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Accessibility Analysis of the South Commuter Railway Project of the Philippines

KEY POINTS

- Aside from reducing travel time and costs, large urban transport infrastructure projects can help fill gaps in the labor market by closing the distance between job seekers and job opportunities. This increases labor market matching efficiency and improves quality of life as well as productivity.
- The South Commuter Railway (SCR) project will make it easier and faster for workers in at least 48 cities and municipalities in Metro Manila and Southern Luzon to get to work. Workers in cities and municipalities with SCR stations will gain access to more than 300,000 jobs on average—an increase of 15.3% in the south and 8.5% in Metro Manila.
- The areas within and outside of Metro Manila that make up the SCR catchment area currently differ considerably in wages, job accessibility, and other labor indicators. Poorer areas tend to have low access to more and better jobs.
- Most users of the urban rail service are from the higher income groups. Operated efficiently and priced optimally, the SCR service will encourage people across more income groups to shift to rail as their preferred form of transport.

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INTRODUCTION

Cities, and urban areas in general, contribute to economic growth and improve public welfare. Economic activities are often concentrated in cities, which offer better infrastructure and services and thus higher efficiency and productivity. The promise of more opportunities, better amenities, and higher income draws not just businesses but also workers. Cities play a critical role as a labor market by efficiently matching workers with jobs. However, the competitiveness of cities deteriorates if investments in necessary infrastructure, such as mass transport systems, cannot keep up with their rapid growth. Travel from one place to the other in a city needs to be both affordable and fast to move people, goods, and services smoothly.

This is one of the fundamental challenges facing megacities in Asia and the Pacific including Metro Manila. Home to 12 million people, Metro Manila as the capital of the Philippines is among the most severely congested cities in the world (ADB 2019). Millions of workers from within the metropolis and surrounding provinces commute to their workplaces every day, but the public transportation system is far from adequate and efficient.

The city's rail network has only three rapid transit lines (Light Rail Transit 1, LRT-2, and Metro Rail Transit Line 3 or MRT-3) covering less than 50 kilometers (km) and one Philippine National Railway (PNR) line connecting Metro Manila with Laguna province in Southern Luzon. Unsurprisingly, the three urban lines have been operating at overcapacity, while the PNR line is struggling to provide reliable service. Because of the lack of functioning trains and frequent service interruptions, the ridership of the LRT-1 and MRT-3 lines dropped by about 30%–40% in 2015 (JICA 2018).

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ADB

Discontent with the mass transportation system has resulted in the dramatic increase of car ownership in the region, contributing further to traffic congestion. The traffic surveys conducted by the Japan International Cooperation Agency (JICA) indicate a multifold increase in the number of private motor vehicles entering Metro Manila from Cavite and Laguna provinces between 1996 and 2017.[1]

In 2017, the Government of the Philippines unveiled the Build, Build, Build Infrastructure Program. The program is designed to address the huge infrastructure backlog in the country and support rapid economic growth as well as poverty reduction. A significant portion of the program is designed to improve mobility within Metro Manila and with adjacent regions. Projects include two subway lines, Skyway Stage 3 linking the Northern Luzon Expressway and Southern Luzon Expressway, and two major expressways linking the rest of Luzon to Metro Manila.

The North–South Railway Project is another major transport project in the program, which cuts travel time between the metropolis and growing urban areas. With a total length of 163 km, the suburban railway project will connect Metro Manila to Clark in Pampanga province in the north and Calamba, Laguna in the south. The project comprises three segments: the Malolos–Clark Railway, the North–South Commuter Railway Phase 1 (between Tutuban and Malolos), and the South Commuter Railway (between Blumentritt and Calamba). The project is cofinanced by the Asian Development Bank and JICA, except for the North–South Commuter Railway Phase 1, which is financed only by JICA. The first two segments are under construction, while the South Commuter Railway (SCR) project is in the advanced stage of the procurement process.

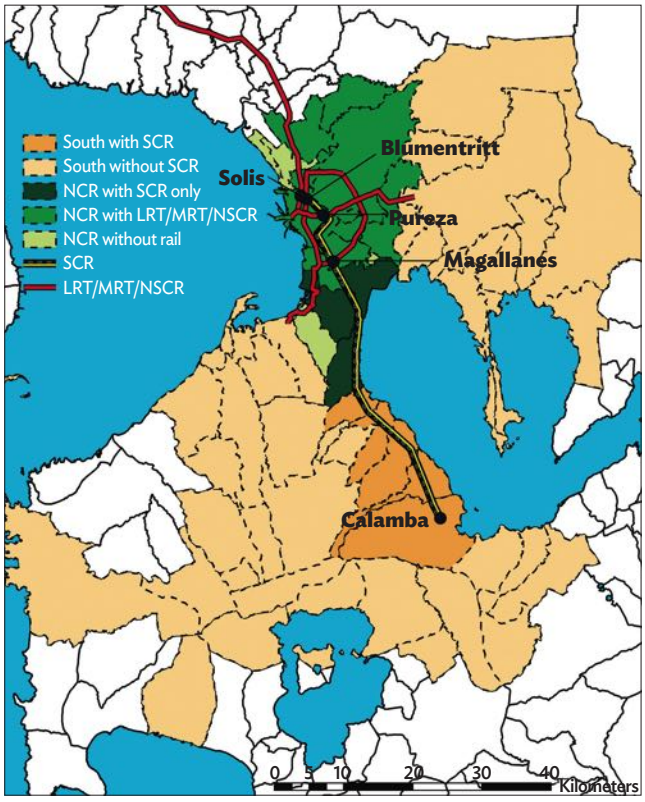
This brief focuses on the SCR and provides a quantitative analysis of how the railway would improve the levels of job accessibility in Metro Manila and its suburbs. Using the most recent data available, we first document the stylized facts of Metro Manila as a labor market and describe commuting patterns in the region. We then estimate the increase in residents' accessibility to jobs as a result of the SCR. The results of the study are meant to indicatively gauge the potential impacts and beneficiaries of the project, which could help policy makers to consider such benefits in future planning. This exercise also contributes to efforts to quantify the wider economic benefits of infrastructure projects that are often missing in conventional economic analysis, yet crucial in avoiding the risk of uncoordinated efforts and missed opportunities (Roberts et al. 2018). Estimates may be adjusted when more factors affecting employment and travel modes are taken into account using a more sophisticated model with more recent data.

