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YSSP Report
Young Scientists Summer Program

Scaling-up Public Investment for Low-Carbon Urban Transit: Lessons from Mexico and Peru

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Approved by

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Abstract

Under what conditions do governments in emerging economies scale-up public investment for mass transit systems in cities? In addressing this policy question, this project develops a political economic explanation of sustainable transport investment in middle-income economies. It moves beyond political will and individual leadership as explanatory factors and instead offers a more structural understanding of when political support for accelerated public investment is likely to emerge. As its research design it employs a comparative policy analysis of public investment programs for Bus Rapid Transit (BRT) systems in Mexico and Peru, two middle-income democracies in Latin America. Unlike Mexico, which deployed 11 BRTs between 2003 and 2017, Peru adopted a single BRT corridor in 2010 and never developed a national investment program, despite substantial multilateral assistance. I argue that the variance in these policy outcomes (scaled-up investment in Mexico vs. meddled investment in Peru) can in part be explained by how investment decision-making is shaped by the relationship between national and sub-national decision-makers, and by how this relationship is conditioned by institutions. My methods combine process tracing and expert interviews. The results of the empirical assessment generally support the argument, and link to several ongoing research debates at IIASA, including political feasibility (Brutschin et al. 2021), diffusion of policy and innovation (e.g., Wilson et al. 2020; Zimm 2021), decent living standards (e.g., Rao and Min 2018; Kikstra et al. 2021), low-energy demand scenarios (e.g., Grubler et al. 2018), and scenario design for global energy modelling.

Keywords: Public investment; mass transit; cities; political economy; Mexico; Peru

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Introduction

Carbon emissions from cities are projected to increase 50% by 2050, compared to 2013 (IEA 2016). Nearly 90% of the projected growth in urban primary energy demand is expected to occur in cities in low- and middle-income economies (IEA 2016; cf. World Bank 2010). Carbon emissions from transport are particularly worrisome (Seto et al. 2014). Without policy change, emissions from transport could nearly double globally from 7.0 $GtCO_2eq$ in 2010 to 12 Gt CO_2eq per year by 2050 (Creutzig et al. 2014). The Covid-19 pandemic is unlikely to change this trend in the medium- and long-run and could even accelerate it (Quéré et al. 2020; World Bank 2020a).

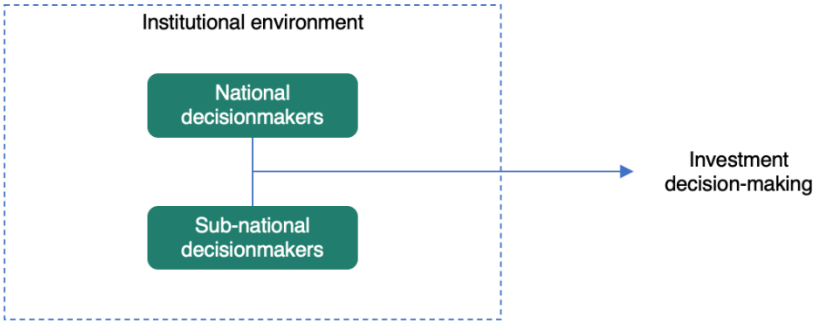
Transport research has made significant headway in advancing our understanding of how cities can more effectively decarbonize urban transport (Dalkmann and Brannigan 2007; Banister 2008; Hidalgo and Huizenga 2013). The Avoid-Shift-Improve framework, for instance, has been tremendously influential in reorienting transport policy objectives away from optimizing the flow of cars to optimizing trips (Hidalgo and Huizenga 2013).[1] We now also know that most future greenhouse gas (GHG) emissions from transport are expected to come from private vehicles running on fossil fuels, enabled by changes in urban form that favor cars (World Bank 2016; Creutzig et al. 2016, 2014; Jones and Kammen 2014). This creates a particularly urgent need to present alternatives to private vehicles motorization—especially the deployment of urban mass transit systems (Lindau, Hidalgo, and Lobo 2014; Creutzig et al. 2016; Ürge-Vorsatz et al. 2018).

Surprisingly, however, transport policy has not yet taken full advantage of insights from comparative political economy to accelerate investment for low-carbon public transit. While transport scholarship often acknowledges that investment for urban transport projects can be highly political (e.g., Ardila and Menckhoff 2002; Wu and Pojani 2016), especially when state capacity is weak (cf. Post and Murillo 2013; Post 2018), studies tend to reduce political questions either to individual leadership (e.g., "mayor X was critical") or to political will (e.g., "project Y lacked political will"). Comparative political economy offers tools and theory which can develop a richer and more nuanced understanding of how broader social conditions foster political support for investments in sustainable transport technologies (e.g., Bergara, Henisz, and Spiller 1998; Henisz 2002; Henisz and Zelner 2006). This project does precisely this, helping to extend a critical research frontier

I develop the following argument: that decisions whether to invest in low-carbon urban mass transit are significantly shaped by the relationship between national and sub-national policymakers; a relationship that is in turn conditioned by the institutional environment (Figure 1). This relationship will either enable or disable public investment for mass transit.

