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Impact of Public Investments on Iran Rural Income Inequality

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Abstract: This study attempts to analyze contribution of various types of public investment to income inequality. The applied data for the present study are from 25 provinces over period 1995-2004 which including a panel data set. The results showed that, public investments have contributed to production growth in the agricultural sector, but various types of public investment have different impacts on income inequality. However, additional investments in electrification and agricultural R&D have most effective in reducing income inequality in less-favored rural areas. Therefore, an analysis of appropriate political is much needed to improve the efficiency of public investment.

Key words: Public investment · Income inequality · Rural regions · Panel data

INTRODUCTION

Governments use public spending to achieve both economic growth and equity goals. Their public spending often consists of long-term investments in research and development, education and infrastructure (like roads, electricity, telecommunication and water), as well as short-term social spending on sectors such as education, health, social security and direct food subsidies to poor households. Studies have shown that public investments in agriculture and rural areas are major contribution to agricultural growth and rural poverty reduction (IFPRI). Investment and accumulation of capital is economic growth key of each country. Investment in the agriculture sector is very important than other economic sectors in Iran [1].

Investment in rural infrastructures, road, agricultural R&D, irrigation, draining, agricultural mechanizations, electrification, rural education, new technology, marketing services are prior condition of rural-agricultural sector development. The government has key role in reduction of income inequality using different types of public investment [2]. Public investments can be allocated to promote growth directly by providing various public goods, such as research and development (R&D), infrastructure and education, or indirectly by creating an environment to attract private investment. Different public goods have different characteristics and externalities and may, therefore, have different impacts on growth and equity. However, most theoretical and empirical studies focus on either just one type of public investment or on total public investment and ignore differences between types of public investment Due to budget constraints, significant increases in public investment in rural areas seem unlikely. Therefore, the governments must give greater emphasis to using their public investment resources more efficiently. Reliable information on the marginal effects of various types of spending will help governments to determining future investment priorities to achieve the goals of equity and growth [3].

Many developing countries, however, survive substantial budget cuts in agriculture and the rural development sector as a consequence of macroeconomic reforms and structural adjustment, declines in international commodity prices and reduced private investment in agriculture sector and foreign aid to agriculture. These budget cuts will not only affect future productivity growth and food supplies, but also slow progress in reducing rural poverty and accelerate the degradation of natural resources. Given this reality, how can governments better target their limited and often declining financial resources to achieve growth, poverty and environmental goals as well as more efficient provision of public goods and services? In this study considered six major types of public investment: Roads, education, electrification, rural reform and development, health and agricultural R&D. These investments are the major instruments used by the

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government for growth and poverty reduction. In addition, these measures are readily available at the provincial level and consistently compiled for a reasonably long period [3].

Astaneh and Karbasi [4] have analyzed impact of investment on agricultural R&D and factors marginal productivity in the agricultural sector. Akbari *et al.* [5] found that investment in agricultural R&D has a positive impact on added value of agricultural sector. Fan *et al.* [6] estimated the impacts of different types of government expenditure on agricultural growth and rural poverty in Thailand. The results show that, despite Thailand's middle-income status, public investments in agricultural R&D, irrigation, rural education and infrastructure (including roads and electricity), still have positive marginal impacts on agricultural productivity growth and rural poverty reduction. Anderson *et al.*[7] explored the linkages between public investment, growth and poverty reduction, with the aim of providing an overall view of existing theories, evidence and methods and of examining ways to provide better guidance to policy-makers in the use of available techniques and information to set priorities for public investment.

Despite rapid growth of economy in the recent decades, income inequality has increased extensively in Iran agricultural sector, that appropriate strategies about public investment will help government to improve future investment priorities to achieve the goals of equity and growth.

MATERIALS AND METHODS

In this study has been supposed that the agricultural production function is of Cobb-Douglas form, with k conventional inputs and m public inputs as follows [3]:

$$Y = A\prod_{i=1}^{k} X_i^{a_i} \prod_{j=1}^{m} P_j^{\beta} \quad (1)$$

where; Y is the added value of agricultural sector, A the intercept, X_i the conventional inputs such as labor, capital and land, P_j the public investments such as roads and R&D, β_i the output elasticity with respect to conventional input i and $\tilde{a}_j$ the output elasticity with respect to public investment j.