STYLIZED FACTS OF THE CATCHMENT AREA

Geographic Scope of the South Commuter Railway Project

The SCR is designed to be 54.6 km in length with 19 stations between Blumentritt in the city of Manila in the north and Calamba in the south. Following the alignment of the existing PNR line, the SCR will pass through five cities in Laguna and five cities in Metro Manila.[2] Each of these 10 cities will have one or more train stations. The SCR will have a speed (likely average) of 80 km per hour, allowing riders from Calamba to get off at Blumentritt station within 1 hour—shorter than the usual 2- to 3-hour travel by bus (Figure 1).

Figure 1: Existing Metro Manila Rail Network and the South Commuter Railway and Its Catchment Area



LRT = Light Rail Transit, MRT = Metro Rail Transit, NCR = National Capital Region, NSCR = North–South Commuter Railway, SCR = South Commuter Railway.

Source: Authors.

[1] See Figure 2.1.5 of JICA (2018).

[2] From south to north, these cities are Calamba, Cabuyao, Santa Rosa, Biñan, and San Pedro in Laguna province, and Muntinlupa, Taguig, Parañaque, Makati, and Manila in Metro Manila.

From the south, the SCR will intersect with the MRT-3 line at the EDSA Magallanes station in Makati and with LRT-2 at Pureza and LRT-1 at Blumentritt in Manila. Commuters can continue their trip on the North–South Commuter Railway and Malolos–Clark Railway to Clark and Clark International Airport in Pampanga and to New Clark City in Tarlac province in Central Luzon. This means that SCR riders could transfer to all the existing and future LRT/MRT lines and reach areas covered with relative ease and may need to transfer trains only once.[3] When more rail lines are added to the network in Metro Manila, the SCR could transport passengers to the majority of areas in the metropolis and enable travel by rail to cities and municipalities in Southern Luzon, where several manufacturing industries and resorts are located.

We define the SCR's catchment area broadly as cities and municipalities that have access to the SCR or could potentially be affected by it. We use satellite data on night lights to identify a continuous, illuminated area that is considered the SCR's catchment area, which includes 17 cities in Metro Manila and 47 cities or municipalities in four provinces (Laguna, Batangas, Cavite, and Rizal) in Southern Luzon (hereinafter referred to as "southern cities").

Overview of the South Commuter Railway Catchment Area

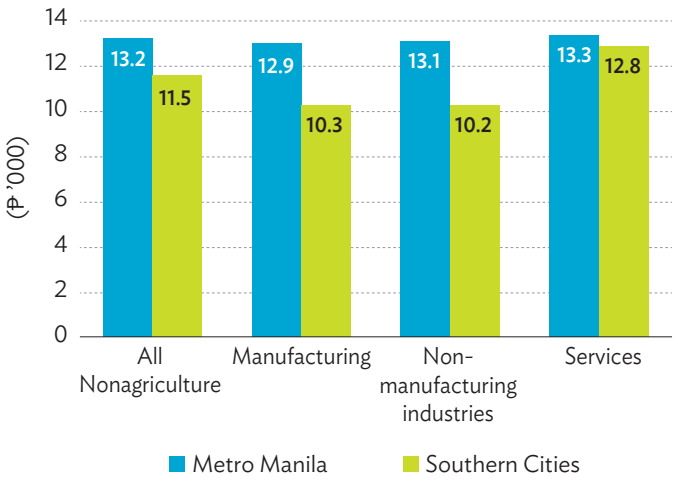
We characterize the basic demographics and labor market in the catchment area using data from the 2010 and 2015 Census and Labor Force Survey (PSA 2015a).[4] In 2010–2015, the population of Metro Manila increased to 12.9 million from 11.9 million and in southern cities, to 9.0 million from 7.4 million. While Metro Manila is more populated (in 2015, its density was seven times that of southern cities), the absolute increase and growth rate of the population in southern cities are much higher. The average annual population growth was 3.8% in southern cities and 1.8% in Metro Manila. A similar pattern can be seen in the working age population, those between 15 and 64 years old. In Metro Manila, about 0.8 million people were added to this group between 2010 and 2015 at an annual growth rate of 2.0%, while the working age population in southern cities increased by 1.0 million or 3.9% per year.

The labor force of Metro Manila, defined as those aged 15 years or older who are either working or looking for work, totaled 5.3 million in 2015, about 1.5 times more than the 3.4 million in southern cities. Both regions had employment rates, or the share of the total working labor force that is working, above 90% but Metro Manila's rate was 2 percentage points higher. Metro Manila had more self-employed and full-time workers at 28% and 91% than southern cities at 25% and 88%.

There is a stark difference in the sectoral composition of workers between the two regions. In Metro Manila, workers in manufacturing accounted for 9% of the working population; in other industries (e.g., transport, utilities, construction), 10%; and in services, 80%. In southern cities where several large-scale industrial clusters/parks are located, manufacturing workers made up 24% of the working population; other industries, 9%; and services, 64%. Given the sector-specific gaps in labor demands, the SCR could transport some residents from Metro Manila to work in manufacturing in southern cities, while residents in southern cities could commute to Metro Manila by SCR to work in the service sector.