[1] This captures the 'demand and needs' perspective, in terms of mobility services for human wellbeing, which has been developed by IIASA research (e.g., Rao and Min 2018).

Figure 1: Main argument



Notes: Investment decision-making is shaped by the relationship between national and sub-national decisionmakers, as well as by the institutional environment.

To examine this argument, I conduct a comparative policy analysis of public investment for Bus Rapid Transit (BRT) systems in Mexico and Peru, two middle-income democracies in Latin America. BRTs are bus-based mass transit systems, which, evidence shows, have contributed to GHG mitigation in emerging economies (Mejía-Dugand et al. 2013; Hidalgo 2012; Wirasinghe et al. 2013). Unlike Mexico, which deployed 11 BRTs between 2003 and 2017, Peru adopted a single BRT corridor in 2010 and never developed a national investment program, despite substantial multilateral assistance.[2] This project therefore asks the following case-specific question: why did Peru, unlike Mexico, never adopt a national transport program? To approach this empirical question, I develop a theoretical framework around two sets of key independent variables: interests and institutions. The research design thereby follows a classical comparative political economy approach. As my methods, I combine process tracing and expert interviews.

The remainder of this report is structured as follows: Section 2 outlines the theoretical framework. Section 3 summarizes my methodology, including the research design, case selection, and research strategy. Section 4 presents the main findings. Finally, in section 5 I summarize conclusions that can be drawn from the present findings, and point to several avenues for further research and application.

Theoretical Framework

To structure the methods and guide the data collection, I begin with the following theoretical framework, which helps to define and relate variables that may vary across the cases.

Interests

Three different sets of interests are expected to shape the relationship between national and subnational decisionmakers. The first set encompasses *subnational interests* (e.g., Bulkeley 2011; Luque-Ayala, Marvin, and Bulkeley 2018; Andonova, Hale, and Roger 2017). Several different

[2] Throughout this paper the term 'BRTs' refers to 'BRT systems', as opposed to 'BRT lines'. A single system can have multiple lines.

mechanisms could be at play. For example, sub-national governments might demand financial support from their national government to implement projects, such as urban transit. Such demand could pressure national decisionmakers to issue a national support program, which would then explain why certain countries have scaled-up their public investment. Alternatively, public investment might be scaled-up because of dynamics associated with fiscal federalism (e.g., Gadenne and Singhal 2014; Kemmerling and Stephan 2015): if the national government finances a transit project in one city, other cities in the same country could demand to be treated equally and request national financing as well, even in the absence of a common support program. Yet another potential explanation could be pork barrel politics (e.g., Evans 2011)—national decisionmakers might cater to sub-national interests as a strategy to buy political support at the national level.

The second set is *national interests*. Here too various mechanisms might be unfolding. Public investment in urban transit could simply reflect national policy preferences (e.g., Simon 2017). A leftist government, for instance, could be inclined to divert public resources away from highway construction to public transport projects for normative reasons. Or public investment could be scaled-up because of a campaign promise by the head of state or their party (e.g., Keefer and Vlaicu 2017). In this case, public investment might vary with election cycles. Another explanation would be major international sports events (e.g., Wood 2019), which are expected to lead to an influx of tourists. Several studies have suggested that national investment in public transport in Brazil and South Africa, for instance, can be partly explained by how both countries hosted the FIFA World Cup.

The third set encompasses *international interests*. We know that international interest, for instance by multilateral development banks or global non-profits, can influence infrastructure projects in low- and middle-income countries (e.g., Post and Murillo 2013). Such interests could also influence public investment around subnational transit. Just like how scaled-up investment might reflect national policy preferences, scaled-up investment could equally reflect international policy preferences and the choices of non-national actors to focus on particular countries.

Institutions

Alongside interests, institutions will also shape the relationship between national and subnational decisionmakers. Institutions determine "the rules of the game" (North 1990). They confer the formal and informal rules, roles, and responsibility of political governance, and structure how sub-national, national, and international interests interact with each other.

I expect three institutional features to be of particular importance in the context of urban transit projects. The first refers to *regulatory and fiscal decentralization* (e.g., Herrera and Post 2014; World Bank 2001; Bardhan and Mookherjee 2006). In some institutional environments, sub-national entities might be endowed with the formal regulatory responsibility to govern urban transit. In other contexts, this responsibility could be conferred to the national government. Depending on which level of government has formal authority, either subnational or national policymaking will represent the main political-economic arena within which the distribution of public outlays must be negotiated. Fiscal decentralization, in turn, will determine the extent to which sub-national entities can rely on own-source revenue to fulfill their respective regulatory responsibilities (e.g., Bahl 2010; Bird and Slack 2013).

The second feature captures *institutional checks and balances* (e.g., Levy and Spiller 1994; Henisz and Zelner 2006; Henisz 2002). Examples of checks and balances include independent financial and technical review of projects, rules and processes that govern access to public resources, and legal systems that protects property rights. Such checks and balances will create veto players whose policy preferences condition investment decision-making. For instance, if urban projects need to be approved by a national Ministry of Transport before a municipal government can receive inter-governmental transfers, then the Ministry of Transport will act as a veto player. Its national policy preference will thereby come to shape sub-national projects.

