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**Working Paper**

## Infrastructure development and public-private partnership: Measuring impacts of urban transport infrastructure in Pakistan

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**ADBI Working Paper Series**

**INFRASTRUCTURE DEVELOPMENT  
AND PUBLIC–PRIVATE PARTNERSHIP:  
MEASURING IMPACTS OF URBAN  
TRANSPORT INFRASTRUCTURE  
IN PAKISTAN**

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**Asian Development Bank Institute**

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**Abstract**

The core objective of this study is to determine the impacts of improvement and modernization of transport infrastructure on households' income. We analyzed the impacts of a rapid transit system in urban areas of Punjab Province, Pakistan. We have compared the effects of this program in Punjab (treated group) with the other provinces (controlled groups). We applied the data from the "Households Income and Expenditure Survey (HIES)" for seven years across eight administrative regions. The "panel least square" model was constructed for this comparison and a "difference-in-difference (DinD) approach was followed. The total number of households included in the data is 120,048, of which 45,952 belong to urban areas. The empirical results show a significant improvement in households' income after improvement in transport infrastructure. This improvement and modernization of the transport infrastructure in urban areas of Punjab Province has increased households' income by more than 14% of the mean income compounded annually. These results are consistent and robust in various alternative scenarios. The study presents a very strong justification in favor of spending on transport infrastructure, as it is envisaged that spending on transport infrastructure can improve households' income significantly, which may be transformed ultimately into higher tax revenue and GDP growth. The study recommends investing in transport infrastructure to improve households' income because it may provide more connectivity and speedy access for workers to their workplaces. This phenomenon is confirmed by a significant increase in household incomes in those urban areas of Pakistan where the transport system has been improved.

**Keywords:** difference-in-difference analysis, transport infrastructure, urban transport, households' income, panel least square, public-private partnership

**JEL Classification:** E62, G28, H54, O23

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## 1. INTRODUCTION: INFRASTRUCTURE AND ECONOMIC GROWTH – DIRECTION OF CAUSALITY

Economic theory strongly supports the significant role of infrastructure development in economic growth. Though infrastructure development can directly generate several economic activities in the chemical, cement, steel, banking, transportation, energy, and services sectors, its main role is to provide a catalyst for the development of other sectors. There are numerous examples in economic literature that demonstrate that the development of various kinds of infrastructure improves people's living standards and creates employment opportunities. In the context of Uzbekistan, Yoshino and Abidhadjaev (2017) found that connectivity through railways led to a significant increase in GDP. A study carried out in the context of Pakistan by the World Bank concluded that infrastructure development significantly impacts per capita income at purchasing power parity (World Bank 2017). The results of this study provide a useful insight into how much contribution in terms of per capita income is provided by spending on infrastructure development. It explains that a spending of one billion rupees on improving the quality of roads can increase people's per capita income by Rs371 (2.4 US\$) on a permanent basis. This mechanism is much more powerful than subsidies and transfer payments, because it provides a sustainable solution to poverty.

Other studies in the context of Pakistan have established linkages between economic growth and infrastructure development. Some of those studies have tested the direction of causality and explained how various types of infrastructure affect GDP growth. Several studies tried to quantify the impact of infrastructure on economic growth. Hussain and Zhang (2018) estimated that the net income loss from a lack of reliable access to electricity for households in Pakistan is \$4.5 billion a year, which is about 1.7% of GDP. Electrification has a significant positive impact on households' income and expenditure. Gaining access to electricity is associated with a 37% increase in per capita income and an 11% increase in expenditures (Hussain and Zhang 2018).

The World Economic Forum (2012) and the Organisation for Economic Co-operation and Development (2010 and 2012) have estimated the impact of various types of infrastructure on the growth of per capita income. The Organisation for Economic Co-operation and Development (2018) have estimated the required investment in infrastructure to achieve the targets of the Sustainable Development Goals (SDGs). The Asian Development Bank has estimated that developing Asia will need to invest \$1.5 trillion per year in infrastructure through 2030 to maintain its economic growth momentum and tackle poverty. Total infrastructure financing as a share of gross domestic product (GDP) will need to increase from around 3.8% to 5.6% by 2020 worldwide (Yoshino, Matthias, and Abidhadjaev 2018). In this context, a declining trend in developing expenditures by government and the negligible role of the private sector in infrastructure development in Pakistan indicate an alarming situation. According to GI Hub/ Oxford Economics (2016 and 2017) estimates, Pakistan has to face a shortfall of 124 billion dollars in the infrastructure development between 2016 and 2040. The size of this gap is more than the total outstanding external debts of Pakistan.

The lack of appropriate infrastructure, declining business competitiveness, lower rate of growth, and economic miseries are interconnected variables. The lower growth of the economy has resulted in falling tax revenue and insufficient resources to operate government institutions. On the other hand, it is also a common phenomenon that in the case of lower tax receipts and insufficient financial resources, government has to cut back necessary development projects and investment in public sector

infrastructure. Mehar (2018) and FPCCI (2016) have established a causal relation between deterioration in infrastructure and the level of poverty. It is recommended in various research reports that Pakistan has to develop its infrastructure on a priority basis to accelerate its economic growth and to revive its economy (FPCCI 2015).

In Pakistan, the government has tended to prioritize spending to meet its recurring expenditures such as debt servicing, defense, and general administration. Therefore, spending on the development of infrastructure has become the lowest priority. This situation has led to deterioration in the physical infrastructure of Pakistan. Now, the economy is facing a crisis in the supply of energy, a shortage of water, a badly damaged sanitation system, and outdated means of transportation. The deterioration in infrastructure has led to a lower ranking in business competitiveness, which has created a situation in which industries cannot utilize their available production capacity because of energy shortages, frequent interruption to energy supplies, and poor logistic facilities in transportation. The badly deteriorated physical infrastructure in Pakistan does not support economic progress and industrialization. The lacking in physical infrastructure has become the primary cause of declining growth in GDP.

A consecutive decline in the inflow of foreign direct investment (FDI) is also a drastic indicator for the economy of Pakistan. Attracting foreign and local investment and discouraging the outflow of domestic capital are natural requirements for rapid industrialization and economic development in Pakistan. It is obvious that inducing private sector investment – both foreign and domestic – requires a significant and visible improvement in public goods infrastructure. The problematic side of these suggestions is the lack of sufficient funds for the required development, which is also a concern of this study. The other objective of this study is to measure the impact of change in transport infrastructure on people's living standards.

The study has been divided into seven sections. The next section discusses the infrastructure financing policies in Pakistan in different regimes. Section 3 describes the issues and complications that are involved in private sector investment in infrastructure-related projects. A comparison of the impacts of urban transport infrastructure in Punjab Province (treated group) with the other provinces (nontreated group) has been quantified in Section 4, which establishes a methodology to estimate the impact of improvement in transport infrastructure in Pakistan on households' income, while Section 5 explains the statistical results. The policy implications are discussed in Section 6 and the last section presents some limitations and conclusions.

