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Agriculture Public Spending and Growth: The Example of Indonesia

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This note[1] analyzes the trends and evolution of public spending in the agriculture sector in Indonesia, as well as its impact on agriculture growth during the period 1976–2006. We demonstrate empirically that public spending on agriculture and irrigation had a positive impact on agriculture growth during that period, whereas public spending on fertilizer subsidies had the opposite effect. As Indonesia continues its efforts to revitalize the agriculture sector, public spending should be directed at improving the provision of public services rather than the subsidization of private inputs.

Supplying Public Goods Versus Subsidizing Private Inputs

According to the theory of public economics, only the public sector can supply public goods efficiently (and at adequate amounts) because the market will always under-provide those goods. When supplied in a cost-effective way, public goods will generate higher returns than will investments in private inputs because they will create positive externalities for the economy as a whole. Because governments have the capacity to collect individual contributions to provide public goods, they can also capture economies of scale, access funding, and manage risk better than farmers can manage it. As a result, they are better suited to supply public goods.

However, the impact on productivity of subsidizing private inputs is unclear. As shown in the literature review conducted for the Indonesia Agriculture Public Expenditure Review, the record of governments subsidizing private inputs in the agriculture sector is mixed, at best—although many governments spend a considerable share of their budgets on such subsidies. The productivity impact of subsidizing private inputs *at the expense of* the provision of public goods is often negative (as will be discussed and shown in this "Economic Premise"). Subsidizing private input often represents only a transfer of resources, with no impact on the consumption of that input; and, even if the subsidy increases its use, its impact on productivity is unclear. For example, there are diminishing returns on fertilizer use beyond a point; additional use may no (or a negative) effect on production if other production inputs are not available.

The Importance of Public Spending for Agriculture Growth

The purposes of the public sector in the development of agriculture—primarily a private sector activity—are to set an enabling environment where private sector activities can flourish; to correct circumstances under which the market fails to allocate resources efficiently; and to minimize the price distortions faced by both farmers and consumers—all while promoting inclusive growth. In practice, those tasks translate into interventions along several dimensions:

- *correcting for externalities,* which requires making people pay (or be paid) for the

cost and benefits of their actions— such as by discouraging the overuse of fertilizer that leads to pollution, or by rewarding with a patent advances in research and development;

- *providing for public goods that are not efficiently and sufficiently produced by the market*—such as by building rural roads and irrigation systems, providing extension services and agriculture marketing, and funding more agriculture research and development;
- *addressing information asymmetries and eliminating information gaps* so that farmers and consumers can make informed decisions on what to produce, with what level of inputs, and at what price—for example, by certifying product input and output quality standards and ensuring plant and animal health; and
- *regulating against monopolistic behavior* that reduces social welfare—for example, by having lower outputs sold at higher prices.

There is renewed interest in improving our understanding of the impact of public spending on agricultural growth.[2] All these studies emphasize the concept of *opportunity costs of subsidies*. Although increased use of a particular input may have a positive effect on production (such as the effect of fertilizer on rice production), the impact of subsidizing such inputs is often negative because it is done at the expense of providing public goods (such as funding for research on newer varieties or improvements to the irrigation network) that have a larger positive impact on production.

In Indonesia, Fuglie (2004) identifies the drivers of growth in agriculture between the 1960s and 2000. He argues that although agricultural productivity in the 1970s and 1980s was increasing, this trend has been flat since the early 1990s, with most growth in agriculture being explained by increases in production inputs (labor and land). Fuglie also argues that the reason for the productivity stagnation from the 1990s onward is the low levels of both private and public investments—with public investments in research and development, rural infrastructure, and irrigation being necessary complements to private investments in agriculture.