Finally, I would expect *technical capacity* to be a key institutional feature with significant implications for urban transit projects (e.g., Flores Dewey 2013). For instance, even if sub-national governments are endowed with both formal regulatory responsibility and rule-based access to external financing, projects will not materialize if local officials cannot technically execute transit system planning and implementation nor convince (inter-)national actors that funding should be disbursed. Technical capacity will thus capture a critical background condition for successful disbursement of mass transit investment.

These variables capture my theoretical framework. To link the variables in this theoretical framework, I hypothesize that investment decision-making around urban mass transit infrastructure is shaped by the relationship between national and sub-national decisionmakers. On the one hand, this relationship will be formed by sub-national, national, and international interests. On the other, this relationship will be structured by the institutions which govern how sub-national, national, and international interest interact with each other. While this framework cannot be assumed to be complete, given the inductive nature of the project, it serves as a theoretical starting point.

Methodology

Research Design

To examine my argument, I conduct a comparative policy analysis of public investment programs for Bus Rapid Transit (BRT). BRT systems are commonly defined as a "flexible, rubber-tired form of rapid transit that combines stations, vehicles, services, running ways and information technologies into an integrated system with strong identity" (Levinson et al. 2003). BRTs present an ideal case for examining the political economy of urban transit investment: they offer significant passenger capacity at relatively low cost (Mejía-Dugand et al. 2013), evidence a track-record of urban carbon mitigation (Lindau, Hidalgo and Lobo, 2014), have been designated as a critical low-carbon urban innovation by major development institutions (e.g., Lazer, Khandelwal, and Wellman 2020; UN-Habitat 2020), and combine accessibility and affordability (cf. Kikstra et al. 2021; Rao and Min 2018). Notably, over half of all transport projects under the Clean Development Mechanism were BRT projects (UNFCCC, 2020). Focusing on one type of transport infrastructure helps control for cross-system variation, and thus makes investment decision-making more comparable across political economic contexts.

It is striking how unevenly distributed BRT deployments have been across low- and middle-income economies (Table 1). Over 70% of all BRT systems are located in just five countries, most of which, if not all, have had national BRT investment programs or derivatives thereof. Case studies in the BRT literature have tended to focus on sub-national comparisons at a system level, with single-city systems as the main unit of analysis, either within a country (e.g., Rizvi and Sclar 2014) or across countries (e.g., Scholl et al. 2015). Since this project seeks to explain variance in transport investment decision-making, and given the significant role that national investment programs seem to play, it employs a *country-level* comparative research design.

Table 1: Distribution of BRT Systems across Low- and Middle-Income Economies

Country	Region	BRT Systems [a]	Percent	Governance Type [b]	Regime Type [c]	Income Classification[d]
China	East Asia Pacific	23	25%	Unitary	Autocracy	Upper middle
Brazil	Latin America	15	16%	Federal	Democracy	Upper middle
Mexico	Latin America	11	12%	Federal	Democracy	Upper middle
India	South Asia	10	11%	Federal	Democracy	Lower middle
Colombia	Latin America	7	8%	Unitary	Democracy	Upper middle
All other		26	28%			
Total		92	100%			

Sources: (a) BRT+ Centre of Excellence and EMBARQ (2020), (b) Forum of Federations (2020), (c) Center for Systemic Peace (2020), (d) World Bank (2020). The table excludes BRT systems in high-income countries.

Case Selection

The case selection is informed by the results of a large-n survival model analysis of 92 BRT adoptions across 138 low- and middle-income economies between 1974 and 2017 (currently under peer-review).[3] Employing a broader political economy framework to explain variance in infrastructure deployment across a larger set of economies, it suggests that politically decentralized countries are significantly more likely to adopt BRT systems, yet this effect is driven by an interaction effect between political decentralization and democracy. In the absence of democratic governance, the effect of political decentralization turns negative. Employing a variety of different statistical models, the analysis also finds income and regional effects: countries are significantly more likely to adopt BRTs when they reach middle-income status and are in Latin America.

This project builds on these findings. Following a nested analysis approach (Lieberman 2005), the comparative case study compares variance in BRT investment programs across two middle-income democracies in Latin America characterized by varying degrees of political decentralization. Two economies are particularly well suited to serve this research design: Mexico and Peru. Mexico, a federal middle-income democracy, deployed 11 BRTs between 2003 and 2017, with significant financial support from the Public Transportation Federal Support Program (PROTRAM – *Programa de apoyo federal al transporte masivo*). Peru, a unitary middle-income democracy, in contrast, never developed a national transport investment program, despite substantial international assistance from the World Bank and the Inter-American Development Bank, and heavy involvement from EMBARQ, an international non-profit associated with the World Resources Institute (WRI). Peru opened a single BRT corridor in Lima in 2010, after a lengthy deployment process which started in 1997. The

[3] This work is from an earlier phase of my doctoral dissertation.

empirical question of this project therefore is this: why did Peru never adopt a national transport program akin to Mexico's PROTRAM?