## **2. INFRASTRUCTURE FINANCING IN PAKISTAN: HISTORICAL TRENDS AND POLICY CHANGE**

Pakistan has experienced an interesting history of economic development. It enjoyed a remarkable rate of growth in its early years; however, today's Pakistan is very different to the country it was in the 1950s and 60s. It is unfortunate that Pakistan's growing external debt has reached a level where further borrowing may destabilize the economy. The burden of these debts is transferred to the next generation and repayment is the foremost problem in Pakistan's fiscal policy. The gigantic volume of debt and servicing of the interest prevent Pakistan from using its fiscal resources for its infrastructure development. Pakistan's external debt liabilities are dominated by long-term loans from IFIs, multilateral agencies, and the Paris Club. The share of sovereign bonds (market-based external debt) in public debt is less than 5%. Another problem that exacerbates the high level of external leverage is the impact of the deteriorating value of the Pakistani rupee. The devaluation of the Pakistani currency means that

Pakistan will have to pay more interest in real terms, which will require higher levels of resource mobilization from domestic sources. This will lead to higher taxes on business and the public at large, especially since tax rises for the rich are not politically feasible. It indicates that the present burden of external debt does not allow the dependency of infrastructure development on foreign debt. Here it is also important that the majority of the present outstanding external borrowing belongs to “program loans.” The share in infrastructure-related projects has declined significantly.

The last decade has reflected the fast deterioration in macroeconomic indicators, and currently Pakistan is facing the lowest development ranking in the region. A global comparison also confirms the deterioration of physical infrastructure in Pakistan in terms of international ranking. Pakistan is ranked 110th in the overall infrastructure ranking of 137 countries (WEF 2011, 2018). Table 1 shows the deterioration in the quality of transport infrastructure in Pakistan over time. This deterioration in infrastructure has badly damaged the country’s economic competitiveness. Despite the badly required infrastructure development, the spending on this sector in Pakistan is negligible compared to the spending on nondevelopment expenditures. Even the investment in infrastructure with private participation is not up to the required level. The lack of appropriate infrastructure can be observed in public places, civic facilities in metropolitan cities, the supply of utility services, electricity, railways, highways, shipping, and its national carrier airline – Pakistan International Airlines (PIA).

It is notable that the development and modernization of physical infrastructure in developing countries during the bipolar regime was largely based on subsidized external debts and grants from industrialized countries. Affiliation with a political ideology was a more important consideration than economic justification and viability in this type of financing. This phenomenon is explained by the “dependency theory” and “domino effect model.” The “hegemonic stability theory” (Kindleberger 1970) has also explained this phenomenon in a different way. Consequently, the infrastructure financing activities in low- and middle-income countries before 1990 have been considered a public sector responsibility. The flows of external debt and foreign direct investment (FDI) have also been associated with political affiliations. After the fall of the bipolar regime, it was difficult for the politicians and the public in developing countries to understand the new realities. Though some development finance institutions (DFIs) in every developing country have been working for infrastructure financing through venture capital activities, these DFIs were in the public sector and their budgets and accounts were integrated with the centralized public accounts offices. Unfortunately, the statesmen and policymakers in these countries still consider foreign aid and external subsidized loans to be an option for infrastructure development, while misuse of public funds, populism, corruption, and inefficient planning have badly failed the economic governance in those countries. In the present context of the global economy, a compatible infrastructure is required for economic competitiveness, but further external borrowing does not seem a feasible option in this scenario. Some developing countries have recognized that private investment is the only option to develop costly infrastructures.



**Table 1: Pakistan's Global Ranking in Infrastructure**

Indicator	2010–11		2017–18	
	Rank (out of 139)	Score (1–7)	Rank (out of 137)	Score (1–7)
Quality of overall infrastructure	110	2.8	110	3.0
Quality of roads	72	3.8	76	3.9
Quality of railroad infrastructure	55	3.1	52	3.3
Quality of port infrastructure	73	4.0	73	4.0
Quality of air transport infrastructure	81	4.3	91	4.0
Available airline seat kilometers*	48	345.6	46	551.3
Quality of electricity supply	128	2.1	115	2.9
Mobile telephone subscriptions**	107	57.0	125	71.4
Fixed telephone lines	115	2.2	114	1.6
Lack of infrastructure as most problematic factor in doing business recognized by people (%)	4.7	--	4.4	

\*Scheduled available airline seat kilometers per week originating in Pakistan (in millions).

\*\* Number of mobile cellular telephone subscriptions per 100 people.

Source: World Economic Forum (2011, 2018).

Historically the infrastructure development in Pakistan has also been associated with development finance institutions (DFIs) and the provision of developing expenditures in the annual budget. It is the present practice in Pakistan that all infrastructure-related development projects in the public sector are controlled and financed through a centralized bureaucratic mechanism. Under this mechanism the Planning Commission in Islamabad approves the feasibility reports of the infrastructure-related projects. Pakistan has a three-tier government system (federal, provincial, and local governments). However, a centralized Public Sector Development Program (PSDP) is controlled by the Planning Commission. Some projects under this program are directly launched and managed by the federal government. The construction of railways, motorways, national highways, a communication network, energy distribution, distribution of water for irrigation and power generation, and construction of ports are included in the federal projects, while 50% matching grants are transferred to the provinces for the development of those projects that are launched by the provincial governments after approval by the Planning Commission.

There were several development finance institutions (DFIs) in the public sector and the government has been providing equities for the establishment of those DFIs before 1990s. The National Development Finance Corporation (NFFC), the Industrial Development Bank of Pakistan (IDBP), the Agriculture Development Bank of Pakistan (ADBP), the Pakistan Industrial Credit and Investment Corporation (PICIC), the Pakistan Industrial Development Corporation (PIDC), and many such other institutions were responsible for providing funds for big infrastructural projects in public and private sectors. Now, these institutions have either been dissolved because of bad governance and a lack of funding or play an ineffective role in the economy. In 2014, the government again announced it was to establish a new DFI (Pakistan Investment Fund) by inducting Rs500 billion (US\$3.2 billion) initial equity, but it is still inactive. The large commercial banks in the public sector also provide financing facilities to public sector projects. The monetary policy of the State Bank of Pakistan plays an important role in allocating credit facilities to different sectors and determining the rate of interest. All these policy measures indicate the overdependency of infrastructure development on the public sector.

Some important changes in economic regulations and policies were observed in Pakistan in 1993 when the then caretaker government decided to limit the role of the public sector in infrastructure development and an unplanned openness in the economy was initiated. Deregulation and privatization of public sector commercial enterprises were proposed. For a smooth implementation of the trade openness the tariff structure was downward revised. The convertibility of the Pakistani currency, stock market reforms, the adoption of a new mechanism to determine interbank offering (interest) rates, reforms in monetary policy, the introduction of a green channel for duty-free imports of goods in permissible quantities through air travel, the introduction of a withholding tax culture for direct taxes, and a significant enhancement of general sales tax were included in the economic policy reforms in Pakistan in 1993.

Some public sector responsibilities and activities were shifted to the private sector. The participation of the private sector in infrastructure development was realized and it was planned to involve the private sector in transport, communication, and infrastructure development. After three months of the caretaker government, the then newly elected parliament endorsed the continuity of policy reforms that were introduced by the caretaker government. Consequently, the share of development expenditures in the total public expenditures of the federal government was reduced significantly.

The developing expenditures to GDP ratio in the federal budget was always greater than 6% before 1993, but was reduced to less than 4% after 1993 and even reached 1.8% in 2018–19. The declining role of DFIs in the economy and the closure of some big DFIs have aggravated the deterioration in infrastructure development in Pakistan, while monetary policy has induced consumer banking services in Pakistan, as commercial banks have enhanced their lending for personal loans, credit cards, auto financing, and various types of revolving credits for maintaining households' expenditures. This situation shifted the focus of commercial banks from industrial development financing to consumer-oriented lending. A sharp decline in public sector development expenditures as a percentage of GDP without ensuring a substitution from the private sector can be seen in Table 2.