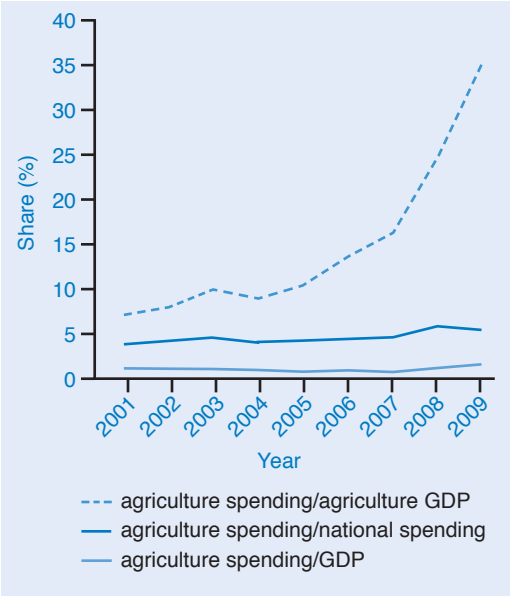
We have reviewed areas through which government spending can have a positive impact on agriculture growth—irrigation, agriculture research and development, extension services, infrastructure/rural roads, and subsidies to private inputs. These do not necessarily constitute an exhaustive list of factors that determine agriculture growth; but our focus is primarily on the provision of public goods and services with high fiscal implications, and on other public spending categories that are not necessarily public goods (primarily, the provision of subsidies to private inputs such as seeds, fertilizer, or credit) but that do affect the volume and composition of the budget. Items such as trade policy or the business environment are also crucial for the development of agriculture; but because public intervention in these areas usually has lower spending implications, it will be excluded from this note.

Trends of Agriculture Public Spending in Indonesia

The question that motivated the analysis was whether the volume and composition of public spending are having an impact on growth in the agriculture sector. We first analyze recent trends for public agriculture spending in relation to growth, followed by a time-series quantitative assessment of the impact of public spending on per capita growth in Indonesia's agriculture sector during the period 1976–2006.

Public spending on agriculture has increased recently in real terms and without a corresponding increase in agricultural production. During the years 2001–09, national spending on agriculture[3] increased from Rp 11.0 trillion to Rp 61.5 trillion, an annual av-

Figure 1: Agriculture Spending, 2001–09



Source: World Bank staff calculations.

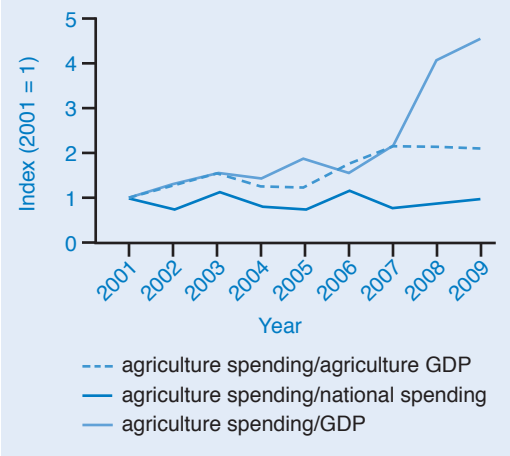
erage of 12 percent in real terms. This was the result of large budget increases and a big spending boost from decentralization across all sectors, with even greater amounts for agriculture. As figure 1 illustrates, the agriculture share of the budget doubled from 3 percent in 2001 to 6 percent by 2008; by that year, it reached 1 percent of GDP because of increased spending on agriculture subsidies. This increase did not result in a corresponding rise in agricultural production, which increased an average of 3 percent between 2001 and 2009. Low agriculture growth combined with a constant share of labor force participation in the sector has led to stagnant per-worker value-added.

Recent public spending trends in agriculture show that resources are being directed toward supporting private goods at the expense of providing public goods. In 2009, the government of Indonesia directed 56 percent of agriculture resources (Rp 34.4 trillion) toward subsidizing private goods: fertilizer subsidies accounted for almost half (Rp 18.5 trillion), and the remainder was allocated to seeds, RASKIN,[4] and agriculture credit. As figure 2 shows, by end-2009 the allocation for agriculture subsidies was four times its 2001 level, while resources for irrigation have been flat since 2001. The budget of the Ministry of Agriculture has increased significantly since 2001, but has grown at a slower pace than agriculture subsidies.

Government investment in public goods was largely behind Indonesia's success in increasing agricultural productivity from the 1970s to the early 1990s. During the years of the Green Revolution, Indonesia invested heavily in its irrigation network, research and development, extension services, and rural infrastructure; and it subsidized private agriculture inputs (fertilizer, seeds, and credit). By the early 1990s, the country had achieved high yields across several commodities, including rice, cereals, and potatoes (World Bank 1994). Unfortunately, in the 1990s the upward trend in productivity flattened. Exacerbated by declining levels of private and public investment, agricultural productivity growth remains sluggish today.

Spending as a share of GDP in agriculture averaged 10 percent and 8 percent in the 1970s and 1980s, respectively, compared with 40 percent today. As discussed earlier, we argue that because most of the increased

Figure 2: Index of Agriculture Spending, 2001–09



Source: World Bank staff calculations.

spending in agriculture is directed at private goods, it has not translated into a proportional increase in growth.