Research Strategy: Process Tracing and Expert Interviews

To empirical analyze how a national investment program came about in Mexico and not in Peru, I combined process tracing with semi-structured expert interviews. My research strategy fell into four distinct steps. First, I identified and documented specific policy outcomes to approximate my main dependent variable: scaled-up public investment in Mexico vs. meddled public investment in Peru. For Mexico, this mainly meant delving into the institutional design of PROTRAM and documenting the various BRT systems that have been financed through the program. For Peru, I documented the *Metropolitano* system in Lima, which started operations in 2009, and the *Mistibus* project in Arequipa, which unfolded between 2008 and 2014.

Second, I conducted desktop research and document analysis to develop detailed timelines of major events that led up to the specific policy outcomes. Here, I used news sources, policy reports, and other types of primary and secondary sources to outline how PROTRAM came about in Mexico, how the *Metropolitano* system was developed in Lima, and how the *Mistibus* project in Arequipa ultimately failed. This helped identify major knowledge gaps and allowed me to uncover potential leads for expert interviews.

Third, using the detailed timelines, I developed interview guides, one for each of PROTRAM, Lima, and Arequipa. All three guides followed the same basic structure. A first set of questions helped clarify the policy outcomes (e.g., 'How does PROTRAM work?'). A second set formulated various versions of an open-ended question that prompted interviewees to formulate causal explanations of the policy outcomes (e.g., 'What explains the creation of PROTRAM?'). A third set confronted interviewees with hypotheses from the theoretical framework (e.g., 'To what extent, if any, does demand from cities help explain the creation of PROTRAM?). A final set helped triangulate findings from other interviews (e.g., 'I've been told X. To what extent, if any, would you agree with that explanation?').[4]

Fourth, I implemented the expert interviews (cf. Mikecz 2012; Turner 2010). This meant using email to reach out to my interview leads. I developed an Excel-based CRM tool to manage and track the recruitment process and snowball the interviewee sampling frame. Once an interviewee agreed to share their thoughts, I scheduled an appointment at their convenience, typically using Zoom, MS Team, or Google Meet. At the beginning of each conversation, I typically started by asking about the interviewee's background and training. This allowed me to frame the questions from the interview guide in terms of their specific expertise. I tried to formulate all questions as neutral and standardized as possible, to avoid biasing response. Towards the end of each conversation, I asked for additional interview leads and clarified the confidentiality of the exchange.

[4] The interview guides are available upon request and will be published as part of the supplementary materials of the peer-reviewed version of this report.

Table 2: Overview of interview process

	Peru	Mexico	Total
Pending	1	0	1
Tentative	0	0	0
Confirmed	4	1	5
Declined	1	0	1
Invalid email	0	1	1
Completed	10	15	25
Total	16	17	33

Status: 24 September 2021

As of 24 September, I had snowballed and completed 25 semi-structured expert interviews in this way (Table 2). Interviews lasted between 30 and 150 minutes, and on average took 60 minutes. The conversations were held either in English, Spanish, or German. Importantly, the interview process is still ongoing and will most likely not be completed until mid-October. The below presented results therefore must be interpreted with caution. For this report, all participants have been kept anonymous. A detailed Gantt chart with all research steps is listed in the Annex.

Findings

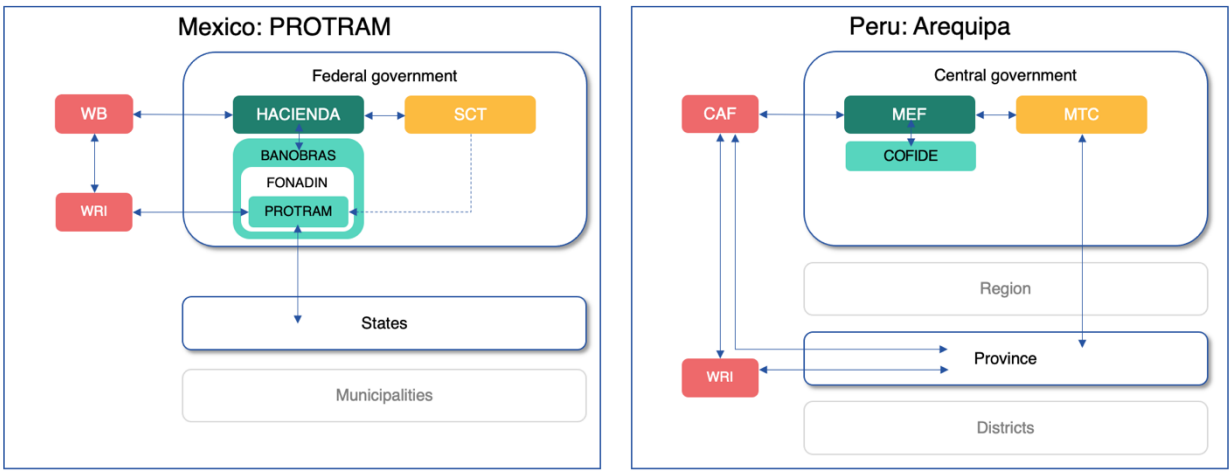
For reasons of space, I here synthesize the convergent evidence from the interview responses, rather than parsing particular statements by individual interviewees.[5] Overall, the comparative analysis supports my argument that investment decision-making around urban transit is shaped by the relationship between national and sub-national decisionmakers, and by how this relationship is conditioned by institutions. The main findings are schematically presented in Figure 2. In Mexico, the relationship between federal and sub-national actors is principally governed by the rules, roles, and procedures associated with PROTRAM. PROTRAM, in turn, is institutionally embedded within Banobras, one of Mexico's national development banks, which is controlled by Mexico's Finance Ministry (HACIENDA - *Secretaría de Hacienda y Crédito Público*). The interviews show how PROTRAM's rules, roles, and procedures have insulated urban transit projects from special interests and political meddling, and have thereby enabled public resources to be allocated to civil works that offer significant public benefits.