The declining development expenditures of the public sector without ensuring substitution from the private sector have damaged the economic growth of Pakistan. No significant contribution from the private sector has been noted in infrastructure-related projects. The negligible share of the private sector in infrastructure development activities and the declining development expenditures of the government reflect the causes of deterioration of the country in the global infrastructure ranking. The deterioration in infrastructure was the obvious outcome of this policy and led to the declining rate of GDP growth and its spinoffs: exports, tax revenue, investment, savings, employment, etc. A visible difference in the economic growth of Pakistan before and after 1993 can be seen in Table 2. This change in 1993 was not a success story of fiscal reforms. Though prudence in the utilization of debt money was observed, overall its effect on growth was negative because private sector participation could not be ensured before a drop in public sector development expenditures. This was a policy failure that lowered the long-term economic growth of Pakistan.

The role of the private sector in infrastructure development financing has not been successful in Pakistan because of several frictions and bureaucratic barriers in the implementation of private financing procedures. According to a survey conducted by the World Bank, Pakistan is in a relatively better position in the preparation and procurement of a "public-private partnership" (PPP), but its position is below average in terms of contract management. The study was carried out among 135 countries, and 47 indicators belonging to preparation, procurement, management, and unsolicited proposals of PPP projects were analyzed. The scores range between 0 and 100.

Higher scores signify good practices, while lower scores indicate that there is considerable room for improvement because of less adherence to international good practices measured by procuring infrastructure (World Bank 2018b). The findings for Pakistan are summarized in Appendix A.

**Table 2: Structural Changes in 1993: Patterns of Development Financing**

Year	GDP Growth (%)	Development Expenditures as % of GDP	Investment in Infrastructure on PPP Basis as % of GDP	Year	GDP Growth (%)	Development Expenditures as % of GDP	Investment in Infrastructure on PPP Basis as % of GDP
1980–81	6.4	9.3	0.0	2000–01	2.1	2.4	0.0
1981–82	7.6	8.2	0.0	2001–02	3.1	4.3	0.0
1982–83	6.8	8.1	0.0	2002–03	4.7	2.2	0.0
1983–84	4.0	6.7	0.0	2003–04	7.5	3.1	0.0
1984–85	8.7	7.0	0.0	2004–05	9.0	3.9	0.9
1985–86	6.4	7.7	0.0	2005–06	5.8	4.5	0.2
1986–87	5.8	6.3	0.0	2006–07	5.5	4.6	1.5
1987–88	6.4	6.9	0.0	2007–08	5.0	4.0	0.8
1988–89	4.8	6.3	0.0	2008–09	0.4	3.5	0.9
1989–90	4.6	6.5	0.0	2009–10	2.6	4.4	0.8
1990–91	5.6	6.4	0.0	2010–11	3.6	2.8	0.3
1991–92	7.7	6.5	0.0	2011–12	3.8	3.7	0.6
1992–93	2.3	5.7	0.0	2012–13	3.7	5.1	0.1
1993–94	4.5	4.5	3.1	2013–14	4.1	4.9	0.0
1994–95	5.2	4.1	3.3	2014–15	4.1	4.2	0.3
1995–96	6.0	4.3	3.7	2015–16	4.6	4.5	0.6
1996–97	1.7	3.5	0.4	2016–17	5.4	5.3	1.9
1997–98	3.5	3.9	0.0	2017–18	5.5	4.7	0.4
1998–99	2.0	3.3	0.0	2018–19	3.3	1.8	0.0
1999–00	3.9	2.5	0.0	2019–20*	4.0	2.0	–
<b>Decade-wise Analysis</b>							
1980s	6.5	7.3	0.0	2000s	4.7	3.3	0.5
1990s	4.6	4.7	1.0	2010s	4.1	3.8	0.4

Source: Pakistan Economic Survey (Various Issues), Budget in Brief (Various Issues); \* Budgeted.

**Table 3: Approval Process of a Project**

Stages	Description	Concerned Authority
1	Identification of project	Planning Commission/IPDF/Line Ministry/Relevant Department
2	Selection and hiring of transaction advisor	IPDF/Line Ministry/Relevant Agency
3	Approval for selection of preferred options for feasibility study	IPDF/Line Ministry/Relevant Department
4	Approval of feasibility report	IPDF/Line Ministry/Relevant Department
5	Pre-qualification and approval of bidder and PPP structure	IPDF/Line Ministry/Relevant Department
6	Approval of project	ECC/ECNEC/CDWP and MOF and/or Board of Ministry/Relevant Department
7	Award of project and contract signing	Line Ministry/Relevant Department
8	Execution of project including financial closure	Private Party
9	Project monitoring and evaluation	Line Ministry/Relevant Department

Source: Author's own based on the Public Private Partnership Act 2017.

**Table 4: The Largest Public–Private Partnership Programs in Pakistan**

<b>Project</b>	<b>Sector</b>	<b>Year of Financial Closure</b>	<b>Investment (Million US\$)</b>
China Power Hub Generation Company	Electricity	2017	1,940
Suki Kinari Hydropower Plant	Electricity	2017	1,888
Karot Hydropower Plant	Electricity	2017	1,700
Hub Power Company	Electricity	1994	1,632
Pakistan Deep Water Container	Ports	2010	1,200
Engro Thar Coal-Fired Power Plant Phase 1	Electricity	2016	1,108
Uch Power Ltd	Electricity	1996	713
Chashma-2 Nuclear Power Plant	Electricity	2005	559
Gwadar Port Phase II	Ports	2007	550
Wak Port Qasim Power Company	Electricity	1996	515

Source: Author's own using PPP Knowledge Lab (2018), Country Profile Pakistan.

### **3. ISSUES AND COMPLICATIONS IN INFRASTRUCTURE INVESTMENT BY PRIVATE SECTOR**

Pakistan established a policy and regulatory framework for public–private partnership (PPP) in the telecom and power sectors in the early 1990s. But the government introduced a PPP policy for various sectors in its Medium-term Development Framework (MTDF) 2005–2010. According to this policy, there can be several potential sources of revenue or income depending on the type of PPP project and the likely financial performance of the project (Government of Pakistan 2010). These include: tariff-based PPP projects, projects requiring subsidy to fill the viability gap funding, long-term funding, fiscal incentives, other incentives to manage risks, ceilings in terms of guarantees and future annual annuity payments, etc. The Ministry of Finance has constituted a dedicated company, Infrastructure Projects Finance Facility (IPFF), to provide residual long-term funding at commercial rates for PPP projects. It is a nonbanking financial company (NBFC) established under the Companies Ordinance, 1984. The following institutions have played key roles in these arrangements:

1. The Ministry of Finance (MoF) including the following institutions:
  - The Infrastructure Project Financing Facility (IPFF),
  - The inter-ministerial PPP Taskforce (TF) and its working groups,
  - The Infrastructure Project Development Facility (IPDF),
  - The Debt Policy Coordination Office (DPCO),
  - Project Development Fund (PDF),
  - Viability Gap Fund (VGF)
2. The Planning Commission and its Central Development Working Party
3. Line ministries and their relevant departments at federal, provincial, and local levels as contracting authorities

The Planning Commission, in consultation and coordination with the IPDF and the line ministries and other contracting authorities, reviews and approves the potential PPP projects from the Public Sector Development Program (PSDP). Establishing a project development fund (PDF) in line with the emerging PPP program is the responsibility of federal government. This fund is operated according to the standard operating procedures (SOPs) and guidelines. In fact, this is a revolving fund with third-party costs being reclaimable from winning bidders in some instances, particularly where projects reach financial closure. The government is also responsible for establishing a viability gap fund (VGF) in line with the emerging PPP program. Its aim is to provide rule-based subsidies for PPP projects (Government of Pakistan 2010).

