regime set. As the Province shouldered construction and initial operation risks, some believe the subsequent tender represented a financial windfall, providing the concessionaire with substantial toll revenue at little risk (32). Lindsey (33) suggests 407 ETR’s pricing policies are inefficient from a wider corridor management perspective, hindering expected freight mobility improvements by diverting trucks to the un-tolled 401. Davies also explained challenges to inter-modal integration: technically Ontario maintains policy and network investment flexibility; but, contractual provisions protecting against government discriminatory actions halted at least one corridor rail transit investment. Some perceive the ETR privatization decision as politically motivated, leading to stakeholders criticizing pricing policies and public returns on investment (32).

ETR initially delivered on a broadly agreed-upon public investment, introduced electronic pricing, and provided a dedicated finance source generally absent in Ontario transportation policy (34): it supported fiscal equivalence. Nonetheless, the subsequent PPP has not necessarily improved long-term life-cycle efficiencies vis-à-vis the originating public authority. Opportunities for efficient corridor network pricing and mobility management have disappointed. ETR continues to operate profitably (31), but remains threatened by litigation, political pressure, and poor public acceptability. By most accounts, the lessee has managed the project competently, but the contracting approach and underlying politics appear to weigh heavily, hampering integrated corridor strategies.

The PPP benefitted from fortuitous timing, capturing the financial upside. The complexity of developing a large greenfield project probably warranted more flexibility, especially for demand risk and changing government priorities for land use, economic, and multi-modal transportation development. The 2011 tendering of a concession to extend Highway 407 into eastern Greater Toronto will be delivered via a Design-Build-Finance-Maintain (DBFM) structure. The public sector will retain ownership and tolling rights, remunerating the lessee from toll revenues over 30 years (35), reducing the direct link between market efficiency and toll setting.

Melbourne: CityLink
In 1995, State of Victoria legislation led to a 37-year concession to develop and toll a 22-km inner-Melbourne highway system (36). The contract, awarded to Transurban, includes a material adverse effect (MAE) clause allowing Victoria to enact policies and make investments affecting
CityLink finances while providing compensation, but otherwise transfers demand risk to the concessionaire (37). Ken Daley, a Transurban executive who led the CityLink project, explained that the contract fixes toll rates, giving Transurban rights to raise tolls by up to 4.5% per year or the rate of inflation (whichever is higher) until 2015, and at the inflation rate thereafter. A partial brownfield, the project upgraded existing infrastructure along both north-south and east-west downtown expressway axes and made new capital investments facilitating movement from the airport, seaport, industrial areas, and inter-urban highways through the city center.

At first glance the context offers a poor example of fiscal equivalence. The State of Victoria dominates metropolitan transportation policy and administration as well as planning and community development in Melbourne (38). This sets political authority above the metropolitan scale, but confers some policy consistency and continuity across the concession’s spatial scope, offering some degree of fiscal federalism in administration. The project apparently improved fiscal equivalence by introducing road pricing, and its partial use of existing infrastructure in a fully-developed area probably reduced uncertainties about demand and capacity needs.

Regarding SMM efficiency and integration objectives, some suggest CityLink’s toll levels have diverted traffic to free routes (39, 40). Transurban argues that toll increases have been met with ever-increasing demand due to economic and population growth (necessitating additional inter-modal capacity), and returns have been fair given the risks. With respect to integration, Daley explained that in an MAE claim concerning the construction of a nearby parallel free road, arbitrators ruled against Transurban. Otherwise, profit-sharing provisions have supported public-private collaboration on corridor investments like intelligent transportation system (ITS) installation (41), and Transurban has at times agreed to more expensive options deemed consistent with environmental priorities and community relations (42).

Overall, the evidence suggests that CityLink delivered market efficiency benefits as a PPP while addressing broader transport system and wider metropolitan societal goals. The contract helps internalize user costs and benefits, covers project costs (mostly), efficiently allocates risk, and provides stability (via the MAE clause) for balancing private and public objectives and arbitrating conflict. Established surrounding land uses in most areas may have removed some of the uncertainty. Peak tolling is not used (except for commercial vehicles), however, and inter-modalism, while considered in some investments (according to Daley), remains absent in system management.