In Peru, in contrast, the relationship between the central and provincial governments is mainly enacted through the national Transport Ministry (MTC - *Ministerio de Transportes y Comunicaciones*). While the Finance Ministry (MEF - *Ministerio de Economía y Finanzas*) also acts as an important veto player, the Finance Ministry relies on the technical review of the Transport Ministry. Compared to Mexicos' Transport Ministry (SCT – *Secretaría de Comunicaciones y Transportes*), Peru's Transport Ministry therefore has significancy more leverage over urban transport projects. By

[5] In the peer-reviewed version the main findings will be backed up with additional quotes and references to primary and secondary sources.

extension, its policy preference in favor of capital-intensive rail projects in Lima has had an adverse effect on urban transport investment in secondary cities (cf. Robinson and Torvik 2005). Several BRT projects in Peru never materialized because of a clash in policy preferences between local authorities and the Transport Ministry. In the following, I further substantiate these observations by synthesizing the key findings regarding each dimension of the theoretical framework from section 2.

Figure 2: Main findings



Notes: Since Peru does not have a national program, the figure uses Arequipa's Mistibus project as an example. WB – World Bank; WRI – World Resources Institute; HACIENDA – Mexico's Finance Ministry; SCT – Mexico's Transport Ministry; BANOBRAS – one of Mexico's national development banks; FONADIN – Mexico's National Infrastructure Trust Fund; PROTRAM - Public Transportation Federal Support Program; CAF - Andean Development Corporation; MEF – Peru's Ministry of Finance; MTC – Peru's Ministry of Transport; COFIDE – Peru's national development bank. Please note, however, that the schematic representation is preliminary.

Interests

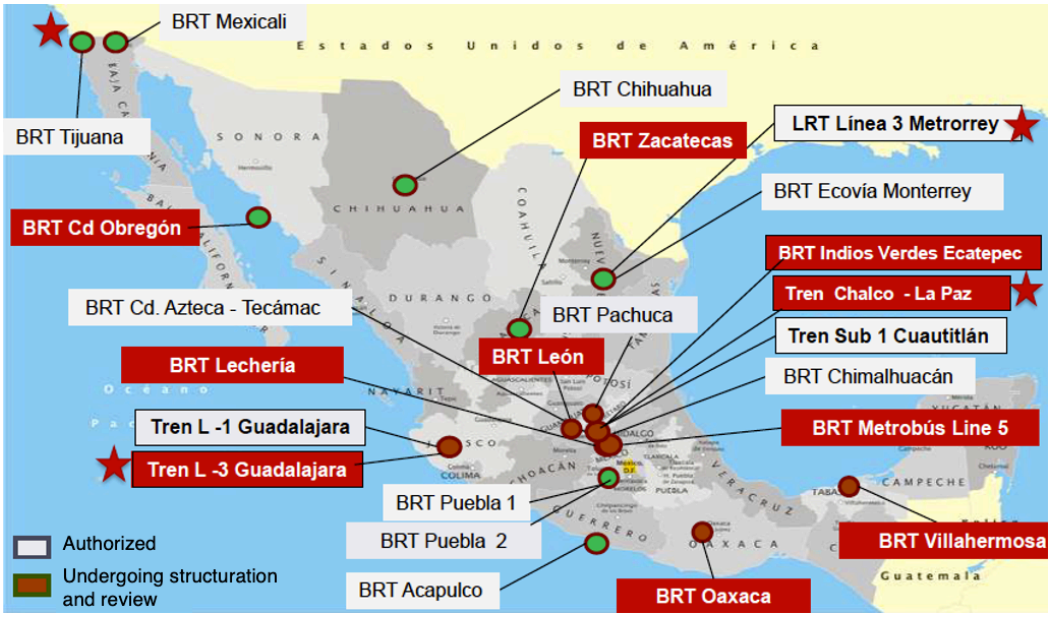
Subnational interests

Demand from cities – One major difference between Mexico and Peru is the number of their respective urban agglomerations. In Mexico, there are 35 cities with over 500,000 inhabitants. In Peru, there are only five cities with over 500,000 inhabitants. This difference suggests that, in aggregate, there are more urban interests in Mexico than in Peru. The interviews suggest, however, that this difference only created a more amenable backdrop condition for national investment in Mexico, but cannot itself explain the creation of PROTRAM. Process tracing shows how demand from sub-national governments in Mexico for federal funding only started *after* PROTRAM was launched in 2008. In fact, the Banobras felt compelled to organize a national tour to advertise the program across the country and stimulate interest from municipalities and states. The Arequipa case, in turn, indicates that cities in Peru were requesting financial support from the central government in the absence of a national investment program. I was also able to uncover conversations that occurred at Peru's Transport Ministry, while the project in Arequipa was already unfolding, about what a Peruvian national investment program could look like. In other words, while in Mexico demand from cities followed the issuance of PROTRAM, in Peru demand from cities preceded national support.