Figure 2 shows a significant earnings gap between workers in Metro Manila and in southern cities, especially those in the industry sector. The average monthly wage for nonagricultural workers was ₱13,200 in Metro Manila in 2015, 15% higher than ₱11,500 in southern cities.[5] This may partly reflect the higher living costs in Metro Manila. Manufacturing and nonmanufacturing industrial wages were lower than the overall average but with greater gaps between the two regions. In Metro Manila, the average industrial worker was paid about ₱13,000 per month, 26% higher than ₱10,300 in southern cities. In contrast, service workers received about ₱13,300 per month in Metro Manila and ₱12,800 in southern cities—a mere 4% difference.

Figure 2: Average Monthly Pay by Sector (2015)



Source: Authors' estimation based on data from the Philippine Statistics Authority (2015a).

[3] The North–South Commuter Railway is under construction and will be operational before the SCR. Note that there will be direct trains from SCR to Bonifacio Global City, Ortigas Center, and Quezon City, through which passengers can switch to the forthcoming Metro Manila subway and access more urban centers easily. Our analysis is confined to the network available around the time when SCR is operational. The benefits of SCR will increase when the network is continuously expanded as planned.

[4] The Labor Force Survey is designed to be the representative sample at the provincial level.

[5] These are equivalent to $264 and $230, respectively, at the recent exchange rate of $1.00=₱50.

The wage comparison suggests that with reduced commuting costs, more industrial workers from southern cities could be attracted to work in Metro Manila in either industries or services to earn higher income. On the other hand, manufacturing firms may move out of Metro Manila for lower labor costs if their managers can commute more easily to southern cities. Both shifts could help equalize the industrial wages in the two regions.

The poverty level in Metro Manila is significantly lower than in southern cities. In 2009–2015, the average poverty incidence ranged from 2.1% to 3.2% across 17 cities in Metro Manila and from 5.8% to 6.5% across 47 cities/municipalities in Southern Luzon.

Based on differential access to the SCR and the existing rail network, we divided the catchment area into five subregions: (i) 5 cities in Laguna province with SCR stations; (ii) the remaining 42 cities and municipalities in the south without SCR stations; (iii) 3 cities in Metro Manila with SCR stations but without MRT/LRT or North–South Commuter Railway (NSCRP) stations; (iv) 10 cities in Metro Manila with MRT/LRT or NSCRP stations; and (v) 4 cities in Metro Manila without any rail station. Conceptually, subregions (i) and (iii) will benefit from the SCR directly and have the most improved connectivity with the economic centers in Metro Manila. Subregion (iv) would receive more workers and visitors from subregions (i) and (iii) when its existing rail network links to the SCR. Subregions (ii) and (v) could benefit from the SCR as well although to a lesser extent because of limited improvement in rail access.

Table 1 compares the demographic and labor market statistics across the subregions. In general, subregion (i) has a higher density and share of working age population and stronger labor market indicators than subregion (ii). The employment rate would be higher, the share of formally employed workers (or those with full-time jobs) larger, monthly pay higher, and the poverty rate lower in the five cities connected by the SCR than in the rest of the southern catchment area.

Manufacturing workers accounted for 31.4% of total workers in subregion (i), much greater than 16.7% in subregion (ii). The average wage was ₱12,100 for all nonagriculture workers and ₱14,100 for service workers in subregion (i), 10% and 22% higher than those in subregion (ii). Service workers in subregion (i) earned even higher wages than those in Metro Manila. However, industrial

Table 1: Population, Poverty Incidence, and Jobs in the Catchment Area

	Southern cities		Metro Manila		
	Subregion (i)	Subregion (ii)	Subregion (iii)	Subregion (iv)	Subregion (v)
	SCR station	No station	SCR station only	MRT/LRT or NSCRP station	No station
No. of cities/municipalities	5	42	3	10	4
Total area (km^2)	304.6	3,015.5	119.7	418.5	60.7
Population, 2015 (million)	1.7	7.3	2.0	9.6	1.3
Annual growth, 2010–2015 (%)	2.6	4.1	3.4	1.6	0.8
Population density, 2015 (1,000/km^2)	5.6	2.4	16.5	23.0	20.9
% of working age population, 2015	71.3	66.3	68.5	68.3	67.2
Employment rate (%)	92.2	90.8	94.2	92.9	93.5
% employed, full-time	91.0	85.8	91.4	90.7	89.8
% formally employed	77.3	71.0	70.6	73.8	69.0
% employed in manufacturing	31.4	16.7	9.0	9.2	8.6
% employed in services	60.6	67.3	78.3	81.6	79.6
Average monthly pay (₱)	12,097	10,970	13,273	13,348	13,080
Average monthly pay for manufacturing (₱)	10,216	10,338	13,891	11,870	13,027
Average monthly pay for services (₱)	14,050	11,647	13,239	13,723	12,990
Average poverty incidence 2015	4.4	6.7	2.9	3.1	3.9

km^2 = square kilometer, NSCRP = North–South Commuter Railway, SCR = South Commuter Railway.
Sources: Authors' estimates based on Census 2010 and 2015; updated list of establishments (PSA 2018); and poverty estimates from PSA (2019).

workers in subregions (i) and (ii) received similar wage levels, which were considerably lower than those in Metro Manila.

The differences in the three subregions in Metro Manila are not as substantial as the differences in the two subregions in southern cities. In subregion (iii), the average population growth rate was 3.4% and the working age population was 3.7%, closer to those in subregions (i) and (ii) and higher than in subregions (iv) and (v). Although subregions (i) and (iii) are adjacent to each other, the manufacturing workers of subregion (iii) earned ₱3,700 or 36% more per month than those in subregion (i). This may be because subregion (iii) workers are more likely to access higher-paying jobs in Metro Manila.