**Santiago: Costanera Norte**

In 2000, the Chilean Government awarded the 42.4-km, 30-year Costanera Norte (CN) PPP, the country’s first major urban highway concession. The award followed years of conflicts between the national Ministry of Public Works (MOP) and local communities on project scope and vision, and lukewarm private-sector interest. To ensure financial stability and mitigate excessive profits, the CN contract sets minimum income guarantees and gives MOP an upside share: 50% of gross income above certain fixed thresholds enumerated per contract year (43, 44). The contract fixes maximum tolls for peak and off-peak periods, and congestion fees (43). The government retained policy and network flexibility through structured renegotiations, with the concessionaire compensated for losses.

The CN’s alignment through the city center posed social, political, environmental, and technical complexities challenging SMM notions of inter-sectoral integration and public acceptability. The highway connects Santiago’s wealthy eastern suburbs with the downtown, the Panamerican highway, the airport and growing industrial parks in the western suburbs, and the
highway to the West Coast. Residents in the city center protested potential environmental and community impacts. In addition, the concession granted a highway infrastructure monopoly for the east-west axis, bundling an existing previously free 7.4-km highway, raising fairness and equity concerns among directly affected residents. Ultimately, MOP agreed to an alternative road alignment to mitigate some central community impacts and aligned tolling on the existing link to exempt payments for short trips (45). The government also covered some environmental mitigation costs (46). The result, though imperfect, apparently balances the objectives of a broader set of stakeholders, while meeting the concessionaire’s financial requirements.

The CN may have contributed to greater fiscal equivalence, but created other challenges to fiscal federalism affecting SMM. A highly centralized country, Chile subjects most major public investments to rigorous project evaluation. National infrastructure concessions legislation passed in 1991 gives MOP authority to administer all concessions (47), providing some program stability and predictability. However, Chile’s roadway PPP program operates largely outside traditional transportation planning and evaluation processes (48), frustrating fiscal federalism, possibly contributing to the community backlash that delayed the project, and continuing to hamper system-wide, multi-modal service integration.

Despite its polemics, the CN instituted variable pricing, addressed several inter-sectoral concerns, and delivered robust financial returns (49). MOP transferred significant demand risk to incentivize innovation and competitive pricing while retaining some policy and network flexibility and constraining market power. While some find fault with excessive renegotiations (17, 48) – which occurred outside the normal project evaluation process and impaired transparency – the process allows for flexibility and, potentially, fair compensation. The CN was the first of eventually six major PPP highways in Greater Santiago, transforming most of the metropolis’ limited access highway system (approximately 180 kms) into toll-based, private operations.

**Madrid: Metropolitan Madrid Concessions (MMCs)**

These PPPs consist of three radial toll routes obligated to partially fund a new, toll-free suburban ring route. They mostly follow the contract model of Spain’s expansive inter-urban highway PPP program: government accepts most policy and network risks through “financial balance” clauses; concessionaires can claim compensation for certain policies adversely affecting project finances. The government specifies maximum, inflation-adjusted tolls below which concessionaires can vary rates (50).

The MMCs did more to reveal than to alleviate contemporary challenges to Spain’s fiscal federalism. Notably, while the Autonomous Community of Madrid (CAM) functions as an empowered regional government within the Spanish political system (51), the national government maintains control over highway policy (52). This centralization conveys a uniform and predictable PPP environment, but the MMCs reveal that Spain’s inter-urban highway concession structure translates poorly into Madrid’s evolving and expanding metropolitan geography, failing to deliver fiscal equivalence. The complexities of delivering toll roads in a metropolitan network with multiple free highway alternatives and high land acquisition costs (concessionaires carried land acquisition responsibility) probably led to poorly allocated supply. The new radial routes, in lower-density suburbs, terminate just outside the congested central areas, leading to highly speculative demand. The network structure makes transfers from congested free routes to tolled highways inconvenient. With poor supply-demand alignment (and
Zegras, Grillo

a weak economy), finances have underperformed (53). Meanwhile, non-tolled highways within the CAM remain congested.