Fiscal federalism – Fiscal federalism indeed plays out in Mexico. PROTRAM projects are widely distributed across the country, which suggests that the program has sought to treat states equally (Figure 3). I was able to uncover at least one instance where PROTRAM funded an urban transport project in a city below 500,000 inhabitants because it was the capital of a state facing economic difficulties (interview w/ PROTRAM official, 2021). Interviews also revealed that Banobras is

sometimes called 'the bank of federalism', which might reflect an institutional culture that prefers such decisions. That being said, because demand from sub-national actors followed the creation of PROTRAM, and given moreover that Mexico's first BRTs were not funded with federal support, fiscal federalism can at best help explain the distribution of federal investment, but not necessarily its scaling-up. Peru, in turn, cannot have experienced fiscal federalism, because the country is governed as a unitary state.

Figure 3: Distribution of PROTRAM projects



Source: Mier y Teran (2013)

Pork barrel politics – I was not able to uncover any conclusive evidence that national transit investment has been exploited to buy state or municipal political support, neither in Mexico nor in Peru. That is not to say that special interests have not shaped BRT projects in either country. It does, however, suggest that pork barrel politics cannot necessarily explain the *creation* of PROTRAM in Mexico or the absence of a national program in Peru. This makes intuitive sense: if national interests were to try to buy state or municipal support through federal outlays, it would make more strategic sense to distribute outlays in an ad hoc way amenable to political influence, rather than through a rules-based federal program. I was able to find at least one urban transit project in Mexico with was motivated by a form of pork barrel politics, but the project was not financed through PROTRAM.

National interests

National policy preferences – National policy preferences have played a significant role in both Mexico and Peru. In Mexico the main national actor is Hacienda, which oversees both Banobras and, by extension, PROTRAM. Hacienda evidences a policy preference both in favor of urban transit investment and financial feasibility. Here it is important to remember that PROTRAM is not a BRT program, but a mass transit support program. In principle, it can also help finance urban rail projects. Given the economics of urban transit, cost-benefit analyses tend to point to BRT rather than subway as the more cost-effective intervention in medium-sized cities, which explains why PROTRAM has in effect mainly financed BRTs. This mechanism thus does not reflect an explicit modal or technology preference in favor of BRT, but rather a policy preference in favor of financial sustainability. In Peru, on the other hand, the main actor is the MTC, which evidences a modal preference in favor of subway systems, as confirmed by several interview subjects who are independent experts. The

reasons for this modal preference are complex but appear to involve a combination of regulatory responsibilities and political incentives.

Campaign promises – In Mexico, Hacienda's policy preference for urban transit investment is partially linked to President Felipe Calderón's political infrastructure platform. Calderon sought to present himself as "the president of infrastructure" (add reference). In 2007 he first created FONADIN by presidential decree, a federal trust fund for national infrastructure projects. In 2008, PROTRAM was created as one program under FONADIN. Similar to how Hacienda's policy preference is not necessarily in favor of BRT but rather in favor of financial sustainability, Caledorn's policy preference was not necessarily in favor of transit investment, but rather in favor of infrastructure investment. I posit that in the absence of these powerful national interests, PROTRAM would probably not have come about. In Peru, campaign promises have also played a role, but generally in disfavor of BRT. In 2003, Luis Castañeda was elected mayor of Lima based on a subway platform. Only after several unsuccessful attempts to execute the project, he eventually endorsed Lima's *Metropolitano* project. In 2006, Alan García was re-elected president of Peru, whereupon he completed Lima's metro project. He did not reveal significant interest in other forms of urban transit. This pattern, again, reflects strong political incentives in Peru to devote public investment to capital-intensive infrastructure projects in Lima.

International sports events – Neither Mexico nor Peru have hosted major international sports events, such as the FIFA World Cup or the Olympics, in recent history. Interviewees did not identify international sports events as an explanatory factor. In the context of this case study, I can therefore rule out this causal explanation from the literature.

International interests

Multilateral development banks – The involvement of multilateral development banks appears to have played a larger role in Peru than in Mexico. While in Mexico the World Bank was promoting urban transit as a strategy to mitigate urban air pollution as far back as the 1990s, both Mexico City's *Metrobus* BRT project and Banobras' PROTRAM instrument were mainly driven by domestic interests. The *Metrobus* system was led by Claudia Sheinbaum, who was then serving Mayor Manuel López Obrador as Environment Minister, and PROTRAM was led by Hacienda. The World Bank mainly acted as an adviser. In Peru, in comparison, there were times when the World Bank was the only BRT promoter. Lima's *Metropolitano* system would probably not have materialized without involvement from the World Bank.