Empirical Application to Indonesia's Agriculture Sector

In the empirical analysis, we look at the relationship between agriculture public spending and the growth rate of agriculture GDP per capita, using time-series data with both ordinary least squares and general method of moments econometric techniques. The model chosen for this policy note introduces specific characteristics and innovations to fit the Indonesian context as well as the broader analysis objectives of the Public Expenditure Review.[5]

Empirically, the connection between public spending and growth has been difficult to establish in the literature. The relationship between agriculture and nonagriculture GDP is likely to be simultaneous rather than unidirectional—and that can introduce a simultaneity bias within the fiscal variables and the dependent variable (growth rate of agriculture GDP). To minimize this risk, the fiscal variables enter the specification lagged, and a more rigorous use of instruments is considered by using the general method of moments technique. Estimating the model with general method of moments is a way to test the robustness of these empirical estimations by exploring the relationship within a dynamic setting. Also, although time-series analysis ideally would benefit from a longer time span, data availability limited the number of observations in the model to a 30-year period.

The basic model is as follows:

$$\ln y_t = b_0 + b_0 \ln y2_t + b_2 \Delta APE_{t-1} + b_3 \Delta ATR_{t-1} + b_4 \Delta \ln l_t + b_5 \Delta \ln la_t + b_6 \Delta \ln GD_t + b_7 Dummy98_t + \varepsilon_t, \quad (1)$$

where t is the year, y is the per capita growth rate of agriculture GDP, and $y2$ is the rate of growth of nonagriculture GDP per capita. *Fiscal variables: APE* is the ratio of total agriculture public expenditures to agriculture GDP; *ATR* is a ratio of 3 percent of total tax revenues to agriculture GDP. *Control variables: l* is the agriculture labor force (in thousands); *la* is the arable land, as an asset of the farmers (hectares); *GD* is an index of global demand for agriculture exports, total world demand for agriculture, crops, livestock, and primary and processed exports (in billions of U.S. dollars). *Dummy98* is a dummy, 1 for the 1998 financial crisis; ε_t is an error term; and b_0, b_1, b_2, b_3, b_4, b_5, b_6, and b_7 are the coefficients assigned to the independent variables.

Initially, the direct sensitivity of agriculture GDP per capita growth to public spending is tested using a functional specification in which the rate of growth is the dependent variable. Two groups of independent variables are considered: *fiscal variables* and *control variables*. Regarding the former, the spending effect initially is aggregated into total agriculture public spending (*APE*)[6] and then is broken down into two components: (1) development spending on agriculture and irrigation and (2) fertilizer subsidies. All fiscal variables include central government and subnational spending and are considered as ratios to agriculture GDP. The government budget constraint is considered in the specification function, for methodological reasons, by introducing *ATR* as a proxy for fiscal revenues.[7] This assumes implicitly that, under an earmarking hypothesis, there would be no fiscal deficit for the agriculture sector (period average).

The selection of control variables takes into account the factors affecting supply of and demand for agriculture output in Indonesia. Nonagriculture GDP is used to capture the spillover synergies from growth in industry and services. On the supply side, the labor and arable land variables are used as proxies for private inputs to capture possible complementarity effects between private and public assets. The agriculture demand variable *GD* is an index of global demand for agriculture exports whose fluctuations may

have affected the production supply response in Indonesia. Finally, a time dummy variable[8] is introduced for 1998 to control for growth effects related to events in that year—namely, the Asian financial crisis affecting Indonesia.

The fiscal variables enter the functional specification with a one-year lag to capture the fact that the agriculture GDP per capita growth rate is dependent on the previous year's public spending. Changes in taxation, for example, may have a particularly lagged effect because they affect the following fiscal year. In contrast, the control variables are considered contemporaneously, assuming that they are most likely to determine the agriculture growth rate within the same year.[9]

The overall results show that spending on agriculture has a statistically significant positive effect on the agriculture GDP per capita growth rate, after controlling for the effects of nonagriculture GDP per capita growth and for private inputs (labor and arable land). We then split public spending on agriculture into (1) spending for public goods (development spending for agriculture and irrigation) and (2) spending on fertilizer subsidies. We find that spending on public goods is a positive driver of the per capita growth rate of agriculture GDP, whereas spending on fertilizer subsidies appears to have a significant negative effect. The positive effect of public spending on agriculture is associated only with the agriculture and irrigation public spending component. Given the opportunity cost of further financing subsidies at the expense of other agriculture spending and irrigation directly contributing to growth, the government should consider reallocating spending from fertilizer subsidies to public goods (such as agriculture extension services, research and development, and irrigation) that could lead to faster sector growth.