Overall, physical configuration impairs efficiency, system performance, and integration with land use and development. The MMCs demonstrate progress towards network-based planning and the introduction of metropolitan-level user-fee principles, but the program suffered from conflicting objectives. In particular, the conflict between demand management near the CAM and suburban land use and development in previously non-metropolitan areas contributed to the problematic physical alignment. As a result, concessionaires face financial distress and Madrid continues to experience highway supply-demand mismatch.

**Porto: Douro Litoral**
The Douro Litoral (DL) concession commenced in 2007, roughly coinciding with Portuguese reforms to privatize state infrastructure companies. Portugal already had decades of experience with inter-urban PPPs. Similar to the MMCs (except under a single contract structure), however, the DL concession in Greater Porto involved financing and delivering a network of metropolitan highways, setting maximum inflation-adjusted tolls, and including a “restoration of financial balance” clause. The 30-year concession bundles tolled, suburban radial segments with a 5-year M&O contract for an un-tolled inner-metropolitan ring route, with the former cross-subsidizing the latter (54).

The DL PPP aims to internalize pricing, funding, provision, and maintenance of Metropolitan Porto highways in a unified manner but ultimately creates distortions that threaten financial viability and fiscal equivalence. Like CityLink and the initial (public) development of ETR, but unlike the CN, government intervention from above the metropolitan scale apparently helped facilitate project implementation while engendering support from diverse stakeholders. Moreover, the national government’s control of Porto’s regional transit system aided inter-modal integration in planning. However, fear of public backlash on pricing existing un-tolled routes motivated an inefficient pricing regime: the most congested routes are free, likely leading to future overuse and underinvestment.

The DL concession aims to retain government flexibility in integrating modes and sectors while maintaining public support, but the resultant compromises adversely affect efficiency in pricing and supply. The contract assigns all demand risk for the tolled BOT segments to the concessionaire, while assigning policy and some network risks to the Government through the financial balance clause. Poor demand for the greenfield toll routes dampened the venture’s financial prospects, which may result more from Portugal’s economic crisis than government or concessionaire mismanagement. The parties have since entered arbitration proceedings, and the national road authority has taken on responsibilities for the inner-ring highway (55).

The DL attempts to extend Portugal’s extensive highway PPP program and user-pay concepts into a major urban area, while fostering integrated investment and management. But, combining toll routes in low demand areas with free routes in congested areas creates financial imbalances and risks, while not introducing road pricing where needed. The need to finance ring road improvements causes higher tolls on unproven radial routes, with initial traffic estimates indicating unexpectedly low traffic on the tollroads. Furthermore, the short (five-year) time-frame of the M&O contract mostly eliminates potential life-cycle-based management and cost benefits.

**London: The M25**
London’s M25, a circumferential highway around Greater London, is not a “typical” PPP; the private partner assumes no demand risk. Nonetheless, the project involves a long-term contract between government and an infrastructure operator, representing an extreme among the case studies. In contrast to SR91 and ETR, the M25 remains under public control for the investment scope, sacrificing road pricing and demand risk transfer.

In 2009 the UK Highways Agency (HA) contracted a 30-year PPP to widen 200-km of the M25 and maintain and operate the entire network (including 200-km of feeder routes). Remuneration is based on meeting outcome-oriented performance requirements (56). Although consultants recommended toll financing (57), HA tendered the PPP without tolling, anticipating an eventual, yet-to-happen, national road pricing regime (58). Deferring on pricing, the concession focuses instead on private-sector incentives for life-cycle management through performance-based payments.