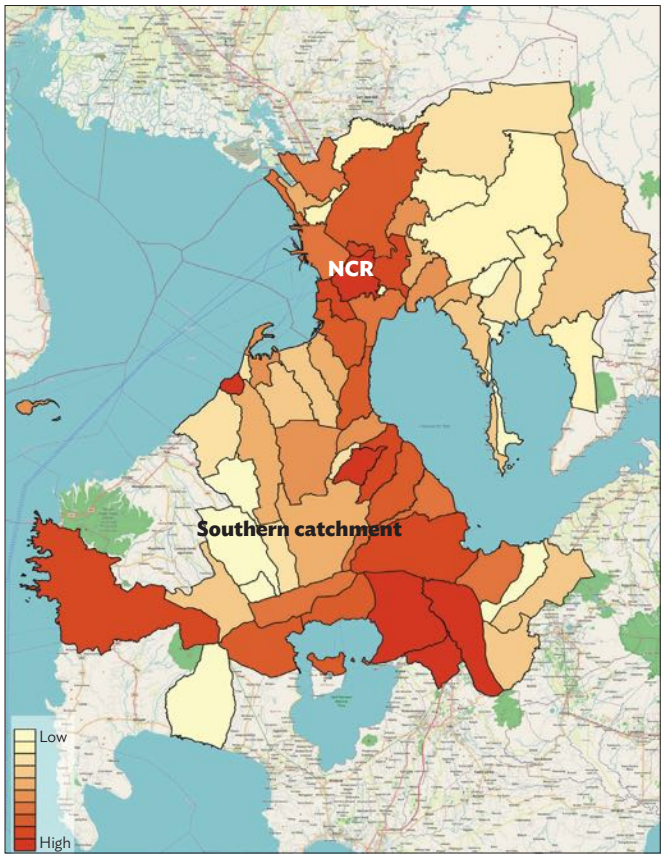
Employment Centers and Mismatch between Jobs and the Labor Force

The Labor Force Survey contains only residence and wage information of workers. To better identify where jobs are, we used the 2018 list of establishments in the Philippines (PSA 2018), which contains information on the total number of establishments and the number of jobs in the formal sector by firm size and sector at the city/municipal level.[6]

Several patterns of job distribution emerge from this exercise. First, jobs are unevenly distributed and heavily concentrated in Metro Manila. Of the 6.7 million jobs in the catchment area, Metro Manila hosts 4.7 million (70%), while the 47 southern cities host the remaining 2 million. The top 10 cities with the greatest number of jobs account for 4.2 million or 63% of the total. Nine of these cities are in Metro Manila, including the largest cities, such as Quezon City (17%), Makati (12%), Manila (8%), and Pasig (5%). Only one southern city (Calamba) is included in the top 10 with 3% of total jobs.

Second, manufacturing jobs show a different clustering pattern from service and other industrial jobs. Service jobs are clustered in southern cities while industrial jobs are predominantly in Metro Manila. Eight of the top 10 cities with the greatest number of manufacturing jobs are southern cities. In contrast, none of the top 10 cities with the greatest number of service jobs are located in the south. Moreover, service jobs are more spatially concentrated than manufacturing jobs. For instance, the top 10 cities with the highest number of service jobs account for 69% of total service jobs in the catchment area whereas the top 10 cities with the most manufacturing jobs account for 60% of total manufacturing jobs. The uneven distribution of jobs across the catchment area results in spatial mismatch between workers and jobs. Based on combined information from Labor Force Survey and list of establishments, Figure 3 shows the job-to-labor-force ratio in each city/municipality. The darker color indicates a higher ratio, which means more jobs than workers.[7] Cities in Metro Manila have a higher ratio. Outside of Metro Manila, more cities exhibit a decreasing job-to-labor ratio, except the most southern part of the catchment area, which has a lower number of jobs and a smaller labor force.

Figure 3: Spatial Distribution of Jobs and Labor Force Ratio



NCR = National Capital Region (Metro Manila).

Notes: The color of each cell represents the jobs-to-labor-force ratio in each municipality/city, which ranges from as low as less than 30% to as high as 200%.

Source: Authors' estimation using the List of Establishments 2012 and 2018; Labor Force Survey 2015; and Census 2010.

[6] Data limitations include the following: (i) only formal sector jobs are included; (ii) several service sector jobs, such as public administration, are excluded; and (iii) information on the number of jobs is available at the city/municipal level in Metro Manila but only at the provincial level in Southern Luzon. To overcome the exclusion of informal sector jobs and jobs in several missing sectors, we complement the dataset with estimates from the 2010 Census. To calculate job distribution in southern cities, we assume equal distribution of jobs in a province for a given firm size category across time.

[7] At the time of this analysis, there was no reliable official data that captures well the recent spatial discrepancy between jobs and the labor force across all sectors at the city/municipal level. To provide a balanced estimate, we pooled multiple datasets and tested different estimation methods. We first used the 2018 list of establishments as the base dataset and complemented it with informal sector jobs extrapolated from the 2010 Census. We applied an alternative method to the sectoral job growth rate from the 2012 and 2018 lists of establishments to the estimated number of jobs from the 2010 Census. Both methods yielded largely similar patterns. We averaged the two results to obtain the final estimate.

The spatial mismatch leaves the labor force outside of Metro Manila with limited options for earning a living. They either endure long commute times to job centers or seek local jobs in the informal sector. With increased transport connectivity, residents in several southern cities will benefit from the increased number of accessible jobs either directly because of the SCR, such as in Cabuyao in subregion (i), or indirectly through the NSCRP as it connects to the SCR, such as in Caloocan in subregion (iv). Section 3 quantifies the benefits of increased job accessibility in detail.

