

## Regional Disparity and the Roles of Public Capital in Pakistan's Economy(パキスタン経済における地域格差と公共資本の役割)

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号	194
発行年	2000
URL	<a href="http://hdl.handle.net/10097/12884">http://hdl.handle.net/10097/12884</a>

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学位の種類	博士 (情報科学)
学位記番号	情博第194号
学位授与年月日	平成13年3月26日
学位授与の要件	学位規則第4条第1項該当
研究科・専攻	東北大学大学院情報科学研究科 (博士課程) 人間社会情報科学専攻
学位論文題目	Regional Disparity and the Roles of Public Capital in Pakistan's Economy
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## 論文内容要旨

The purposes of this research are twofold; first is to analyze the role of public capital in national economy of Pakistan and trace its relationship with economic growth, and second is to investigate the role of public capital in regional economies and its relationship with inter-regional disparity.

The productivity and economic growth analysis was carried out, by estimating the production functions both at national and sectoral level including public capital as one of inputs. We also calculated output elasticity and marginal productivity of inputs to evaluate their contribution in the production process of the economy. The Investment behavior of the private sector and the issue of substitutability and complementarity between public and private capital has been analyzed by estimating the capacity-acceleration type investment functions both at national and sectoral level including public capital as one of arguments. We derived a theoretically consistent and empirically estimable investment model under the assumption that growth in public capital affects the capital-output ratio and the speed of adjustment between desired and actual capital stocks is positively depends on the changes in bank credit to private sector. Furthermore the net effect of public capital on the national economy was also analyzed by estimating the reduced form relation for national output. Finally the average contribution of each input to the total growth of national economy has been assessed.

### **The main findings of national analyses are as follows:**

1. The estimates of production functions show that the public capital-labor ratio and private capital have significantly positive effect on output. It is concluded that the productivity contribution of public capital is sufficiently large at national aggregate and sectoral level, and that on aggregate level public capital plays very effective role in the production process, in the economy of Pakistan. Among alternative components of public capital stocks,  $G_3$  and  $G_2$  have higher productivity than  $G_1$ .
2. The estimation results of investment analysis show that the coefficients of output, private capital, public capital ratio and bank credit to private sector play important roles in explaining private sector's investment behavior and the speed of adjustment to the desired capital stock is explained well by bank credit variable. The coefficient of growth rate of public capital ratio is negative, indicating that public capital works as a substitute for private capital.
3. The results of production analysis indicate that public capital significantly increases output, and the output elasticity and marginal productivity of public capital are sufficiently large. On the other hand, the investment analysis reveals that aggregate public capital, in many cases, has negative effect on private investment, though in some cases that effect is statistically insignificant. These opposing effects necessitate to investigating the net effect of public capital on the national economy of Pakistan. We estimated the reduced form relation for national output, and found that the net contribution of public capital to national product is positive.
4. The average contribution of different inputs in total growth of the economy over the time indicate the public capital's contribution in growth has been sufficiently large during early periods of the sample and it decreases over the time.

For the regional analysis we first, measured the extent of interregional disparity among the regions of Pakistan by utilizing different indexes. In analyzing regional economic behavior, regional production functions are often examined by researchers, as it is considered a mark of regional economic development level. The difference in production functions will lead to the difference in regional output level, and interregional disparities may occur. We thus estimated regional production functions for two regions case at sectoral level, including public capital as one of inputs. By means of technological difference tests, we investigated whether the two regions utilize the same or different production technology in their production process. We also estimated the regional population, labor employment and regional sectoral labor allocation functions. Finally, using the estimated regional production, investment, and demographic models, we constructed a regional econometric model to evaluate various government policies, especially the public investment policies, for reducing regional disparity among the regions of Pakistan.

### **The main findings of the regional analyses are as given below:**

1. The measures of regional disparities show that a sizable disparity in per capita incomes continuously persists among the four regions of Pakistan. The extent of regional disparities in labor productivity and employment ratio are also high and have increasing trend since 1982. In the case of two regions, the disparity in per capita incomes is relatively smaller because of specific distribution of population between two regions.
2. The estimation results of regional production functions show that about 90% of private capital stocks have been allocated to relatively advanced region and the economic activities are mostly concentrated in that region. Public capital has been efficiently used in the production process of Region 1. In Region 2 since small share (about 10%) of private capital is allocated, economic activities are also low and the use of public capital is not efficient and thus public capital does not play a significant role in the production process. Further, since private capital is scarce in Region 2, it is used more efficiently so as to heighten the labor productivity. In other words, there is potential in Region 2 (backward region) to grow i.e., increase production and income, given that a higher share of private capital allocated to that region to stimulate the level of economic activities and make efficient use of public capital.
3. The tests of technological difference show that the two regions utilizes different technologies in their production process, and the difference is seems to stem from the allocation of private capital and, as a consequence, from differences in the efficiency of use of public capital between the two regions. The regional production analyses conclude that there is significant difference in production technology, which causes the interregional economic disparity between the regions.
4. The estimation results of regional population functions indicate that relatively higher job opportunities give incentives to people to move from one to another regions.
5. The simulation analysis shows that regional disparity and efficiency of the national economy are strongly affected by changing the regional allocation patterns of private capital stocks and the level of public capital. The analysis also suggests an inverted-U shape relationship between regional disparity and the efficiency of the national economy, which is consistent with the ground realities and the observations in the literature.