Decoupling pricing and supply decisions has consequences for fiscal equivalence. The National Audit Office suggests that the HA-specified investment program neglected a potentially less costly option involving peak-hour use of shoulder lanes (58). Although the Madrid and Porto cases suggest problems with toll-financing suburban highway capital improvements in less dense areas with alternative routes, the high-demand M25 has a long performance record.

Interestingly, while the M25 provides critical metropolitan mobility and practically bounds the Greater London Authority (GLA), the metropolitan government had little involvement. Still, HA appropriately treated the M25 as an integrated network and, by bundling a system of potential serial and substitute routes, internalized network decision-making under a unified structure. Not including tolls eliminates monopoly pricing risks but also fails on the key pricing-related market efficiency SMM objectives. Time will tell if, and how, any eventual national road pricing scheme improves the efficiency of M25 corridor management and investment.

**CASE SYNTHESIS**

The cases reveal mixed “success” in supporting SMM objectives. Table 3 summarizes qualitative judgments on each case’s relative performance; Grillo (25) provides details across all criteria. As space precludes presenting depth and nuance, this synthesis concentrates on identifying trends relating back to the theoretical relationships between PPPs, the broader institutional setting, and SMM.

Generally, the cases provide varied evidence that ex-ante adherence to fiscal federalist principles increases compatibility between PPPs and SMM at the project level. CityLink probably comes closest to making the fiscal federalism case. The authority created to oversee the implementation of the CityLink PPP seems to have done a responsible job of balancing market efficiency and SMM. While not without detractors, CityLink made progress on road pricing, integrating with environmental and land use/development concerns, and ensuring balance in public value and private returns on investment. The fiscal federalism is state-, not metropolitan-driven. Victoria integrates land use and transportation planning, coordinating planning with Greater Melbourne’s municipalities to support an integrated, metropolitan approach to transportation policy, including roadway PPPs. In fairness, however, much of Melbourne’s progress towards integrating metropolitan transportation and land use planning occurred post CityLink.

SR-91 and ETR developed in state/provincial contexts similar to CityLink, except that local and regional governments have greater autonomy and power. In these two cases, however,
coordinating private highway finance with broader transportation system and land use development across multiple jurisdictions proved difficult. The shortcomings appear less associated with fiscal federalist-related institutional issues. Instead, the problems apparently arose from a lack of contract flexibility consummate with risks associated with greenfield projects.

Chile and the UK are essentially unitary democracies with heavily centralized transportation policy structures (the GLA is an exception in the UK, but the M25 lies just outside GLA’s jurisdiction). The M-25 may have been designed to mitigate negative spillovers to metropolitan mobility and land use, but the lack of risk transfer to private partners (and failure to introduce road pricing) meant that privatization missed opportunities for greater market or economic efficiency in pricing and design. Unitary national government combined with decentralized administration enabled a relatively integrated approach to transportation investment in Santiago, but highways are a notable exception. MOP’s implementation of highway PPPs largely outside of normal metropolitan planning structures likely contributed to public backlash. The project’s eventual relative success in balancing market efficiency and SMM can be partially attributed to community pressures to address environmental and social equity concerns.

Spain and Portugal are federal and unitary, respectively, but the PPPs studied exhibited similar outcomes. Both disappoint on nearly all PPP and SMM objectives, primarily due to poor project designs. Recent economic crises also likely contributed.

So, the cases reveal little consistent evidence regarding ex ante fiscal federalism-consistent institutional structures and PPP performance towards SMM. What about the converse? Are metropolitan highway PPPs leading towards better institutionality and SMM? Not necessarily. CityLink is illustrative. Melbourne’s suburban EastLink project is implemented in a similar institutional environment as CityLink, albeit with a more peripheral alignment, but reportedly has not performed as well financially. Regarding fiscal equivalence, introducing pricing on existing un-tolled roadways remains politically difficult under any institutional structure, including PPPs. However, CityLink and the CN introduced pricing on existing highway links as part of large-scale capacity improvement projects. The larger network cases either avoided pricing altogether (M25) or priced new uncongested roads rather than existing congested links (MMCs, DL). An apparently emerging approach in metropolitan highway network PPPs, where the public sector remunerates concessionaires through availability payment schemes, also counters the idea of PPPs serving as a road pricing “Trojan Horse.” This approach has now been partially adopted in a more recent network concession in Greater Lisbon (Portugal) (55). While apparently practical, this approach conflicts with market efficiency and SMM efficiency objectives. Separating some or all elements of pricing and demand risk from supply decisions counteracts many of the economic efficiency (and political) arguments for PPPs, as articulated in contract and property rights theories.