Spatial Patterns of Commuting Behavior

Commuting behavior based on residence–work location patterns provides a basis for anticipating travel patterns once the SCR is operational. Using residence and workplace information from 2010 Census, Table 2 summarizes the subregional origin–destination flow of workers: the rows refer to the subregion where the residence is located and the columns indicate the subregion where the jobs are. The diagonal cells refer to the number of those who work in their subregion of residence, with the figures in parentheses showing the number of residents who live and work in different cities. For example, 474,240 or 88% of the working residents in subregion (i) also work in subregion (i).

The off-diagonal figures indicate the number of individuals who commute to work outside their subregion of residence. For instance, 27,017 or 5% of workers who live in subregion (i) work in cities in Metro Manila with LRT/MRT/NSCRP stations or in subregion (iv). Over 9,000 workers living in subregion (i) work in cities where the Malolos–Clark (North Rail) segment of the commuter rail will pass.

Table 2 also reveals that for those who commute to other subregions, the cities in Metro Manila with LRT/MRT/NSCRP stations (subregion iv) are the most important work destinations, providing jobs to 5% of residents from subregion (i), 14% of residents from subregion (ii), 16% of residents from subregion (iii), and 18% of residents from subregion (v). Nonetheless, most people tend to reside and work within the same subregion; this pattern is mirrored at the city/municipal level.

The data on workers' characteristics show that those who travel to another city or municipality for work tend to be younger, more educated and skilled, and work in the formal sector. These commuters are also likely to work in industries and occupations that offer better-quality jobs in

Table 2: Residence-to-Work Flow by Rail Catchment Subregions

	Places of work						
	Southern cities		Metro Manila				
Residence (no. of cities/municipalities)	(i) **South with station**	(ii) **South without station**	(iii) **Metro Manila, with SCR only**	(iv) **Metro Manila with LRT/MRT/NSCR**	(v) **Metro Manila, without station**	**North rail** (Malolos-Clark)	**TOTAL RESIDENTS**
i. South with SCR station (5)	474,240 (47,631)	11,664	15,183	27,017	1,523	9,189	**538,816**
ii. South w/o station (42)	41,200	1,541,509 (197,986)	34,154	267,266	13,463	29,326	**1,926,918**
iii. Metro Manila w/ SCR only (3)	10,083	5,038	459,596 (19,273)	94,777	5,182	13,309	**587,984**
iv. Metro Manila w/ LRT/MRT/NSCR (10)	6,150	24,996	45,862	3,017,208 (552,751)	17,042	114,276	**3,225,535**
v. Metro Manila w/o station (4)	1,945	4,409	18,586	74,884	300,134 (6,680)	22,665	**422,622**
North rail (Malolos-Clark)	3,197	9,522	7,043	153,894	5,022	1,580,492	**1,759,169**
TOTAL JOBS	**536,815**	**1,597,138**	**580,425**	**3,635,045**	**342,365**	**1,769,257**	**8,461,044**

LRT = Light Rail Transit, MRT = Metro Rail Transit, NCR = National Capital Region (Metro Manila), NSCR = North–South Commuter Railway, South = southern cities, SCR = South Commuter Railway.

Notes:

1. Overseas Filipino workers are excluded from calculations.
2. The north rail area comprises cities and municipalities in Bulacan, Pampanga, and Tarlac where the Malolos–Clark stations will be located.
3. The numbers in parentheses refer to workers who travel out of their city/municipality of residence for work within each subregion.

Sources: 2010 Sample Household Questionnaire, Census of Population and Housing.

terms of formal employment, such as in manufacturing and administrative and support services . These patterns make intuitive sense and are congruent with work–commuting patterns in high-income countries, such as the United Kingdom, where the distance traveled for work increases with education and skill qualifications (ONS 2016). A worker is naturally only willing to travel a greater distance if travel costs are less than or at least equal to the benefit of working in their city of residence. Educated and skilled workers are more likely to make this decision.

When analyzed in conjunction with the 2015 Family Income and Expenditure Survey (PSA 2015b), we observe that rail service users tend to fall in the wealthier third and fourth income quintiles for Metro Manila and southern cities' households. This is consistent with the observation that the more educated workers take the longer commute to work. An efficiently operated and optimally priced SCR service is anticipated to increase railway ridership of workers in the current income profiles and encourage those from the lower-income group to shift to rail as their transport mode of choice.

ACCESSIBILITY ANALYSIS

One main economic benefit not considered in conventional economic analysis for urban transit projects is improved access to jobs for city residents and thus increased overall productivity. Users with access to the SCR can explore a wider range of job opportunities that used to be beyond a reasonable commuting time. This section investigates how the SCR will increase job opportunities for residents in the catchment areas.

Methodology

The job accessibility analysis estimates and compares the number of jobs within a 1-hour commute before and after the completion of SCR. We follow three steps to achieve this objective.

First, we compute the number of jobs accessible within an hour's travel by road. We choose the geographic center of each municipality/city as the origin location and calculate the area accessible by car within a 1-hour window through the HERE API (an open location platform) and geographic information system (GIS) algorithm, which optimizes routing while taking real traffic into account. The area is also known as the 1-hour "isochrone," which represents the accessible area via road-based transport.[8] We overlay the isochrone on the geographic distribution of jobs to estimate the number of jobs accessible within a commuting time of 1 hour.[9]

Second, we quantify the accessible jobs via road and rail network, which includes the planned SCR, the NSCRP under construction, and the existing MRT/LRT. To do this, we need to obtain 1-hour isochrones for the rail network. For railway users, we break down their trip into three segments: (i) from home to departure station, we estimate the travel time from the city center to the nearest railway station; (ii) from departure station to every possible arrival station, we estimate the time using a simulated timetable of the rail network, which accounts for the user's waiting and transition time; and (iii) from arrival station to potential destinations, we restrict the time to 1 hour and subtract the times spent on the first two segments. The isochrone is created for each arrival station if the remaining time is positive. We then aggregate all the isochrones from possible arrival stations into one isochrone, which outlines the area accessible within 1 hour via rail network from each city.