The logarithmic form of Eq. (1) is given by:

$$\ln Y = a_0 + \sum_{i=1}^{n} a_i \ln X_i + \sum_{j=1}^{m} \beta_j P_j + e_i \quad (2)$$

where; lower cases indicate logarithms. An error term is added to represent stochastic shocks to output and is assumed to be unrelated to the other variables.

Following [8], the variance of y in Eq. (2) can be decomposed as:

$$s^2(y) = \sum_{i=1}^{n} \mathrm{cov}(y, a_i x_i) + \sum_{j=1}^{m} \mathrm{cov}(y, \beta_j d_j) + \mathrm{cov}(y, e_i)$$

$$s^2(y) = \sum_{i=1}^{k} \mathrm{cov}(y, a_i x_i) + \sum_{j=1}^{m} \mathrm{cov}(y, \beta_i p_j) + s^2(e) \quad (3)$$

where; $\sigma^2(y)$ is the variance of y and cov(y, •) represents the covariance of y with other variables. Since all the right-hand side variables in Eq. (2) are not correlated with the error term, the covariance of y and ε are equal to the variance of ε. Considering that y is in logarithmic form, $\sigma^2(y)$ is a standard inequality measure known as the logarithmic variance [9]. It has the property of invariance to scale. According to Shorrocks [8] the covariance terms on the right-hand-side of (3) can be regarded as the contributions of the factor components to total inequality.

Using estimates from (2) and applying the decomposition in (3), we are able to quantify the contributions of various public investments to income inequality in agricultural sector.

Data: A panel data set including 25 provinces over the period 1995–2004 was constructed from various governmental data sources. The agricultural production function includes conventional inputs (land, labor and capital) and public investment goods such as roads, education, rural reform and development, health, electrification and agricultural R&D generated by government investment. Additionally, annual rainfall reflects regional differences in natural production conditions.

Impact of public investments to agricultural production are defined as a function of past government expenditures. For simplification, has been assumed that public investments follow an Almon polynomial distributed lag (PDL) of degree 2. Based on available data and econometric tests [10-14].

RESULTS

Agricultural production function was estimated based on Eq. (2) and the results are presented in Table 1. This paper present three different specifications: fixed effects, random effects and none method.

Table 1: Production function estimations

	Added value of the agricultural sector		
Variable	None	Fixed effects	Random effects
land	0.147*(0.031)	0.046***(0.025)	0.235*(0.07)
labor	0.067**(0.029)	0.073*(0.01)	0.218*(0.64)
capital	0.287*(0.047)	-0.042(0.045)	0.455*(0.068)
road	0.042(0.031)	-0.001(0.021)	-0.088(0.07)
electrification	-0.015(0.023)	-0.001(0.012)	-0.16(0.04)
education	0.047(0.036)	-0.081*(0.029)	-0.28(0.067)
health	0.214***(0.044)	-0.016(0.032)	0.53(0.07)
agricultural R&D	0.036***(0.021)	-0.046*(0.01)	0.096(0.064)
rural reform	0.072*(0.018)	0.061*(0.011)	-0.05(0.059)
rainfall	0.049**(0.021)	0.032*(0.016)	-0.039(0.056)
R^2	0.98	0.99	0.88

Note: The data used are from 1995 to 2004. All variables are in logarithms. Figures in parentheses are standard errors.

* significant at the 1% level **,significant at the 5% level and *** significant at the 10% level

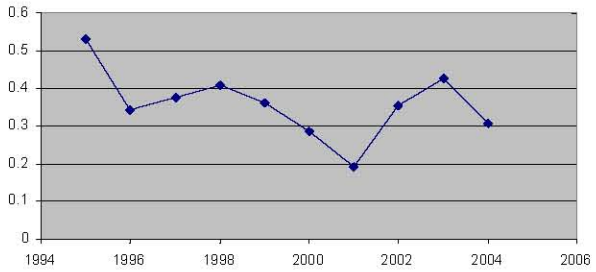

Fig. 1: Income inequality from 1995 to 2004 (log variance)