The cases provide limited support for a link between greater PPP size/scope and SMM. The European projects aim to internalize relevant transportation system network effects through greater project geographic scope and network scale; however, these particular cases fail to move towards a more system-optimal pricing regime, pricing the wrong parts (MMCs and DL) or not at all (M25). Two smaller-scale projects configured through city centers, CityLink and CN, suggest that project delivery in areas of mature mobility and land use patterns might confer some stability and relative predictability of use and capacity needs. Nearly all the suburban PPPs (SR91, ETR, the MMCs, and the DL), regardless of size, experienced wide variability in project
Zegras, Grillo

finances, leading to financial and/or public acceptability problems. As an overall program (rather than just a PPP), ETR has in many ways proven a financial and policy success. Its public acceptability problem is as much about politics and process as fairness and equity.

Spatial elements appear relevant. The CityLink and CN projects, routed directly through city centers, provide expedited highway services in areas without comparable direct alternatives (arguably, monopolies). Thus, quality of alternative links and configuration of the highway network may be more important than size and scope. Brownfield or partial brownfield settings contributed to more predictable environments in which to consider other metropolitan system impacts and account for them contractually. At the same time, project alignments through developed, inhabited areas helped reveal true inter-system and -sectoral costs, allowing for greater up-front consideration and mitigation. Suburban PPPs may be disadvantaged in that unintended consequences may not materialize until well after project delivery. Context matters.

CONCLUSIONS
Do sustainability and privatization, two buzzwords in early 21st century metropolitan mobility debates, enhance each other? Theoretically, a fiscal federalist environment can make progress in harmonizing PPP market objectives with sustainability principles of efficiency, integration, public acceptability, and technological innovation. This paper explored the relationship between institutional settings and highway PPPs at different geographical scales and project scopes to evaluate relative “success” with respect to SMM.

The evidence for fiscal federalism is mixed, as good and bad governance occurs in different institutional environments. Greater involvement of the private sector can support some elements of SMM, especially efficiency-related objectives. But privatization will not solve the underlying institutional problems that have weakened the quality and financial stability of metropolitan mobility systems. Government cannot simply abdicate its responsibilities to the private sector.

The cases suggest that spatial context matters. Highway PPPs, greenfields especially, suffer from conflicting jurisdictions and uncertainties in future use and surrounding land development. Some authorities have tried to address network spillovers in PPPs by enhancing their size and scope, but often sacrificing market efficiency and SMM principles. Two projects that may have better harmonized market efficiency and SMM were partial brownfield projects through city centers, where monopolies on quality of service mitigated demand risks while existing land use and travel patterns probably conveyed greater predictability of intra- and inter-system impacts. The latter led to contract structures more explicitly accounting for these variables, whether by explicit design (CityLink) or through the efforts of organized community interests (CN). The former case might have been aided by a more explicitly fiscal federalist design, while the latter may represent the “Trojan Horse” argument. These initial insights warrant further investigation as the body of evidence on metropolitan highway PPPs increases.

