WPS5977

POLICY RESEARCH WORKING PAPER   5977

Agriculture Public Spending and Growth in Indonesia

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Abstract

This paper analyzes the trends and evolution of public spending in the agriculture sector in Indonesia, as well as the impact of public spending on agricultural growth. It finds that, in line with empirical work undertaken in other countries, public spending on agriculture and irrigation during the period 1976–2006 had a positive impact on agricultural growth, while public spending on fertilizer subsidies had the opposite effect. The composition of spending patterns in Indonesia over the past decade can partly explain why significant increases in public spending for agriculture have not resulted in a commensurate increase of agricultural production. The paper is structured as follows. Section I presents analytical and empirical findings about the impact of overall public spending on growth, with a particular focus on Indonesia, followed by an analysis of the government's role in agriculture. More precisely, it discusses how public spending can contribute to higher productivity and faster growth in the sector. The section draws lessons from the empirical literature and country examples worldwide, exploring the implications of some of these findings in the Indonesia context. Section II presents the results of an empirical analysis of the impact of agriculture public spending on agriculture gross domestic product per capita growth in Indonesia, using time series analysis with both ordinary least squares and generalized method of moments econometric techniques. Section III analyzes in detail agriculture public spending trends in Indonesia over the period 2000–08, highlighting that a large and increasing share of the spending is being allocated to subsidies (fertilizer, credit, seeds) and to fund transfers to farmers and farmers' groups.

Agriculture Public Spending and Growth in Indonesia

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I. Can Public Spending Affect Agricultural Development? The Case of Indonesia

What Do We Know about the Impact of Public Spending on Growth?

While the empirical literature on the direction and magnitude of the impact of public spending on growth is mixed, there is growing evidence that, at the macroeconomic and microeconomic levels, public expenditure can impact development.[1] Public investment focused on areas where there are market failures and public good externalities have a highly positive rate of return and yield benefits that substantially outweigh the costs. In contrast, poorly-implemented efforts in activities that are better suited to private activities can be counter-productive.

In the literature on growth, several empirical studies have focused on both the traditional and new channels through which different types of public spending can affect growth.[2] A _direct_ effect relates to an increase in the economy's capital stock (physical or human) reflecting higher flows of public funds, especially when they are complementary to those privately financed. Public investment can also contribute to growth _indirectly_ by increasing the marginal productivity of both publicly and privately supplied production factors. For example, public expenditure on agriculture research and development (R&D) can promote higher productivity by improving the interaction between physical and human capital production inputs. Other components of public spending, related for instance to the enforcement of land property rights, can also exert a positive indirect effect on growth by contributing to better use of existing assets. There is also growing evidence suggesting that, in developing countries, externalities associated with infrastructure public spending may be more important than commonly thought by having a sizable impact on human capital as well.[3]

There are limits to the positive impact that public spending may have on growth. Regarding the total level of public spending, an implicit common result in recent empirical studies seems to support an inverse U-shaped relationship theory,[4] according to which public spending may affect growth positively (after controlling for the negative effects associated with its financing) up to a certain point, above which additional spending may lead to negative growth as the needs for additional (and likely distortionary) financing increase. This caveat on the limits to government intervention should inform policy analysis regarding the likely impact of public spending on growth, as increasing the size of the budget beyond a certain threshold may be associated with efficiency losses.[5]

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[1] There is much debate about the drivers of the so-called "East Asia Miracle", but it is becoming clearer that rising human capital due to improvements in primary and secondary education made an important contribution. Vandenbenbussche, Aghion and Meghir (2005) conclude that there is a link between human capital accumulation, or education attainment, and growth

[2] See Barro and Sala-i-Martin (2003), Zagler and Durnecker (2003), and Agénor (2004) for overviews of this literature, and Agénor and Moreno-Dodson (2007) for a particular focus on public spending on infrastructure. Noteworthy empirical studies include Devarajan, Swaroop, and Zou, 1993; Tanzi and Zee, 1997; Bleaney, Gemmel, and Kneller, 2001; and Bose, Haque, and Osborn, 2007.