In the last step, we compare the isochrones obtained in the first and second steps for each city. The area covered by the "by railway" isochrone but not the "by car" isochrone represents the additional accessible area contributed by the rail network. The jobs in the incremental area are thus considered the additional accessible jobs.

Results

If we focus on road-based transport first, considerable discrepancy exists in the number of jobs accessible within 1 hour from different cities. Commuters in Makati can access as many as 5.4 million jobs whereas those in Nasugbu in Batangas province can access only 31,000 jobs. Generally, commuters in Metro Manila municipalities can access much more jobs than those residing in southern cities (Table 3). Cities in two subregions in Metro Manila with railway stations (subregions [iii] and [iv]) can access more than 4 million jobs on average. By comparison, southern cities with SCR stations (subregion [i]) can access only 2.1 million jobs on average. Also, southern cities with no railway stations (subregion [ii]) can access the least number of jobs on average.

The discrepancy is caused mainly by the high concentration of jobs in a few cities. As discussed in section 2, the majority of service jobs are located in Metro Manila, and manufacturing jobs are concentrated only in a few cities in the south. The discrepancy is greater because of slow and unreliable commuting options as it takes 2 to 3 hours to travel from Calamba to Blumentritt, which is less than 60 kilometers in distance, via existing transport options. As a result, it takes an unbearably long commute to access a large number of jobs.

The variation in job accessibility is also associated with inequality in economic status. Cities where residents can access fewer jobs also suffer from a relatively high poverty rate. Figure 4 shows the

[8] To mimic the experience of a typical daily commuter, we choose the departure time of 8:00 a.m. on 5 consecutive working days and average the isochrones across these days to obtain the final isochrone. Calculating the time taken by road-based public transport also often involves counting the long and uncertain wait times as well as multiple transfers; hence, the estimated 1-hour isochrone is essentially an upper bound of the accessible area via public transport.

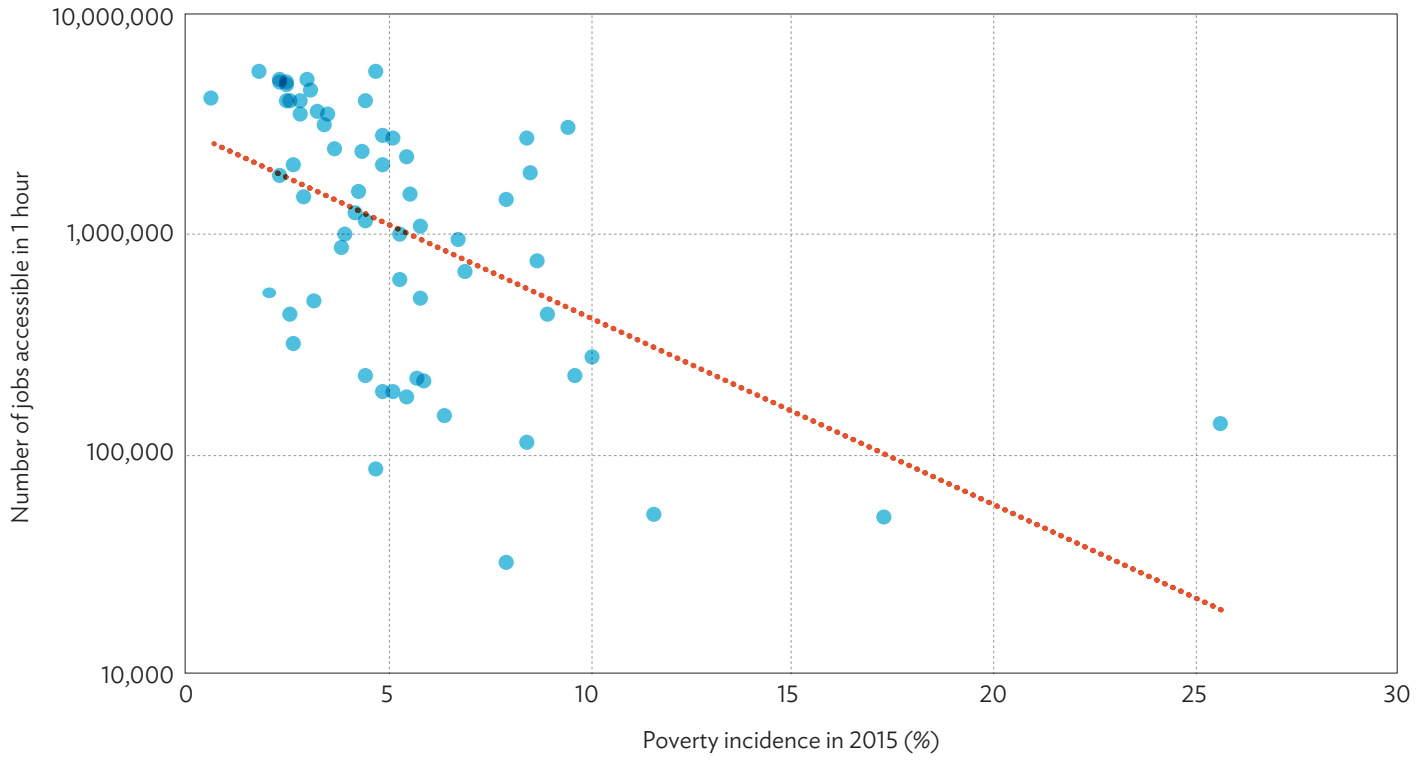
[9] For job distribution, we use data from the 2018 List of Establishments and the 2010 Census at the municipal level. Since we lack job data at a more granular geographic unit, we assume jobs are uniformly distributed within each municipality.