According to the PPP Policy 2010, viability must be met when awarding projects, but generally there is a lack of consistency. There is no infrastructure project to speak of other than the energy sector, where a safety net was provided to private investors to ensure the minimum revenue. Another important challenge related to the lack of debt market maturity is that the availability of long-term infrastructure financing is very limited in Pakistan; only short to medium-term financing is available from commercial banks (ADB 2017). The magnitude of investment on a public-private partnership basis (Table 4) reflects the fact that the gap in development expenditures, which was created in 1993, could not be filled by this mechanism.

In fact, the private sector was reluctant to invest in gigantic infrastructure projects where the required magnitude of investment is much higher and risks are greater than other types of businesses, while several complicated factors are involved in the estimation of risks and returns on such long-term investments. Infrastructure financing requires more prudence in investment decision-making because of the longer duration of projects, high political risk, higher cash outflow at an earlier stage, and barriers to exit before the payback period. Another risk that is always associated with large infrastructure projects (particularly in the construction of highways and land development) is “free riding.” To ensure payments by beneficiaries through user charges, fees, and taxes, government support is required. This is the reason why public-private participation is always required in infrastructure-related projects despite the private investment. Several types of support and guarantees from government are required to make such investment feasible.

## **4. ESTIMATION OF THE IMPACTS OF URBAN TRANSPORT INFRASTRUCTURE IN PUNJAB**

### **4.1 Rapid Transit Program in Urban Punjab**

A rapid transit program was initiated by the Punjab Government during the Muslim League (N) regime in 2013. It serves only urban areas of Punjab and provides a convenient, speedy, and low-cost means of transportation for daily traveling from home to workplace. The strategy of the Muslim League (N) government to develop the regional economy of Punjab Province was based on the development of megaprojects in the power, roads, urban transport, and water sectors. The bulk of investment spending on infrastructure development had been earmarked for roads and urban development.

After a successful experiment in Metropolitan Lahore, the same projects were started in Rawalpindi, Islamabad, Multan, and the other major cities of Punjab. The Lahore Metro Bus Service is operated by the Punjab Mass Transit Authority, which was started in February 2013. Currently, it has 27 bus stations and on average 200,000 passengers

use this service. The e-ticketing and intelligent transportation system is part of this project. This service is subsidized by the Government of Punjab. The Lahore metro bus corridor is approximately 27 kilometers long, and its total cost was Rs29.8 billion (191 million dollars). The Rawalpindi-Islamabad Metro Bus Service connects key areas in the city of Rawalpindi and the national capital city of Islamabad. It is 24 kilometers long and has 24 stations. It was inaugurated in June 2015. The Multan Metro Bus Service connects the main commercial areas of the city. It is 18.2 kilometers long.

**Table 5: List of Urban Transit Systems in Pakistan (Since 2013)**

City	Name of Project	Year	Status	No. of Stations	Length (KM)
Lahore	Lahore Metro Bus Service	2013	Complete	27	27.0
Rawalpindi	Rawalpindi-Islamabad Metro Bus	2015	Complete	24	22.5
Multan	Multan Metro Bus	2017	Complete	18	18.2
Karachi	Karachi Metro Bus	2018	In Progress	90	109.0
Faisalabad	Faisalabad Metro Bus	2018	Planned	28	30.0
Peshawar	Peshawar Metro Bus	2019	In Progress	18	26.0

Source: Author's own.

The governments in other provinces have opposed this kind of project because they consume a large part of the provincial budgets. In particular, Sindh and Khyber Pakhtoonkhwa have opposed this type of investment. More recently, however, the Pakhtoonkhwa government also initiated this kind of project in Peshawar city, but it is still in the construction phase. The federal government also planned a rapid mass transit project in Karachi – the largest city of Pakistan in Sindh Province. Now, the planning of mass transit programs in other provinces reflects its positive impacts in Punjab.

## 4.2 Data and Sampling Methodology

The core objective of this study is to measure the impact of transport infrastructure on households' income in Pakistan. It is notable that infrastructure-related projects in Pakistan are controlled and financed through a centralized Planning Commission, which assesses their impacts at national level. Assessing the impacts of such projects on a regional basis is difficult because of the unavailability of regional data (at province or district level). Therefore, such a comparison is possible only in limited cases. For instance, we can analyze the impacts of urban transport infrastructure in Punjab Province through a difference-in-difference (DinD) approach. The Government of Punjab launched an extensive plan to modernize and upgrade the transport infrastructure in Urban Punjab in 2013. Later on, the Punjab Assembly legislated a law (Urban Punjab Mass Transit Act 2015). The metro bus services in urban areas, metro trains, and several other transport-related projects are included in this program. We have compared the effects of this program in Punjab (treated group) with the other provinces (controlled groups). The change in household income and the patterns of households' consumption have been taken as outcome variables. The trends of households' income by regions and years are shown in Table 6, while Table 7 shows the descriptive statistics of the variables included in the models.

For this purpose, we applied data from the “Households Income and Expenditure Survey” (HIES), which is carried out by the Federal Bureau of Statistics, Government of Pakistan (Various Issues). This survey is conducted once every two or three years, however sometimes it may not be available regularly. We used the data for the most recent available years (2005, 2006, 2008, 2011, 2012, 2013, and 2016) across eight administrative regions: Rural Punjab, Urban Punjab, Rural Sindh, Urban Sindh, Rural Khyber Pakhtoonkhwa, Urban Khyber Pakhtoonkhwa, Rural Balochistan, and Urban Balochistan. The “panel least square” model was constructed for this comparison and a “difference-in-difference” (DiD) approach was followed.

The universe of the HIES survey consists of all urban and rural areas of all four provinces of Pakistan (Punjab, Sindh, Khyber Pakhtoonkhwa, and Balochistan). Separate sampling frames are used in the survey for urban areas and rural areas. The Federal Bureau of Statistics (Government of Pakistan 2016) has developed its own urban area frame. All urban areas known as cities/towns of the urban domain of the sampling frame have been divided into small compact areas known as “enumeration blocks.” Each enumeration block comprises about 200–250 households. Each enumeration block has been divided into low-, middle-, and high-income groups, reflecting the living status of the majority of households. There are 26,800 enumeration blocks in all urban areas of the country (Government of Pakistan 2016).

For rural areas, the lists of villages according to the population census of 1998 have been used as a sampling frame. In this frame, each village is identifiable by its name and cadastral map. There are 50,588 villages in the rural subuniverse of the survey. The total number of households included in the data is 120,048, of which 45,952 belong to urban areas.

In view of the variability of the characteristics for which estimates are prepared, the population distribution, field resources available, and reliability constraints, a sample size is determined at the time of the survey. This sample size has been considered sufficient to produce estimates of key variables at national and provincial level at a 95% level of confidence. A stratification sampling scheme is adopted reflecting the geographical level of estimates to be built up and to control the variation in the characteristics under study of the survey population. With respect to the urban areas, Karachi, Lahore, Gujranwala, Faisalabad, Rawalpindi, Multan, Sialkot, Sargodha, Bahawalpur, Hyderabad, Sukkur, Peshawar, Quetta, and Islamabad, being large-sized cities, have been treated as an independent stratum. Each of these cities has been further substratified into low-, middle-, and high-income groups based on the information collected in respect of each enumeration block. After excluding the populations of large-sized cities, the remaining urban population in each defunct administrative division in all provinces has been grouped and treated as an independent stratum. In the rural areas, the population of each district in Punjab, Sindh, and Khyber Pakhtoonkhwa provinces has been grouped together to constitute a stratum. For Balochistan Province, each defunct administrative division has been taken as a stratum.