As Indonesia modernizes the agriculture sector and income levels increase, it will be important to allocate resources on the basis of a two-pronged strategy that maximizes spending effectiveness, brings higher returns, and leads to growth for the agriculture sector; and pays attention to farmers' welfare and people's access to affordable food.

The government may consider these interventions:

- Reallocate public spending from subsidizing private inputs (fertilizer, seeds, and grants to farmers and farmers' groups) to providing agriculture and irrigation public goods and services.
- Reorient government support to help small farmers and farmers' groups meet the domestic demand for higher-value-added products and gain access to the global value chain. This would entail a shift away from food or estate crops (the focus of the current agriculture policy).
- Continue the government's income support to small and poor farmers, but provide incentives to pursue productive investments. Indonesia has extensive experience in the area of cash transfers. Providing incentives to put these cash transfers to productive use may result in increased investment and productivity in the agriculture sector. Also, careful targeting will be key to ensuring the efficiency of the program and their fiscal viability.
- Put in place a comprehensive monitoring and evaluation system that enables the government to assess the impact of its transfer programs. Such a system would be instrumental in preventing and correcting mistakes in program design, maximizing effectiveness in agricultural productivity, and alleviating poverty in rural areas.

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Endnotes

1. This note is based on the results of the Indonesia Agriculture Public Expenditure Review. The work is being carried out within the Initiative for Public Expenditure Analysis framework, a joint initiative by the government of Indonesia, donors (the Dutch government, the European Commission), and the World Bank. Dwi Endah Abriningrum provided research assistance.

2. Evidence provided by a U.N. Food and Agriculture Organization research project conducted in 20 countries in Latin America shows that public spending in rural areas has a positive impact on agriculture growth (Allcott, Lederman, and López 2006). The study also shows that both the volume and the composition of spending matter. Assuming a fixed amount of spending in the agriculture sector, a large share of spending on subsidies to private inputs has a negative impact on agriculture growth, given the corresponding lower spending on the provision of public goods. López and Galinato (2007) find similar results and argue that the positive effect of public spending on rural incomes is primarily dependent on the composition of spending. They estimate that a 10 percent reallocation from subsidizing private goods to providing public goods can increase per capita income from agriculture by 5 percent. In a related piece of work, Santos and Ortega (2006) show how the share of the budget allocated to subsidizing private inputs has a negative and significant effect on the efficiency of public spending.

3. National spending on agriculture includes central government spending on irrigation by the Ministry of Public Works and on agriculture by the Ministry of Agriculture. Subnational government spending on agriculture and irrigation is done by district and provincial governments and agriculture subsidies.

4. RASKIN (*Beras Miskin*) is not a subsidy to agriculture inputs, but primarily an instrument to subsidize rice consumption for the poor. To the extent that it increases domestic demand for rice and it is partly used to stabilize prices and therefore provide an incentive for increased rice production, it will also have an impact on rice production. In any case, we include it as an agriculture subsidy because the Ministry of Finance includes it; note, however, that it is not entirely a subsidy to agricultural production.

5. Different function specifications were considered, taking into account previous analyses of the impact of public spending in the agriculture sector. See, for example, López and Galinato (2007); Moreno-Dodson (2008); and Bayraktar and Moreno-Dodson (forthcoming).

6. Agriculture public spending is defined as the sum of development spending on irrigation and agriculture plus spending on fertilizer subsidies. All data come from the Indonesian budget publication *Indonesia Statistical Yearbook*.

7. Because there is no variable capturing the fiscal revenue burden on the agriculture sector, we use 3 percent of total tax revenues (based on the fact that average agriculture public spending has represented about 3 percent of total public spending during the period of analysis).

8. Inclusion of the dummy fortifies the results, but it does not change them. It corrects the noise introduced by the economy's contraction following the Asian financial crisis. GDP declined over 13.0 percent in 1998, and agriculture declined by 1.3 percent. Without the dummy, the relationship between the fiscal variables and per capita agriculture GDP growth is similar; but significance levels range between 5 percent and 10 percent.

9. After testing for the stationarity of the series, the variables are estimated in first difference, which ensures the stability of the model over time (and corrects for the possibility of unit roots and the spurious regression problem in the results). This is an important precondition to meet when conducting time-series analysis, because the possibility of including a nonstationary series can result in picking up a spurious effect.

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