Table 3: Job Accessibility by Subregion of Catchment Area

	Southern cities		Metro Manila		
	Subregion (i)	Subregion (ii)	Subregion (iii)	Subregion (iv)	Subregion (v)
	SCR station	No station	SCR station only	MRT/LRT or NSCRP station	No station
No. of cities/municipalities	5	42	3	10	4
Average number of jobs accessible via road-based commuting mode	2,140,904	901,956	4,122,026	4,373,026	3,582,624
Average incremental jobs accessible with rail-based commuting mode	323,952	27,993	343,223	158,448	194,909
Average percentage increase of accessible jobs	15.3%	2.5%	8.5%	4.0%	5.9%

LRT = Light Rail Transit, MRT = Metro Rail Transit, NSCRP = North–South Commuter Railway Project, SCR = South Commuter Railway.
Source: Authors' estimates.

Figure 4: Accessible Jobs and Poverty Incidence



Note: The number of accessible jobs is in logarithmic scale.
Source: Authors' estimates.

negative correlation, statistically significant with the p-value below 0.001, between (log of) the number of accessible jobs and the poverty incidence rate across cities/municipalities. Although this evidence is only suggestive, limited accessibility to jobs may play a detrimental role in pockets of poverty in southern cities.

The completion of the SCR, together with the NSCRP and the existing rail network (MRT/LRT), will give access to more jobs and close the gaps in job accessibility for some municipalities in the catchment area. With rail-based transit, commuters from 48 out of 64 municipalities can travel to a wider area within a 1-hour window,

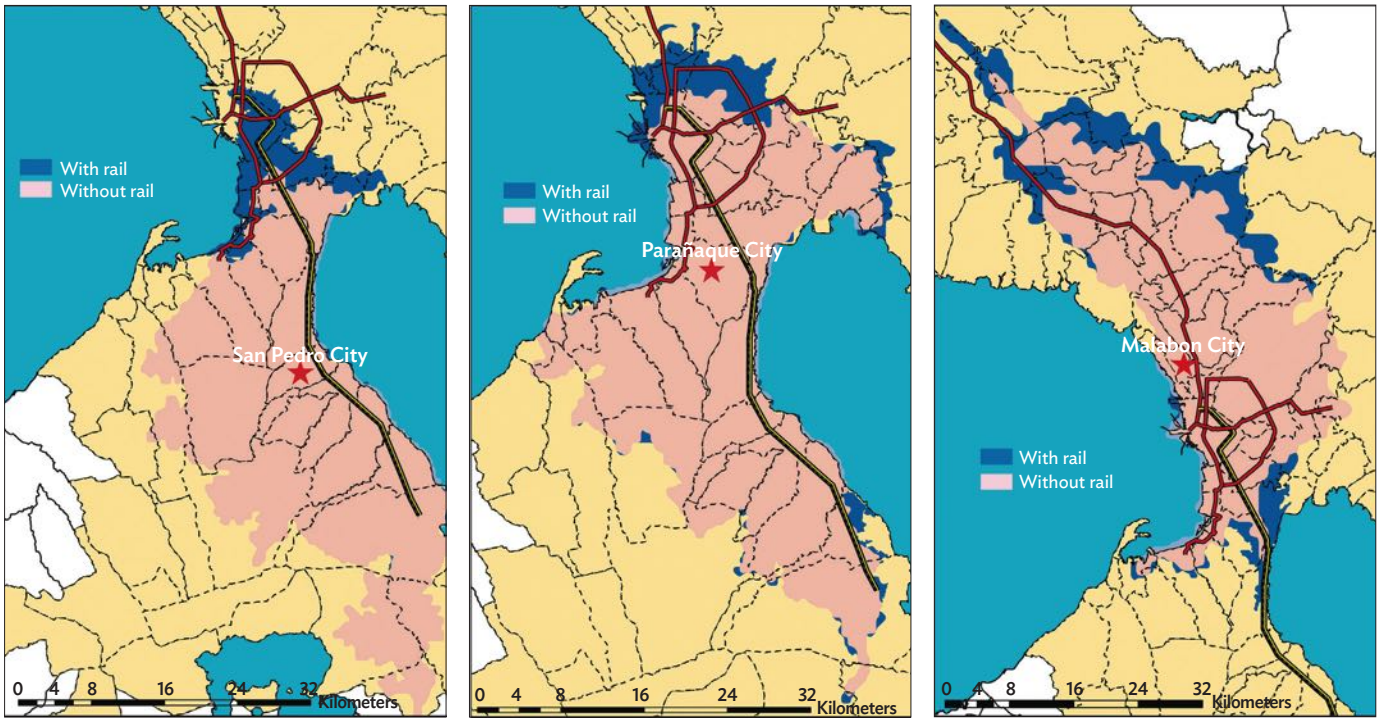
accessing more job opportunities. Figure 5 illustrates the changes in job accessibility for people living in three beneficiary cities across the catchment area (from left to right): San Pedro in Laguna and Parañaque and Malabon in Metro Manila.

A household located in the center of San Pedro City can only access the red-colored areas via the road-based transport within a 1-hour period. With rail-based transport and the SCR in particular, the same household can reach not only the red-colored areas faster but also the farther, blue-colored areas within 1 hour. More importantly, the blue areas, although small geometrically, are packed with more job opportunities. As a result, the same household in San Pedro can access 1.37 million more jobs via railway than the 2.03 million jobs via road-based transport—a 67.6% increase in job opportunities. Not only is there a wider range of jobs to choose from, but these jobs also tend to be of better quality with higher pay and more stability. Thus, the SCR will help mitigate regional income inequality by easing the spatial mismatch between workers and jobs. With easy access to the SCR, the five cities/municipalities in subregion (i) will have the most to gain, one of which is 15.3% higher job accessibility on average (Table 3).