[3] As discussed by Agénor and Moreno-Dodson (2007), public infrastructure affects growth not only through its direct impact on investment and productivity, but also through health and education outcomes.

[4] As suggested by Barro (1998), Tanzi (1997), and others.

[5] For a sample of _developed countries_, Folster and Henrekson (2001) conclude that there is a negative relationship between government expenditures and growth in the EU. Similarly, Afonso and Furceri (2008) find that total public

Both the composition as well as the level of spending matter for growth. Regarding the composition of public spending, some items can trigger a complementary effect by either stimulating private spending or providing additional counterpart funding for growing private sector investments, such as safe roads, and reliable communications and energy supply. On the contrary, some other budget items can crowd out private spending, either by reducing incentives for private investors entering in a particular market or sector, or by triggering higher public deficits and accumulated public debt in need of financing, which reduces the credit available for the private sector and, in the long run, leads to higher interest rates.

Several empirical studies[6] find that, whilst controlling formally for the government budget constraint, under certain fiscal policy conditions (for example, fiscal stability and a relatively small government budget size), at least some categories of public expenditures do exhibit positive growth effects.[7] In particular some authors (Gemmel, 2007; Moreno-Dodson, 2008), provide empirical support for the view that in a developing country context, "productive" public expenditure triggers a growth-enhancing effect.[8]

Comparing Indonesia with Other Fast-Growing Countries

A recent empirical study (Moreno-Dodson, 2008) that includes Indonesia together with six other fast-growing countries (South Korea, Singapore, Malaysia, Thailand, Botswana, and Mauritius) finds an empirically robust relationship between public spending and GDP per capita growth for the period 1970-2006. Furthermore, medium-term and dynamic effects of public spending on growth are identified for some categories of spending, such as education, and economic spending (both in the short and medium term), and "productive" spending (with a dynamic effect)[9]. The study also highlights the importance of maintaining macroeconomic stability to ensure the positive contribution of public spending to growth.

In this study, Indonesia was identified as the only country in the sample in which the results of the overall impact were inconclusive.[10] Several preliminary explanations could be advanced. First, it is a relationship difficult to quantify because the budget deviations —those differences between the planned and executed budgets — can account for finding a weaker and/or distorted impact in the data. Second, although political economy variables were not introduced in the analysis, all countries in the selected sample, with the exception of Indonesia, rank quite

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expenditures seem to impinge negatively on the real growth of per capita GDP, indicating that government size is likely to be detrimental to economic growth. See also Pushak, Tiongson, and Varoudakis, 2007.

[6] See Haque and Kim (2003), Bose *et al.* (2007), Adam and Bevan (2006), and Moreno-Dodson (2008).

[7] In addition, there is growing evidence that there is a higher growth pay-off from macroeconomic stability and public spending in countries characterized by relatively better public sector governance.

[8] This categorization was introduced by Bleany, Gammel, and Kneller in 2001. *A priori* the public expenditure categories that are expected to have a positive joint impact on growth are called "productive" expenditures and include spending in general public services, defense, education, health, housing, and transportation and communication.

[9] See Moreno-Dodson, 2008, for further clarification on the different definitions of public spending used in this section.

[10] The analysis was conducted including both central and sub-national government public spending in Indonesia, and the results were similar. The findings of this exercise, however, need to be interpreted with caution as no further country analysis of the Indonesia case has been so far undertaken.

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favorably in terms of government effectiveness[11] when compared with the rest of the world. Indonesia, having made significant governance improvements over the past decade, still ranks lowest in the sample on both government effectiveness and corruption control in 2006. Finally, it is possible to envisage that the composition of public spending in Indonesia has not evolved according to development priorities or to the fast growth track that the country experienced in the previous four decades. In this case, restructuring public spending in favor of the most "productive" categories driving growth, while releasing funds from other activities where the private sector is capable and willing to invest more effectively, could be highly beneficial for Indonesia.