Global non-profits – The World Resources Institute (WRI), a global non-profit headquartered in Washington DC, has played a role in both Mexico and Peru. However, the extent to which the NGO's involvement can help explain variance in the policy outcomes remains somewhat unclear. In Mexico, WRI founded the Center for Sustainable Transport (CTS) in 2003, a local branch which provided technical assistance to Mexico City during the *Metrobus* project. CTS also provided technical assistance to the World Bank, and, on request from Mexican authorities, helped developed an influential white paper on how to structure PROTRAM. Later, CTS was hired by Banobras to review projects under PROTRAM. Nevertheless, because WRI never had any formal political authority, it is unclear to what extent, if any, the creation of PROTRAM can be directly attributed to the NGO. A more plausible explanation is that WRI facilitated an enabling political context by providing independent technical capacity. In Peru, WRI tried to develop Arequipa's *Mistibus* BRT system as a domestic flagship project, but without success. In 2014, WRI closed its Arequipa office after it became clear that the project would not materialize. This suggests that WRI's technical capacity was ultimately insufficient to overcome domestic barriers. Within the context of this comparative analysis, these findings indicate that technical support is a necessary but insufficient explanatory factor.

Institutions

Regulatory decentralization – Mexico is a federal democracy characterized by three levels of governance: a federal, a state, and a municipal level. For historical reasons, regulatory responsibility for urban transport tends to belong to state governments. State governors are thus PROTRAM's key stakeholder. Peru is a unitary democracy characterized by four levels of governance: a national, a regional, a provincial, and a district level. Regulatory responsibility for urban transport in Peru belongs to provincial governments. Lima is an exception to this structure, where the regional and provincial levels coincide. The President of the Province of Lima is simultaneously the Governor of the Region of Lima and the Mayor of the District of Lima. What both Mexico and Peru therefore have in common is that urban transport is governed at a sub-national level. Varying degrees of regulatory decentralization can therefore not explain the variance in the policy outcomes. In fact, this finding further strengthens the comparative research design and thus the other findings, by controlling for regulatory decentralization.

Fiscal decentralization – The interviews moreover revealed that sub-national governments in both Mexico and Peru tend to suffer from lack of fiscal decentralization. While sub-national governments in both countries are responsible for urban transport, states in Mexico and provinces in Peru often lack sufficient own-source revenue to finance urban infrastructure projects. Both states and provinces therefore heavily rely on either inter-governmental transfers or sovereign guarantees from their respective national governments to access external financing. In either case, the national government acts as a key veto player. In Mexico, lack of fiscal decentralization has served as a key justification for the creation of PROTRAM.

Checks and balances – There are both differences and similarities regarding institutional checks and balances. One similarity is that both countries' Finance Ministry and Transport Ministry review urban projects before approval. However, the process by which they do so differs. In Mexico, urban transport projects are reviewed at multiple stages through the PROTRAM process. Certain steps of this process are common to all public investments in Mexico, such as a registry with Hacienda. Other steps are PROTRAM specific, such as technical review by both the Transport Ministry and a technical sub-committee with independent consultants. These steps create an evidence record, backed by technical justifications, which appear to limit the degree to which special interest can sway final decisions. In Peru, access to external resources is also contingent upon approval by the Finance Ministry, but this approval is solely contingent upon a technical review by the Transport Ministry. Compared to Mexico, this gives the Peruvian Transport Ministry more leverage over urban transport projects.

Technical capacity – The interviews confirm that secondary cities both in Mexico and Peru often suffer from lack of technical capacity, and that this lack can seriously jeopardize urban projects. However, technical capacity is highly unevenly distributed. In Mexico, for instance, select state and municipal governments evidence quite substantial capacity, for instance in Monterrey, Guadalajara, and Leon, alongside Mexico City—while others have little or none. In Peru, most technical capacity is concentrated in Lima. Here it is also important to note that Mexico's PROTRAM not only offers federal financial support, but also federal technical support. Banobras helps states and municipalities navigate the PROTRAM process, and thereby also helps cultivate or cover for gaps in capacity within sub-national governments and institutions.

The interviews revealed at least two additional important explanatory factors not present in the initial theoretical framework (Section 2). The first is the role played by *domestic demonstration projects* (cf. Mejía-Dugand et al. 2013). Mexico City adopted Mexico's second BRT in 2005, and Lima launched Peru's first and only BRT in 2010. Both systems were initially heavily criticized but have since gained broad social and political acceptance. Interviews confirmed that Mexico's Metrobus project contributed to the country's BRT surge, mainly because other states and municipalities saw its success and became motivated to develop their "own Metrobus". In Peru, Lima's *Metropolitano*

system appears to have at least partly inspired Arequipa's *Mistibus* project, but did not launch a national trend. This indicates that a domestic demonstration project acts as a necessary but insufficient factor for the creation of a national investment program.