### **Policy suggestions for national issue:**

The results of our national production analysis confirmed that the rate of return on public capital (infrastructure investment) is very high in Pakistan and, as such the country has been able to sustain relatively high rates of growth in the

past, despite lower levels of investment (less than 20% of GDP). The investment analysis revealed that the behavior of the private sector is rather passive (public capital works as substitute for private capital) in taking initiatives in the process of capital formation. One possible reason for such passive behavior of the private sector could be, the inadequate supply of much needed productive infrastructure in many key areas of the economy, which discourage the private sector to take a lead in capital formation. Another possible reason could be that the crowding-out mechanism involving, rising interest rate (stemming from increased public domestic borrowing) work as an important factor in suppressing private investment. But in the context of Pakistan, several studies have tested crowding-out hypothesis and found that interest rate mechanism does not play an active and allocative role and the case for usual crowding-out mechanism is not well established. The above analyses suggest the following policy implications:

1. Public sector investment has been playing an important role in supporting private capital formation. A reduction in investment on infrastructure as a policy would discourage private investment and may further retard growth process. So far much of the public investment took place with low interest rates, mainly from domestic borrowings, as a result internal public debt has accumulated to high levels, which greatly limit the government's ability to increase the rate of invest in infrastructure. The government must find the ways and means for adequate investment in infrastructure. One possible way would be for the government to open up and encourage investment from prospective users of the infrastructure through contracts on the basis of build-operate-and-transfer (BOT). It is assumed that arrangements of this sort might attract considerable foreign investment if the government is able to back these schemes with instruments such as International DFI's or World Bank guarantees.
2. If the economy is to sustain high rates of overall growth in the future, the government must find ways of encouraging the private sector to play a more active role. Privatization of public enterprise, simplification of the investment regime, and removal of the price distortions, are needed to attract foreign private investment.

### **Policy suggestions regarding regional disparity issue:**

Government can use several policy options to encourage private investors to invest in less developed regions. One of such effective policy options is *tax holiday* for private investors in the less developed regions, for specified period, although that policy in the past has proved not to be effective. In regional production analysis above, it is assumed that public capital is equally available to all regions, but the level of economic activities in a region largely depend upon the level of development and availability of basic or "hard" infrastructure. Thus, the result that in the less developed region public capital has insignificant role in the production process implies that the less developed region faces insufficient level of basic

infrastructure. The facilities like water, electricity, sewerage and transport and communication are prerequisite for productive economic activities. Thus a necessary condition to cure the regional disparity/ regional income differences is to install sufficient basic productive infrastructure in less developed regions. Given the provision of basic productive infrastructure, government policies to attract private investment in the less developed regions with incentives like tax holiday or preferential and subsidized credits, will bring about boosts in the level of economic activities and help reduce the economic disparity among regions.

Given the regional data constraints and restricted assumptions regarding the public capital and regional private capital stocks, our findings suggests that the growth of public capital stock and regional allocation patterns of private capital stocks between the regions significantly affects the national as well as regional incomes and consequently interregional disparity. Availability of regional data, specially, on public and private capital stocks will enable the researcher to analyze the regional issues in more detail and depth, and formulate useful policies to help the governments to resolve regional imbalances/regional disparity.

## 論文審査の結果の要旨

パキスタンは経済成長率の鈍化と地域間経済格差の拡大という国及び地域レベル双方で問題を有している。本論文は、公共資本に焦点をあて、パキスタンにおける国及び地域経済システムでのその役割を計量経済モデルによって分析したものである。論文は全編6章から成る。

第1章では研究の背景が述べられているが、パキスタン経済について、1964年以降の変動が数量的にまとめられ、経済システム上の問題が浮き彫りにされている。

第2章では公共資本の国民及び地域経済で果たす役割に関するこれまでの主要な文献が批判的にレビューされている。

第3章では、分析に用いられるデータの収集、加工及び作成について説明がなされている。特に民間資本量、公共資本量については、パキスタンにはこれまで利用可能なデータが存在しなかったが、それらを整備したプロセスについて述べられている。これらのデータは今後パキスタン経済研究のために広く利用されると考えられ、資本ストックデータの作成そのものが本論文の一つの貢献と言える。

第4章では、公共資本が国民経済に果たす役割を解明するために、生産関数と民間投資関数の分析がなされている。可変代替弾力性を持つ生産関数が特定化され、マクロデータ及び産業別データに適用されている。その結果、労働の生産効率が労働単位当り公共資本ストックに有意に依存することが明らかにされた。混雑効果を伴う公共資本の役割の計測は、生産関数の分野における新しい貢献である。本論文の最も独創的貢献は、公共資本の民間投資行動に与える影響を計測したことである。最適資本—生産比率が公共資本ストックの成長率に依存する能力—加速度型投資関数を特定化し、その係数が有意に負であり、パキスタンの経済システムにおいては公共資本は民間資本と代替的であると結論している。これは新しい知見である。公共資本の生産における正の効果と投資における負の効果を総合的に評価するためにGDPを被説明変数とするモデルの誘導型の推定と経済成長率の要因分析がなされ、公共資本は国民経済に大きな正の効果を与えることが明らかにされた。これは、パキスタンの経済政策を立案する上で有用な知見である。

第5章では地域生産関数の分析を通して地域間格差の要因とその是正政策の解明がなされている。地域別資本ストックデータが利用不可能な状況で、民間資本ストックの地域間配分比率そのものをもパラメータとする地域生産関数の特定化とその推定方法に独創的貢献がある。5章の後半では2地域計量経済モデルが構築され、その推定された構造に基づいて交替的政策シミュレーションがなされ、公共資本、民間資本の地域間配分が国民経済と地域経済におよぼす効果が計測されている。このシミュレーション分析は適切な経済政策の立案に資する有益な情報を提供している。

第6章では結論が述べられ、いくつかの経済政策が提案されている。

以上、要するに本論文は計量経済モデルの分析によって、パキスタンの経済システムにおける公共資本の役割を国及び地域レベルで解明し、有用な政策提案を行っているものであり、情報科学の発展に寄与するところが少なくない。よって、本論文は博士(情報科学)の学位論文として合格と認める。