Households in Metro Manila, especially in cities connected by the new rail link between the SCR and NSCRP, will also benefit greatly. As illustrated by the middle and right panes of Figure 5, residents in Parañaque City and Malabon City will have access to more jobs in both the northern and southern parts of currently accessible areas. Parañaque and Malabon will experience an increase of 11% and 13% in accessible jobs. Subregions (iii) and (v) where these cities are located will see an average increase in jobs of 8.5% and 5.9%.

Overall, the accessibility analysis shows that the planned SCR, together with the NSCRP and the MRT/LRT, will significantly enhance job accessibility for most cities and municipalities in the catchment area. Two points are worth further discussion here. First, it looks like we have compared road-based travel against rail-based travel without considering the availability of rail transport (MRT/LRT) in the current network. Taking into account the existing MRT/LRT will unlikely change the results as these rail lines cover a small area, and the cities/municipalities benefiting the most from the SCR are generally far from MRT/LRT stations. In addition, it is not feasible for residents to "park and ride."

Figure 5: Areas with Accessible Jobs within a 1-Hour Commute from Selected Cities



Notes: The three figures show the areas with accessible jobs within a 1-hour commute with and without rail-based public transport in San Pedro City, Parañaque City, and Malabon City. The areas in red indicate the accessible areas via road-based transport within a 1-hour period. The areas in blue indicate the incremental areas accessible via rail-based transport within a 1-hour period compared with road-based transport.

Source: Authors' estimates.

Second, a large share of residents in the catchment area relies on non-rail public transport. Our calculation leaves out the waiting and transition times for such trips, which could be substantial. In this case, the number of road-based accessible jobs are overestimated, leading to an underestimation of the SCR benefit of improved job accessibility.

CONCLUSION

The construction of the SCR is a major project receiving significant support and investment from the Philippine government and funding agencies. We quantify the effects of the SCR on job accessibility for residents in Metro Manila and suburbs. Some key findings are summarized below.

First, in 2010–2015 the working age population in the catchment area outside Metro Manila grew more rapidly than in the metropolis. There is also a dramatic difference in labor market characteristics in the two regions. Service sector jobs are predominant in Metro Manila while manufacturing jobs are more concentrated in southern cities. However, manufacturing wages in southern cities are significantly lower than service wages in the region and those in either manufacturing or services in Metro Manila. Moreover, the spatial distribution of jobs relative to workers' place of residence is far from even, resulting in the spatial mismatch between jobs and the labor force and inadequate livelihood options for households in the outskirts of Metro Manila. Household expenditure data suggest that households in the third and fourth income quintile use rail the most as a form of transport, suggesting that the immediate beneficiaries of the SCR are those in the middle- to upper-middle-income groups and skilled workers.

The job accessibility analysis indicates a considerable discrepancy in the number of jobs accessible to commuters in different cities/municipalities, which negatively correlates with the poverty level of the city/municipality. Linked with the LRT and MRT lines, the SCR will greatly enhance commuters' access to jobs in 48 out of 64 catchment cities/municipalities. The cities/municipalities with SCR stations will have access to more than 300,000 additional jobs on average, indicating an average increase of 15.3% in southern cities and 8.5% in Metro Manila. The improvement could lead to better labor market matching, higher income for workers and more job opportunities for low-income households.

The benefits of the SCR (and more broadly efficient urban transportation) can go beyond increase in job accessibility reported here. First, our analysis does not account for the great network-enhancing role of the SCR when viewed as part of ongoing rail network expansions that include the Malolos–Clark railway, the Malolos–Tutuban segment, the LRT South Extension, and the MRT Line 7. Second, the accessibility analysis remains a partial equilibrium analysis, in which we held as fixed the locations of residence and employment. Over a longer term, improved mobility could lead people to change residence for better amenities and firms to relocate for better employees and market access. A general equilibrium analysis taking into account these effects can identify additional benefits of the public transit project. Moreover, well-functioning public transit could result in a significant increase in urban land value. Accompanied with necessary policy reforms, more efficient distribution of the incremental land value could contribute to further increase in productivity and overall welfare. Quantifying these benefits is worth further study as an efficient urban transport system, though very costly, is imperative in making a city more livable. Considering the high job concentration and mobility challenges shared by other mega cities in developing Asia, the replicability of this study lends itself well to gain additional insights under the context of other cities in developing member countries.

REFERENCES

Asian Development Bank (ADB). 2019. Fostering Growth and Inclusion in Asia's Cities. Theme Chapter in *Asian Development Outlook 2019 Update: Fostering Growth and Inclusion in Asia's Cities*. Manila.

Japan International Cooperation Agency (JICA). 2018. Feasibility Study on the North South Railway Project – South Line (Commuter) in the Republic of the Philippines. JICA Philippines Office, Makati City, Philippines.

Philippine Statistics Authority (PSA). 2010. Census of Population and Housing: Explanatory Text. Manila.

____ . 2015a. Labor Force Survey. Manila.

____ . 2015b. Family Income and Expenditure Survey. Manila.

____ . 2018. List of Establishments. Manila.

____ . 2019. Poverty Small Area Estimate 2009, 2012, and 2015. Manila.

Office for National Statistics (ONS). 2016. Travel to Work Area Analysis in Great Britain: 2016. London, United Kingdom.

Roberts, M., Melecky, M., Bougna, T. and Xu, Y., 2018. Transport Corridors and Their Wider Economic Benefits: A Critical Review of the Literature., Research Working Paper 8302, World Bank, Washington, DC.

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