The second unexpected finding relates to the role of *epistemic communities* (cf. Haas 2008). Many individuals in Mexico who contributed to the mobilization of federal funding for urban transit investment knew each other. Just to give one example, Claudia Sheinbaum, Mexico City's Environment Minister who led the *Metrobus* project, knew Professor Lee Schipper from her time as a PhD student at UC Berkeley. Lee Schipper, in turn, helped WRI secure grant support for the CTS, which first enabled the *Metrobus* project with technical assistance and later served Banobras as a technical advisor to PROTRAM. This network of professionals spanned actors at Hacienda, Banobras, the World Bank, and WRI, helped foster regulatory trust and stability, and thereby cultivated technical capacity.[6] In Peru, I was not able to uncover such a stable BRT coalition.

Conclusion

In this paper I leveraged insights from the comparative political economy of public outlays to better understand the structural conditions under which political support for urban mass transit is likely to emerge. I hypothesized that investment decision-making in significantly shaped by the relationship between national and sub-national decision-makers, and by how institutions determine the rules, roles, and responsibilities surrounding this relationship. To examine this argument, I conducted a comparative policy analysis of public investment programs for BRT in Mexico and Peru.

The empirical assessment, which combined process tracing and expert interviews, generally supports the hypothesis. In Mexico, the relationship between federal interests and state interests is governed through PROTRAM, which has insulated investment decision-making from special interests. While national policy preferences shape projects, they do so mainly by privileging financial interests. In Peru, in contrast, the relationship between national and provincial interests is mainly mediated by the national Transport Ministry, which evidences a policy preference in favor of capital-intensive rail projects. This helps explain why significant public resources are invested in Lima's metro system, at the expensive of more cost-effective transit interventions in both Lima and other secondary Peruvian cities.

This indicates that financial interests can play a critical role in enabling subnational mass transit projects. In Mexico, the policy preferences by Hacienda have played a more influential role than the policy preferences by the Transport Ministry. Important enabling factors include a critical threshold of number of cities to justify a national investment program; a national policy agenda that both prioritizes infrastructure investment and recognizes a gap between regulatory and fiscal decentralization; effective institutional checks and balances; and technical capacity. International interest can, under certain conditions, also play an enabling role.

These findings offer a novel explanation for the structural conditions under which 'political will' for low-carbon transit investment is likely to emerge. A monolithic or undifferentiated notion of 'political will' for low-carbon mass transit investment can instead be understood as emerging from alignment of interests and policy preferences of key actors and veto players across levels of government. The theoretical frame and empirical findings provide a ready starting-point for future research, which can amass evidence from additional political-economic contexts to further testing and refinement. It would be invaluable, for example, to study how and under what conditions other

[6] Compared to a tightly knit community characterized by strong personal relations, external consultants, who 'drop-in' to conduct a handful of technical studies but then leave again, cannot offer the same quality of capacity.

national investment programs for low-carbon mass transit have come about, for instance in Columbia, India, South Africa, and Brazil.

The work also generates productive dialogue with existing research debates at IIASA. For one, beyond the specific case of BRT, the findings can be examined to shed additional light onto common drivers and enabling conditions of low-carbon investment, broadly conceived, and thereby contribute to emerging debates around political feasibility of particular decarbonization pathways (e.g., Brutschin et al. 2021), the diffusion of low-carbon innovation and policy (Wilson et al. 2020; Zimm 2021), and how to achieve decent living standards (Kikstra et al. 2021; Rao and Min 2018). For another, scenario designs for global energy modelling exercises often rest on coarse assumptions of future deployment of technologies such as BRT. Case-based insights, like those developed here, can help to identify novel and realistic pathways to transport decarbonization (e.g., Lamb et al. 2019), and thereby, for instance, contribute to low-energy demand scenarios (e.g., Grubler et al. 2018). They can also help uncover the necessary political-economic conditions for realizing those pathways, thus guarding transport policy and sustainability research against irrelevance.

Transport policy research is just beginning to leverage insights from comparative political economy to speed-up the usage of low-carbon mass transit systems. As GHG emissions form urban transport continue to escalate over the next few decades, finding creative and pragmatic policy levers to accelerate low-carbon transport solutions will only become more urgent.

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Annex

Week	22	23	24	25	26	27	28	29	30	31	32	33	34	Sep	...
Monday	**31-May**	**07-Jun**	**14-Jun**	**21-Jun**	**28-Jun**	**05-Jul**	**12-Jul**	**19-Jul**	**26-Jul**	**02-Aug**	**09-Aug**	**16-Aug**	**23-Aug**		
Conduct systematic literature review															
Assemble interview sampling frame															
Develop timeline for Arequipa, Peru															
Develop interview guide for Arequipa, Peru															
Kick off interviews for Arequipa, Peru															
Develop timeline for Lima, Peru															
Develop interview guide for Lima, Peru															
Kick off interviews for Lima, Peru															
Develop timeline for Mexico															
Develop interview guide for Mexico															
Kick off interviews for Mexico															
Complete final interviews															
Analyze results w/ MAXQDA															
Draft YSSP report														30 Sep	
Draft manuscript															Oct-Dec
Workshop results and manuscript															Oct-Dec
Publish manuscript															2022