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Zegras, Grillo


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Zegras, Grillo


List of Tables

TABLE 1  The sustainable metropolitan mobility (SMM) framework

TABLE 2  Overview of case studies

TABLE 3  Evaluation of case studies against SMM objectives
### TABLE 1 The sustainable metropolitan mobility (SMM) framework

<table>
<thead>
<tr>
<th>Principles</th>
<th>Objective</th>
<th>Supporting Theory</th>
<th>Possible Indicators of “Success”</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Efficiency</strong></td>
<td>Project-oriented productive efficiency</td>
<td>• Public Finance Theory (Productive Efficiency)</td>
<td>• Bundles construction, operations, and management</td>
</tr>
<tr>
<td></td>
<td>Pricing optimizes demand for the asset</td>
<td>Same as above, plus: • Public Finance Theory (Allocative Efficiency – Use) • Network Economics (MSCP, Second-best Pricing, etc.)</td>
<td>• Life-cycle cost management • &quot;Revealed&quot; demand justifies capacity availability • User fee revenues meet expectations • Method for re-investing/re-distributing excess revenues</td>
</tr>
<tr>
<td><strong>Integration</strong></td>
<td>Efficiency of investment for the transportation and related metropolitan systems</td>
<td>Same as above, plus: • Public Finance Theory (Allocative Efficiency – Dynamic) • Institutional and Organizational Theory (Transaction Costs, etc.)</td>
<td>• Introduces road pricing • Time-variant pricing • Dynamic pricing • Asset planned within broader transportation network • Ability to manage corridor as an inter-modal transportation system • Evidence of mutually-beneficial renegotiations/contract changes • Evidence of project meeting corridor mobility objectives • Evidence that project represented best-known transport alternative</td>
</tr>
<tr>
<td><strong>Public Acceptability</strong></td>
<td>Investment supports societal goals</td>
<td>Same as above, plus: • Normative Economics • Political Economy-Derived Theories</td>
<td>• Consistent with plan and/or ex-ante economic evaluation • Public acceptability of electronic tolling • Long-term, stable relationship between public and private partners • Broad stakeholder perception of fairness and equity of project &amp; contract</td>
</tr>
<tr>
<td><strong>Innovation</strong></td>
<td>Employs state-of-the-art technology for pricing and management</td>
<td>Cross-cutting criterion: Required to implement theoretically “optimal” approach</td>
<td></td>
</tr>
</tbody>
</table>
### TABLE 2 Overview of case studies

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Los Angeles, USA</th>
<th>Toronto, Canada</th>
<th>Melbourne, Australia</th>
<th>Madrid, Spain</th>
<th>Santiago, Chile</th>
<th>Porto, Portugal</th>
<th>London, UK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highway PPP</td>
<td>SR91</td>
<td>407 ETR</td>
<td>CityLink</td>
<td>R2, R3, R4, R5, and M-50</td>
<td>Costanera Norte</td>
<td>Douro Litoral</td>
<td>M25</td>
</tr>
<tr>
<td>Continent</td>
<td>North America</td>
<td>North America</td>
<td>Australasia</td>
<td>Europe</td>
<td>South America</td>
<td>Europe</td>
<td>Europe</td>
</tr>
<tr>
<td>Country GDP per Capita (2008 US$)</td>
<td>45,230</td>
<td>45,166</td>
<td>48,253</td>
<td>36,061</td>
<td>10,091</td>
<td>22,805</td>
<td>43,544</td>
</tr>
<tr>
<td>Legal Traditions</td>
<td>Common Law</td>
<td>Common Law</td>
<td>Common Law</td>
<td>Civil Law</td>
<td>Civil Law</td>
<td>Civil Law</td>
<td>Common Law</td>
</tr>
<tr>
<td>Metro Area Pop. (2006)</td>
<td>12.2 million</td>
<td>5.2 million</td>
<td>3.7 million</td>
<td>5.2 million</td>
<td>5.7 million</td>
<td>1.3 million</td>
<td>7.6 million</td>
</tr>
<tr>
<td>Roadway Length</td>
<td>~16 km</td>
<td>68 km (initial)</td>
<td>22 km</td>
<td>175.5 km (radial)</td>
<td>42.4 km</td>
<td>76.2 km (radial)</td>
<td>~100 km</td>
</tr>
<tr>
<td></td>
<td>40 km (new)</td>
<td></td>
<td>85.4 km (ring)</td>
<td>53 km (ring)</td>
<td></td>
<td>~400 km (M&amp;O)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>leased in 1999)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary Motivation</td>
<td>Financial</td>
<td>Financial/Political</td>
<td>Value for Money</td>
<td>Financial</td>
<td>Financial</td>
<td>Value for Money</td>
<td></td>
</tr>
<tr>
<td>Development Cost (US$)</td>
<td>135 million</td>
<td>~1.1 billion</td>
<td>~1.3 billion</td>
<td>~1.9 billion</td>
<td>$384 million</td>
<td>~1.5 billion</td>
<td>~8.8 billion</td>
</tr>
<tr>
<td></td>
<td>(initial)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(est.)</td>
</tr>
<tr>
<td>Contract Type*</td>
<td>BTO</td>
<td>BOT</td>
<td>BOT/BOOT</td>
<td>BOT + DBB</td>
<td>BOT</td>
<td>BOT/M&amp;O</td>
<td>DBFO</td>
</tr>
<tr>
<td>Road Typology†</td>
<td>Radial Suburban</td>
<td>Radial Suburban</td>
<td>Inner-urban</td>
<td>3 Radial</td>
<td>Radial Suburban</td>
<td>3 Radial</td>
<td></td>
</tr>
<tr>
<td></td>
<td>HOT Lanes</td>
<td>and Downtown</td>
<td>Connector and</td>
<td>Suburban and 1</td>
<td>Suburban with</td>
<td>Suburban and 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bypass</td>
<td>Downtown Bypass</td>
<td>Circumferential Urban Ring</td>
<td>Downtown Tunnel</td>
<td>Circumferential Urban Ring</td>
<td></td>
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<tr>
<td></td>
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</tr>
</tbody>
</table>