Role of the Public Sector in Agriculture Development

The role of the public sector in agricultural development, primarily a private activity, is to set the enabling environment in which private sector activities can flourish, correcting for instances under which the market fails to allocate resources efficiently, and minimizing price distortions faced by both farmers and consumers, while promoting inclusive growth. In practice, this translates into interventions along several dimensions:

i)   Correcting for externalities, which requires making people pay (or be paid) for the cost and benefits of their actions, such as discouraging fertilizer over-use leading to pollution, or rewarding advances in R&D with a patent;

ii)   Providing for public goods that are not efficiently and sufficiently produced by the market (e.g. building rural roads and irrigation systems, providing extension services and agriculture marketing, and funding more agriculture R&D);

iii)   Addressing information asymmetries, 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 certifying product input and output quality standards, ensuring plant and animal health) ; and

iv)   Regulating against monopolistic behavior that reduces social welfare by, for example, having lower outputs sold at higher prices.

Why Is the Provision of Public Goods Important for Agriculture?

According to the theory of public economics, only the public sector can supply public goods efficiently (and at adequate amounts) as the market will always under-provide them. When supplied in a cost-effective way, public goods will generate higher returns than 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, can capture economies of scale, access funding, and manage risk better than farmers, they are better suited to supply public goods.

On the other hand, the impact from subsidizing private inputs on productivity is unclear. As the literature review included in this paper will show, the record of governments subsidizing private inputs is, at best, mixed, although a large number of governments spend a considerable share of

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[11] According to the World Bank KKM indicators, government effectiveness measures the quality of public services, the quality of the civil service, the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies.

their budget doing so. The impact of subsidizing private inputs *at the expense of* the provision of public goods on productivity is often negative, as will be discussed and shown in this paper. Subsidizing private inputs 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 (e.g. there are diminishing returns on fertilizer usage, so that beyond a point additional use of fertilizer may not have any impact, or a negative one, on production).

Impact of Public Spending on Growth in the Agriculture Sector

There is renewed interest in improving the understanding of governments of the impact of public spending on agricultural growth. Evidence provided by a research project from FAO in 20 countries in Latin America shows that public spending in rural areas has a positive impact on agricultural growth (Alcott et al, 2006). The study also shows that both the volume and the composition of spending matter. Assuming a fixed amount of spending in the agricultural sector, a high share of spending on subsidies to private inputs has a negative impact on agricultural growth given the corresponding lower spending on the provision of public goods. Lopez and Galinato (2007) find similar results and argue that the positive impact 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 agricultural income by 5 percent. In a related piece of work by Santos and Ortega (2006), the authors show how the share of the budget allocated to subsidizing private inputs has a negative and significant impact on the efficiency of public spending. All these studies emphasize the concept of *opportunity costs of subsidies*. Although increased usage of a particular input may have a positive impact on production (e.g. fertilizer on rice production), the impact of subsidizing such inputs is often negative because it is done at the expense of providing public goods (e.g. research on newer varieties or improvements to the irrigation network) with a larger positive impact on production.

In Indonesia, Fuglie (2004) identifies the drivers of growth in agriculture from the 1960s until 2000. He argues that while in the 1970s and 1980s agricultural productivity was increasing, this trend has been flat since the early 1990s with most growth in agriculture being explained by increases in production inputs (labor, land). (Annex IV illustrates the paths of agricultural growth and yields growth for several commodities in Indonesia over this period.) Fuglie furthermore argues that the reason behind the stagnation in agricultural productivity from the 1990s onwards is the low levels of both private and public investments, with public investments in R&D, rural infrastructure and irrigation being necessary complements to private investments in agriculture.

In the following sections we review the type of government spending that can have a positive impact on agricultural growth. We use primarily evidence collected in other countries, but, to the extent possible, we also include information available for Indonesia in our review. The areas discussed below are not necessarily an exhaustive list of factors determining agricultural growth. We are primarily concerned with the provision of public goods and services with high fiscal implications, and other public spending categories that are not necessarily providing public goods (primarily the provision of subsidies to private inputs such as seeds, fertilizer or credit) but also affect the volume and composition of the budget. Public policies in the areas of trade or business environment are also crucial for agricultural development, but public intervention in

these areas usually has lower spending implications and will therefore be excluded from this paper.