**Table 6: Descriptive Statistics (Region and Year Wise)  
Household' Survey**

Year	Control Groups						Treated Group	
	Balochistan Rural	Balochistan Urban	KP Rural	KP Urban	Sindh Rural	Sindh Urban	Punjab Rural	Punjab Urban
	<b>Average Households' Real Income at Constant Prices of 2005 (PKR per Month)</b>							
2005	7,980	8,516	7,467	7,941	12,470	13,879	14,196	12,854
2006	7,428	10,483	9,795	10,384	11,122	15,995	14,110	13,640
2008	7,421	10,485	8,249	10,583	13,402	14,181	15,201	13,690
2011	11,859	12,721	10,638	13,574	15,629	19,134	17,332	20,242
2012	18,446	13,771	11,769	14,104	21,464	20,648	21,987	23,939
2014	15,415	17,519	12,341	18,026	25,022	27,106	19,023	28,117
2016	15,948	22,219	14,871	19,277	26,212	31,062	26,745	29,032

A two-stage stratified sample design is adopted for this survey (Government of Pakistan 2016). Enumeration blocks in the urban domain and villages in the rural domain have been taken as primary sampling units (PSUs). Those PSUs from each ultimate stratum/substratum are selected on the basis of their proportionate in sample size. The population of rural areas and households for urban areas is adopted as a measure of size for selecting primary sampling units (PSUs) from the strata/substrata formed in urban and rural subuniverses of the survey. Households within each sample primary sampling unit (PSU) have been considered as secondary sampling units (SSUs). For 2016, 16 households were selected from each sample village and 12 households from each enumeration block through a random systematic sampling scheme.

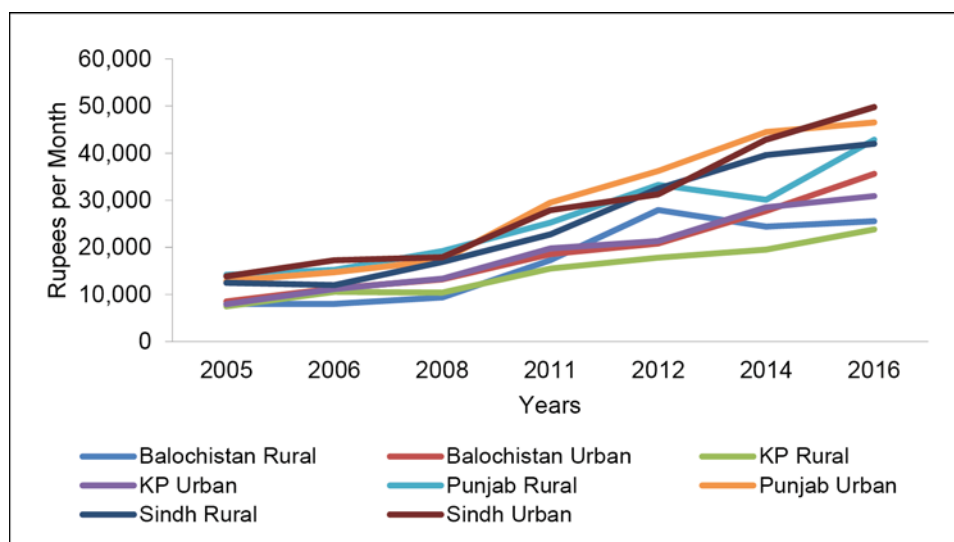
The changes in the patterns of households' income are shown in Figure 1. The graphical approach with these figures compares the patterns of income and expenditures among the regions over time. The steep increase in households' income in Urban Punjab since 2014 indicates the impact of investment in transport on income.

**Table 7: Descriptive Statistics (Overall)  
Household' Survey**

Variable\Statistics	Mean	Median	Standard Deviation	Minimum	Maximum
Monthly Household Income (Rs) – Nominal	22,408	19,354	11,304	7,467	49,761
Monthly Household Income (Rs) – Real	15,833	14,146	6,069	7,421	31,062
Expenditures on Education (%)	3.7	3.6	2.0	0.7	7.9
Household Size (Numbers)	7.0	6.9	0.7	5.8	8.7
Number of Earners	1.8	1.8	0.2	1.5	2.6



Figure 1: Households' Income



### 4.3 Estimation Methodology

We have established the hypothesis that improvement in the transport infrastructure and the number of earning members in a household are the major determinants of the household's income, while expenditures on education as a percentage of total household expenditures  $EDUC_{it}$  and the location of a household in rural areas  $DUMRUR_i$  have been taken as controlled variables. Our estimations of the impacts of transport infrastructure are based on real households' income. The data of households' incomes collected and presented by the Federal Bureau of Statistics (Government of Pakistan: Various Issues) were in nominal terms. To convert these data we used the constant prices in 2005. The year 2005 was applied as a base year to convert the nominal prices into real prices. The changes in overall indexes of prices have been used to convert the nominal incomes into real households' income (Government of Pakistan 2019).

To measure the impact of improvement in urban transport infrastructure in Punjab, Equation (1) allows us to derive the baseline estimation strategy of the difference-in-difference specification, which takes the following form:

$$INCOM_{it} = \alpha_i + \beta_0 PB_i + \beta_1 DUMTRNS_t * P_i + \beta_2 * X_{it} + \varepsilon_{it} \quad (1)$$

where  $INCOM_{it}$  is the average households' real income in year  $t$  for  $i^{th}$  household.  $PB_i$  is a binary variable that takes a value of 1 for a household that belongs to urban areas of Punjab (treated group) and a value of 0 for other provinces (controlled group).  $DUMTRNS_t$  is also a binary variable that takes a value of 1 for the period in which the transport infrastructure was improved in Punjab and 0 otherwise.  $P_i * DUMTRNS_t$  is the interaction term between these two binary variables.  $X_{it}$  indicates all controlled variables included in the regression analysis, while  $\varepsilon_{it}$  is the error term, which is assumed to be uncorrelated among itself and have a constant variance.

In the first stage, we tested the impact of modernization and upgrading of transport infrastructure in Urban Punjab on the income of households. The revolutionary change in the urban transport system in Punjab was initiated in 2013–14. This type of initiative was not taken in other provinces. Balochistan did not initiate such a plan because of the budget constraints and its large scattered areas that require more funding for

transport connectivity, while the governments in Sindh and Khyber Pakhtoonkhwa have opposed heavy spending on such projects. The public and private sectors have focused on the development of transport infrastructure in Punjab Province. The impact of this change has been captured through a dummy variable  $DUMTRNS_t$  which is equal to one for 2014 and 2016 and zero in other cases. The interaction variable  $DUMTRNS_t * PB_i$  reflects the effects of policy intervention. The average number of earners in a household  $EARNERS_{it}$ , households that belong to rural areas  $DUMRUR_i$ , and dummy variables to capture the provincial/regional impacts  $PB_i$  for Punjab have also been introduced as control variables in the model, while other provinces have been considered as a reference category.