### TABLE 3 Evaluation of case studies against SMM objectives

<table>
<thead>
<tr>
<th>Objective</th>
<th>Indicator of “Success”</th>
<th>SR 91</th>
<th>ETR</th>
<th>CityLink</th>
<th>MMCs</th>
<th>CN</th>
<th>Douro Litoral</th>
<th>M25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pricing optimizes demand for the asset (Efficiency)</td>
<td>Bundles construction, operations &amp; management</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>Life-cycle cost management</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td>P</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>“Revealed” demand justifies capacity availability</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td></td>
<td>User fee revenues meet expectations</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Method for re-investing/re-distributing excess revenues</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td></td>
<td></td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>Project-oriented productive efficiency (Efficiency)</td>
<td>Introduces road pricing</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time-variant pricing</td>
<td>Y</td>
<td>Y</td>
<td>P</td>
<td></td>
<td></td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Variable pricing based on marginal costs</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Efficiency of investment for the transportation and related metropolitan systems (Integration)</td>
<td>Asset planned within broader transportation network</td>
<td>P</td>
<td>P</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>Ability to manage corridor as an inter-modal transportation system</td>
<td>P</td>
<td>P</td>
<td>Y</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>Evidence of mutually-beneficial renegotiations/contract changes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Evidence of project meeting corridor mobility objectives</td>
<td>P</td>
<td>P</td>
<td>Y</td>
<td>P</td>
<td>P</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td></td>
<td>Evidence that project represented best-known transport alternative</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>P</td>
<td></td>
</tr>
<tr>
<td>Investment supports societal goals (Public Acceptability)</td>
<td>Consistent with plan and/or ex-ante economic evaluation</td>
<td>P</td>
<td>P</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>P</td>
<td>Y</td>
</tr>
<tr>
<td></td>
<td>Public acceptability of electronic tolling</td>
<td>P</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>P</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Long-term, stable relationship between public and private partners</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td></td>
<td>Broad stakeholder perception of fairness and equity of project &amp; contract</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>P</td>
<td>P</td>
</tr>
</tbody>
</table>

"Y" = Fulfilled “P”=Partial Fulfillment; Otherwise Non-Fulfillment