Turning to two specifications, fixed effects and random effects show that the independent variables are highly correlated to each other. Therefore the third specification uses as a basis for the inequality decomposition. Regarding the None method, the coefficients for the variables of land, labor, capital, rainfall and investments of government in health, agriculture R&D and rural reform are statistically significant. It shows that these investments are more important in the agricultural sector. The R^2 for the agricultural production function is high at 0.98, implying good fits. All the coefficients, except for electrification, in the estimated agricultural production function are positive. The summation of the coefficients for conventional inputs-labor, capital and land, is 0.053, suggesting decrease returns to scale. In Iran, labor is abundant and land is scarce, hence one should expect that the elasticity of land would be larger than that of labor. This is confirmed in Table 1; the elasticity of land is 0.147 while the elasticity of labor is 0.067. Among the six types of public investment goods, health and electrification have the largest and second largest output elasticity.

Fig. 1 shows the time paths of income inequality, measured in log variance, in agricultural sector from 1995 to 2004. Income inequality in agricultural sector changed from 0.53 to 0.03 over this period.

Given the estimated coefficients for the production function, now it can applied the inequality decomposition method outlined in Eq. (3). Table 2; report the contributions of each factor to income inequality for agricultural sector. The contributions of the two inputs labor and land to income inequality in agricultural sector have declined, while the contribution of capital has increased. However, most public investments, especially R&D, electrification, education and rural reform have increased (Table 2).

Table 2: Contributions of input factors to income inequality in agricultural

Variable	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Inequality	0.533	0.345	0.377	0.408	0.362	0.287	0.193	0.353	0.428	0.306
Road	0.009	0.011	0.009	0.008	0.005	0.001	0.002	0.012	0.01	0.006
Electrification	-0.006	-0.004	-0.003	-0.005	-0.006	0.002	0.002	0.001	0.001	0.0002
Education	0.013	0.01	0.01	0.012	0.006	0.013	0.008	0.016	0.016	0.014
Health	0.053	0.05	0.068	0.085	0.072	0.046	0.01	0.053	0.055	0.049
Agricultural R&D	0.007	0.003	0.01	0.004	0.006	-0.002	0.001	0.006	0.007	0.007
Rural reform and development	0.012	0.018	0.019	0.018	0.009	0.017	-0.005	0.026	0.01	0.022
Rainfall	-0.004	-0.005	-0.003	0.001	-0.002	0.004	0.011	0.007	0.004	0.003
Land	0.069	0.065	0.068	0.072	0.059	0.016	0.03	0.067	0.071	0.055
Labor	0.032	0.035	0.009	0.006	0.008	0.005	0.009	0.01	0.013	0.004
Capital	0.142	0.156	0.159	0.171	0.176	0.136	0.129	0.171	0.178	0.143
Other factors	-	0.004	0.029	0.034	0.026	0.046	-0.005	-0.019	0.061	0.001

Land and capital have the largest contributions to income inequality in the agricultural sector, while investment in electrification and rainfall reduced income inequality.

These kinds of results offer policy insights that are extremely useful in making government strategies to alleviate poverty more effective.

CONCLUSIONS

This study attempts to analyze contributions of various types of public investment to income inequality. The applied data for the present study are from 25 provinces over period 1995-2004 which including a panel data set. Using Shorrock's method, the impacts of different types of public investments to income inequality have been quantified. The results show that, public investments to have contributed to production growth in the agricultural sector, but various types of public investment have different impacts on income inequality [4-5].

However, additional investments in electrification and agricultural R&D have most effective on reducing income inequality in less-favored rural areas. Increasing investment in agricultural R&D is one of the most efficient ways to improve agricultural productivity and rural poverty reduction. Among conventional inputs, contribution of labor to income inequality is decreasing rapidly and therefore through enhancing labor productivity and labors' mobility toward better job opportunities; it can reduce poverty in rural areas.

In general, the government must give greater emphasis to using their public investment resources more efficiently. Appropriate strategies about public investment will help government to improve future investment priorities to achieve the goals of equity and growth. Therefore, an analysis of appropriate policical is much needed to improve the efficiency of public investment.

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