To determine households' income  $INCOM_{it}$ , we hypothesized that households' income  $INCOM_{it}$  depends on the number of earners  $EARNERS_{it}$ , improvement in transport infrastructure  $DUMTRNS_t$ , the location of a household in rural areas  $DUMRUR_i$ , and the province of the household ( $PB_i$  for Punjab), while two interaction variables to capture the composite effects of the years of heavy investment in the transport sector in Urban Punjab  $DUMTRNS_t$ , the number of earners in a household  $EARNERS_{it}$ , and the province of a household have also been included. This model is described by the following equation:

$$INCOM_{it} = \alpha_i + \beta_1 EARNERS_{it} + \beta_2 DUMTRNS_t * PB_i + \beta_3 * EDUC_{it} + \beta_4 DUMRUR_i + \beta_5 DUMTRNS_t * EDUC_{it} + \beta_6 PB_i \quad (2)$$

An increase in households' income in Urban Punjab after investment in transport system modernization and improvement can be seen in Table 8. The change in households' income in Urban Punjab is significantly higher than in other provinces. However, the higher change in households' income in Urban Sindh in 2016 (Table 9) indicates some other factors, including the growth in large-scale manufacturing industries in Karachi and improvement in the law and order conditions.

In interpreting the results, it is notable that the explanatory variables of the number of earners and households' expenditures on education that we have included in this study explain the short- to medium-term effects only. There are several other factors, including education of household members, households' assets, professions, and investment in business activities, that can affect households' income. Due to the limited survey data, we have not included these variables. Incorporating these variables is possible either with cross-sectional data or if data from the same households are available over a number of years. Unfortunately, data from the same households have not been ensured in the survey. Our main concern is to capture the impact of infrastructure development on households' income, so we used panel data where testing the policy effects over time is possible.

According to the definition in the Households' Income and Expenditure Survey (HIES), a "household" may be either a single-person or a multi-person household. A multi-person household is a group of two or more persons who make some common provision for food or other living essentials and who have no usual place of residence elsewhere. The persons constituting the group may pool their incomes and have a common budget to a greater or lesser extent; they may be related or unrelated or a combination of both. The general criterion to be used in identifying the members of a multi-person household relates to whether they live and eat together and have no usual place of residence elsewhere (Government of Pakistan 2016). "Earners" are all those persons aged 10 and above who provide the household with material return, in cash or in kind.

**Table 8: Average Household Real Incomes (PKR)  
for the Periods 2005–2012 and 2014**

Group	Region	Pre-Transport Improvement 2005–12	Post-Transport Improvement 2014	Difference
Control (Nonaffected) Groups	Balochistan Rural	10,627	15,415	4,789
	Balochistan Urban	11,195	17,519	6,324
	KP Rural	9,584	12,341	2,758
	KP Urban	11,317	18,026	6,709
	Sindh Rural	14,818	25,022	10,205
	Sindh Urban	16,767	27,106	10,339
	Punjab Rural	16,565	19,023	2,458
Treated (affected) Group	Punjab Urban	16,873	28,117	11,244

Note: "PKR" is Pakistani rupees.

**Table 9: Average Household Real Incomes (PKR)  
for the Periods 2005–2012 and 2014–2016**

Group	Region	Pre-Transport Improvement 2005–12	Post-Transport Improvement 2014–16	Difference
Control (Nonaffected) Groups	Balochistan Rural	10,627	15,682	5,055
	Balochistan Urban	11,195	19,869	8,674
	KP Rural	9,584	13,606	4,023
	KP Urban	11,317	18,652	7,334
	Sindh Rural	14,818	25,617	10,799
	Sindh Urban	16,767	29,084	12,317
	Punjab Rural	16,565	22,884	6,319
Treated (Affected) Group	Punjab Urban	16,873	28,574	11,702

Note: "PKR" is Pakistani rupees.

"Household income *INCOM*" is the sum of monetary income and income "in kind." It consists of receipts that are received regularly by the household or by individual household members. Household income in cash includes all money receipts, such as wages, salaries, rent from land and property, income from self-employment, assistance, etc. Household income "in kind" includes wage payments in kind, goods, and services transferred free of charge by an enterprise to an employee. It also includes the value of home production that is consumed within the household (e.g. agricultural products, livestock products, etc.). Where an employee buys from his employer, for his household consumption, goods and services at concessionary/subsidized prices and thus obtains a significant advantage, the value of these concessions/subsidies is also taken into account as income "in kind."

## 5. RESULTS: IMPACT OF RAPID TRANSIT PROGRAM ON HOUSEHOLD INCOME AND EXPENDITURES

It has been shown in Table 8 and Table 9 that the increase in average household income in Urban Punjab is significantly greater than in other regions. The average monthly real household income in Urban Punjab in 2014 (after new transport infrastructure) was recorded at Rs28,117, which is 66% higher than the average monthly income during the period 2005–12 (before new transport infrastructure). The percentage growth in households' income was 56% in Urban Balochistan, 59% in Urban KP, and 61% in Urban Sindh during the same period. This higher growth in household income in Urban Punjab is attributed to the improvement in transport infrastructure. These inferences are validated by the regression results presented in Table 10a and Table 10b.

The results presented in Table 10a and Table 10b reflect two alternative scenarios. In Table 10a we used entire data including rural households. However, in Table 10b we estimated the parameters based on the urban household data only. The province of Punjab *PB* was taken as the “treated group,” while the other three provinces belong to the “control group.”

It was hypothesized that modernizing and developing the transport infrastructure in urban areas will improve households' income. This hypothesis was accepted and the positive impact of the improvement in transport infrastructure in Urban Punjab on households' income  $INCOM_{it}$  is validated by the results.

The results in Tables 10a and 10b indicate a significant improvement in households' income after improvement in transport infrastructure. These results are consistent and robust in all alternative scenarios. The impacts of investment in transport infrastructure  $DUMTRNS_t * PB_i$  are positive and significant, which shows that improvement in transport infrastructure has affected households' income positively. The significant impacts of the investment in transport infrastructure on per capita income and GDP growth have also been observed in current economic literature (Harmatuck 1996; Mehar 2017; Yoshino and Abidhadjaev 2015, 2016, 2017).

This study estimates the quantum of impact of modernizing and upgrading urban transport on households' income. It shows an improvement in households' income of more than 60% in real terms over four years. The beta associated with the interaction dummy “ $DUMTRNS_t * PB_i$ ” reflects the impact of transport infrastructure on households' income. Based on all regions' data, it is envisaged that the average real income of households increased after four years from PKR9681 to PKR11,828 per month after new transport infrastructure in Urban Punjab. The results are reconfirmed by regression analysis based on urban households' data only. The betas associated with the interaction variable “ $DUMTRNS_t * PB_i$ ” in Table 10b indicate that the increase in average real households' income after four years is between PKR8,404 and PKR10,229 per month.

The regional dummy *PB* showed its effects when it was taken as an interaction variable with  $DUMTRNS_t$  ( $DUMTRNS_t * PB$ ); however, it was noted that the transport dummy variable  $DUMTRNS_t$  does not work simultaneously with its interaction variable  $DUMTRNS_t * PB$ . We applied the interaction variable  $DUMTRN_t * PB$  in all alternative scenarios and found it to be a significant determinant of household income  $INCOM_{it}$ .

The magnitude of the estimated parameters shows some important and interesting behavior on the part of the households. The coefficients associated with the transport interaction variable *DUMTRNS\*PB* are consistent and robust in all alternative scenarios. The estimated results in Table 10b (based on urban households only) revalidate the results in Table 10a (based on urban and rural households). This supports the investment in transport infrastructure for improvement and modernization.

The positive impacts of the improvement in transport infrastructure on households' income can be seen in Tables 10a and 10b. How the improvement in transport infrastructure is transformed into households' incremental income does not directly concern the scope of this study. However, it seems that the provision of a good-quality transport infrastructure provides workers with timely access to their workplaces. Such timely access to workplaces without extra hardship may improve workers' ability to do their work. Some workers cannot take desirable high-income opportunities in the absence of transport infrastructure from their residence to their workplace. A good transport system fills this gap, which may increase households' earning.

The coefficients show some significant and robust effect of the number of earners in a household on household's income. It is envisaged from the regression analysis that average household income in real terms declines by Rs5085 per month per additional earning member in a household. The maximum decline that has been estimated by other alternative models is Rs8792 per month. This effect is between Rs11332 and Rs15608 in the case of urban households' data.

A negative association between the number of earners in a household and the household's income has been observed. It was an interesting and surprising observation that higher numbers of earners are negatively correlated with household income, which indicates that members of poor households have to participate in earning activities, while in the case of handsome earnings by a lower number of household members, the remaining members do not participate in earning activities. So, a higher number of earners is a phenomenon in lower-income households. It was also observed that the average household income in Sindh Province is higher than in other provinces; however, when comparing urban households, Punjab and Khyber Pakhtoonkhwa are in a better position than Sindh and Balochistan. It was explained earlier that more members of lower-income households have to participate in earning activities. Young people, retired persons, females, and even schoolboys may have to participate in earning activities, which is not common in higher-income groups in Pakistan.

The surprising result of the negative impact of the number of earners on household income *INCOM* is counterintuitive. It probably reflects the pressure on poor households' members to work even in underpaid conditions, while the income of higher households with a lower number of earners provides relief for the nonearning members. As regards the relation between a household's income and the number of earners, mixed evidences are available in economic literature. Most researchers have established linkages between family income, family size, education attainment, and poverty (Blanden and Gregg 2004; Ermisch, Francesconi, and Pevalin 2002; Levy and Duncan 2001; Ludwig, Duncan, and Hirschfield 2001; Ludwig, Lad, and Duncan 2001). However, the direction of causality is not clear. The negative relation between household size and household income in the context of Pakistan was also confirmed by Mehar (1995a). In this study, the negative relation between the number of earners and households' income is more significant in the case of urban households (Table 10b).

The impact of expenditures on education by a household has also been tested in various alternative scenarios. For this purpose, the expenditures on education as a percentage of households' income (EDUC) have been used as an explanatory variable. There are several studies in the context of Pakistan that have tested the impacts of spending on education on individuals' and households' incomes (Khan 2003; Mehar 1995, Mehar 1989; Guisinger, Henderson, and Scully 1984). The direction of causality has also been tested in these studies. The majority of studies in the context of Pakistan have concluded that spending on education affects individuals' and households' income positively. A positive impact of education expenditures on households' income was also observed in this study. The parameters are statistically significant and robust. In quantitative terms, a 1% increase in the share of expenditures on education increases households' earnings by Rs1000 per month based on aggregate data. This magnitude is almost the same as in the analysis based on urban households' data.

**Table 10a: Impact of Infrastructure on Households' Income (all regions)**  
**Dependent Variable: Real Households' Income at Constant Prices of 2005**

**Panel Least Squares**

**Number of Households: 120,048; Periods included: 7;**  
**Cross sections included: 8 (All Regions)**

Independent Variables	Model: I		Model: II	
	Coefficient	T-Statistic	Coefficient	T-Statistic
Constant	31,429.21***	5.514	29,251.55***	4.873
<i>DUMTRNS*PB</i> : 1 (If 2014 or 2016) * 1 (If Punjab)	11,828.10***	3.038	10,272.06**	2.493
<i>DUMRUR</i> : Dummy: 1 (If Rural Area)	484.94	0.309	169.11	0.106
<i>EARNERS</i> : No. of Earners	-8,792.17***	-2.751	-7,774.18**	-2.349
<i>PB</i> : Dummy: 1 (If Punjab)			2,033.65	1.130
<i>EDUC</i> : Expenditures on Education as % of Total Households' Expenditures				
Adjusted R-square	0.2396		0.2436	
Akaike Info Criterion	20.0547		20.0657	
Schwarz Criterion	20.1994		20.2466	
H-Q Criterion	20.1108		20.1358	
D-W Statistics	0.6088		0.5748	
Independent Variables	Model: III		Model: IV	
	Coefficient	T-Statistic	Coefficient	T-Statistic
Constant	20,362.29**	2.843	20,375.53***	2.872
<i>DUMTRNS*PB</i> : 1 (If 2014 or 2016) * 1 (If Punjab)	9,680.99**	2.4232	9,942.23**	2.616
<i>DUMRUR</i> : Dummy: 1 (If Rural Area)	1,352.08	0.826	1,462.04	0.941
<i>EARNERS</i> : No. of Earners	-5,084.83	-1.477	-5,155.09*	-1.517
<i>PB</i> : Dummy: 1 (If Punjab)	444.63	0.235		
<i>EDUC</i> : Expenditures on Education as % of Total Households' Expenditures	1,002.76**	2.121	1,046.592**	2.432
Adjusted R-square	0.2922		0.3053	
Akaike Info Criterion	20.0153		19.9807	
Schwarz Criterion	20.2323		20.1615	
H-Q Criterion	20.0994		20.0508	
D-W Statistics	0.7052		0.7225	

\*p < 0.1; \*\*p < 0.05; \*\*\*p < 0.01.

**Table: 10b: Impact of Infrastructure on Households' Income (urban regions)**  
**Dependent Variable: Real Households' Income at Constant Prices of 2005**

**Panel Least Squares**

**Number of Households: 45,952; Periods included: 7;**  
**Cross sections included: 4 (Urban Areas Only)**

Independent Variables	Model: I		Model: II	
	Coefficient	T-Statistic	Coefficient	T-Statistic
Constant	43,316.10***	4.554	43,057.40***	4.465
<i>DUMTRNS*PB</i> : 1 (If 2014 or 2016) * 1 (If Punjab)	10,229.49***	2.967	9,071.22**	2.283
<i>EARNERS</i> : No. of Earners	-15,598.02***	-2.891	-15,607.64***	-2.856
<i>PB</i> : Dummy: 1 (If Punjab)			1,433.04	0.611
<i>EDUC</i> : Expenditures on Education as % of Total Households' Expenditures				
Adjusted R-square	0.3973		0.3818	
Akaike Info Criterion	19.8307		19.8867	
Schwarz Criterion	19.9734		20.0770	
H-Q Criterion	19.8743		19.9449	
D-W Statistics	0.5888		0.5728	
Independent Variables	Model: III		Model: IV	
	Coefficient	T-Statistic	Coefficient	T-Statistic
Constant	31,232.97**	2.704	31,175.07*	2.794
<i>DUMTRNS*PB</i> : 1 (If 2014 or 2016) * 1 (If Punjab)	8,356.27**	2.174	8,404.58*	2.451
<i>EARNERS</i> : No. of Earners	-11,357.71*	-1.955	-11,332.25**	-2.014
<i>PB</i> : Dummy: 1 (If Punjab)	72.99	0.031		
<i>EDUC</i> : Expenditures on Education as % of Total Households' Expenditures	1,036.89*	1.717	1,043.00**	1.870
Adjusted R-square	0.4282		0.4520	
Akaike Info Criterion	19.8376		19.7662	
Schwarz Criterion	20.0755		19.9565	
H-Q Criterion	19.9103		19.8244	
D-W Statistics	0.7492		0.7518	

\*p < 0.1; \*\*p < 0.05; \*\*\*p < 0.01.

## 6. POLICY RECOMMENDATIONS

This study recommends investment in transport infrastructure to improve households' income in Pakistan. A modernized transport system provides more connectivity and speedy access, which may provide timely access for workers to their workplaces. It shows that easy and timely access to workplaces after a rapid transit system has been transformed into increased households' earnings. This phenomenon is confirmed by significant increases in household incomes in those urban areas of Pakistan where the transport system has been improved. The increase in the average household income in Urban Punjab after new transport infrastructure is higher than in other regions. This incremental growth in households' income is also validated by the regression results. It has been ascertained that the average real income of households increased by more than Rs10,000 per month after new transport infrastructure in Urban Punjab. This increase was between Rs9000 and Rs10,000 per month in the case of urban households' data. This represents a very strong justification in favor of spending on transport infrastructure.

A rapid transit system may enhance efficiency in the labor market because it increases the size of the market. The accessibility of workplaces and the availability of more workers to employers create competition and efficiency in the labor market. So, an increase in households' income as a consequence of the availability of a rapid transit system is quite logical, which has been confirmed in this study.

The negative association between the number of earning members in a household and the household's income in the context of Pakistan depicts another important phenomenon. A household has to involve more members in earning activities if the aggregate household's income is insufficient. Adolescent and female household members may have to scarpify their studies, entertainment, and domestic responsibilities to participate in households' income. An appropriate increase in the income of lower-class people can keep adolescents away from earning activities when they are still at school. Thus, investment in transport infrastructure provides an indirect mechanism to provide more opportunities for adolescent and female household members.

It is important evidence in the context of Pakistan that investment in transport infrastructure in Urban Punjab has significantly improved households' income. This phenomenon was confirmed in various alternative models. The results in Table 10a show four different equations based on the entire population. The parameters are robust, while in Table 10b the results are based on the urban population only. The conclusions are the same in both cases. The improvement in transport infrastructure increases households' income because it provides timely access to workplaces. From the perspective of policy formulation, it is noteworthy that spending on transport infrastructure can improve households' income significantly, which can be transformed ultimately into higher tax revenue and GDP growth.

## 7. CONCLUSION AND LIMITATIONS

In interpreting the explanation and uses of these results, it is important to note that we have several limitations in terms of the estimation of the parameters. There are several variables that affect households' income. The qualifications of the earning members, their experience, and the types of professions are the important factors regarding the magnitude of households' earning. Due to the limited data, we have not taken these factors as explanatory variables. The negative impacts of the number of earning members and the positive impact of expenditures on education reflect some special social aspects of Pakistani society. The higher level of earnings of some family members provides opportunities to other members to spend their time on nonearning activities like education, entertainment, and personal grooming. However, in the case of lower earnings, more members of a family will have to be engaged in earning activities. In interpreting the impacts of the transport infrastructure, it is important that this analysis is based on pooled data from selected years. The results may be different in long-term analysis.

It is common knowledge that an efficient and convenient transport system provides more opportunities for work and earning, so it determines households' incomes. In this study, it has been confirmed that the development of urban transport infrastructure has significantly improved households' income in Urban Punjab. However, another aspect of the conclusion and policy recommendations is the lack of fiscal resources in Pakistan. It was stated in earlier sections that Pakistan is facing a fiscal crisis because of high external debts, low tax revenue, and growing fiscal deficit. It is shown in Table 2 that development expenditures have been reducing over the last two decades. In this



situation it is extremely difficult to recommend public sector investment in infrastructure development. To encourage private investment in infrastructure development, including the provision of a rapid transport system, parliament legislated the “Public Private Partnership Act” in 2017. This act determines the modes of private participation in infrastructure development; however, it is also important to mention that the success of a public-private partnership model in Pakistan regarding infrastructure development is closely associated with contract management skills. The capability of private participation in infrastructure financing in Pakistan is summarized in Appendix A. It is a common view that unnecessary fears in the minds of project executers, corrupt practices, and political pressures may lead to the failure of public–private partnership.

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## APPENDIX A

### Government Capability to Prepare, Procure, and Manage PPP Projects

No.	Requirement/Measure	Applicability (Yes/No)	Detail/Indicator
<b>Preparation of PPPs (Pakistan' Score: 67)</b>			
1	Central budgetary authority's approval	Yes	Before tendering and after contract
2	Fiscal treatment of PPPs	No	
3	PPPs' prioritization consistent with public investment prioritization	Yes	Detailed procedure not regulated
4	Economic analysis assessment	Yes	No specific methodology developed
5	Fiscal affordability assessment	Yes	No specific methodology developed
6	Risk identification	Yes	Specific methodology developed
7	Comparative (monetary) analysis	Yes	No specific methodology developed
8	Financial viability or bankability assessment	Yes	No specific methodology developed
9	Market sounding and/or assessment	Yes	No specific methodology developed
10	Environmental impact analysis	Yes	Specific methodology developed
11	Assessments in RFP and tender documents	No	
12	Draft PPP contract included in the RFP	Yes	Tender documents not available online
13	Standardized PPP model contracts and/or transaction documents	Yes	
<b>Procurement of PPPs (Pakistan's Score: 66)</b>			
14	Evaluation committee members required to meet specific qualifications	No	
15	Public procurement notice of the PPP issued by procuring authority	Yes	Available online
16	Foreign companies permitted to participate in PPP bidding	Yes	
17	Minimum period of time to submit the bids	Yes	45 calendar days
18	Availability of various procurement procedures for PPPs	–	Open procedure and competitive dialogue and/or multistage tendering
19	Direct negotiation not discretionary	Yes	
20	Tender documents detail the procurement procedure	Yes	
21	Tender documents specify prequalification/shortlisting criteria	Yes	
22	Clarification questions for procurement notice and/or the RFP	Yes	Answers publicly disclosed
23	Pre-bidding conference	Yes	Results publicly disclosed
24	Financial model submitted with proposal	Yes	
25	Proposals solely evaluated in accordance with published criteria	Yes	
26	Treatment when only one proposal	No	
27	Publication of award notice	Yes	Available online
28	Notification of the result of the PPP procurement process	Yes	Grounds for selection included
29	Standstill period	No	
30	Negotiations with the selected bidder restricted	No	
31	Publication of contract	Yes	Not available online

*continued on next page*

**Appendix A** *table continued*

No.	Requirement/Measure	Applicability (Yes/No)	Detail/Indicator
<b>PPP Contract Management: (Pakistan's Score: 37)</b>			
32	System to manage the implementation of the PPP contract	Yes	Establishment of a PPP contract management team
33	Risk mitigation mechanism. System for tracking progress and completion of construction works	Yes	
34	Monitoring and evaluation system of the PPP contract implementation	Yes	Private partner provides periodic information
35	Procurement authority gathers information. Foreign companies permitted to repatriate income	Yes	
36	Change in the structure (stakeholder composition) of the private partner and/or assignment of the PPP contract regulated	Yes	
37	Modification/renegotiation of the PPP contract is regulated	No	
38	Circumstances that may occur during the life of the PPP contract regulated	No	
39	Dispute resolution mechanisms	Yes	Domestic arbitration
40	International arbitration. Lenders' rights	No	
41	Grounds for termination of a PPP contract	Yes	Consequences of termination expressly regulated
<b>Unsolicited Proposals (Pakistan's Score: 42)</b>			
42	Regulation of USPs	–	Expressly regulated
43	Assessment to evaluate unsolicited proposals	Yes	
44	Vetting procedure and/or pre-feasibility analysis of USPs	Yes	
45	Evaluation of consistency of USPs with other government priorities	No	
46	Competitive PPP procurement procedure	Yes	
47	Minimum period of time to submit the bids	No	

Source: Author's own using World Bank (2018).