Irrigation

Irrigation has been key to increasing productivity in agriculture in many developing countries and investments in the irrigation network are credited with much of the productivity growth achieved in Indonesia and other Asian countries in the 1970s and 1980s. The World Development Report 2008 estimates that returns for investments in irrigation systems are on average 15-20 percent around the world. Furthermore, there are economies of scale in irrigation projects, where the rates of return to large projects have been higher than those of small-scale investments (World Bank, 2008). Therefore, due to the cost structure of infrastructure projects (very high fixed costs and risks) and its quasi-public good character, authorities are better equipped to invest in irrigation systems. They have access to cheaper funding, can handle risk better than small farmer groups, and can overcome the externality problems that may prevent private individuals/ farmers from investing in irrigation.

In Indonesia, the focus of earlier decades on central government development of water resources and infrastructure contributed to food security, rural poverty reduction, and economic growth. Indonesia's agriculture sector is dominated by rice cultivation, of which 82 percent is grown under irrigation. By the 1990s, however, the focus on irrigation area expansion was neglecting maintenance of the existing infrastructure, compounded by the lack of mechanisms for cost recovery, and inadequate local engagement in management. The persistent under-funding of irrigation system maintenance led to one third of the 3 million hectares of government-designed irrigation schemes being rehabilitated at least twice in the past 25 years (ADB/IFPRI, 2003). Recent improvements in the management of irrigation systems through water users' associations and their federations are partly being credited for the increase in rice production in 2007 and 2008. Although the increased participation of communities and water associations in the management of the irrigation systems has improved the maintenance of the existing irrigation network at the local level, it is still unlikely to lead to the large-scale investments in irrigation that may be needed and should be undertaken by the public sector.

Agriculture Research & Development

Agriculture productivity improvements have been closely linked to investments in agricultural R&D in both developed and developing countries. The empirical evidence that R&D for agriculture yields high returns is prominent and suggests it is close to 50 percent in Asia (World Bank, 2008). Thus, Alston et al (2000) found that on average returns to investments in agricultural R&D are around 43%, after examining 700 projects in both developed and developing countries, while Salmon (1991) estimated that the return to R&D for rice in Indonesia was 151 percent using data for 1967-77. Furthermore, research conducted by IFPRI found that the poverty reduction effect per unit of additional agricultural R&D investment ranked second only to investment in rural education. Finally, Fan and Pardey (1997) found that investment in extension services in China accounted for almost 20 percent of the overall agriculture growth from 1965 to 1993.

Increasing public funding for R&D will be necessary for developing countries to adapt and tap into new knowledge to maintain competitiveness in their agriculture sectors. This requires removing barriers to private R&D investments, promoting public-private partnerships, and integrating farmer organizations into technological innovations. In many countries, however, agricultural policies distort prices in ways that eliminate the incentives and opportunities for farmers to adopt these new technologies. Also, barriers to technology diffusion and intellectual property protection act as constraints and prevent the spillover of technology. Hence, countries need to promote ways to better tap into global technological potentials and even expand their own efforts upstream to more relevant areas if they seek to boost their agriculture productivity (IFPRI, 2006).

Indonesia currently ranks near the bottom of Asian countries in R&D public spending, relative to agriculture GDP and to total government spending on agriculture. Public spending on R&D as a share of agricultural GDP was 0.22 percent in 2003, similar to Vietnam (0.17 percent) and Laos (0.24 percent), but much lower than in neighboring Malaysia (1.92 percent) and the Philippines (0.46 percent). The 2002 ratio for Indonesia was roughly half the average for Asia (0.41 percent) and the developing world as a whole (0.53 percent) that year. It has also been pointed out that the highly fragmented current efforts, weak linkages to international providers, limited involvement of universities, and weak intellectual property rights for agricultural technologies all affect negatively the impact that R&D public spending could have on agriculture TFP (IFPRI, 2006).

Extension Services

Agriculture extension services are instrumental in providing human capital-enhancing inputs, as well as flows of information to farmers. Given their public good attributes, most extension services worldwide are publicly-funded and delivered by civil servants. Attempts to privatize them have not been very successful worldwide mainly because farmers seem to be unwilling to pay for agricultural extension services on a continuous basis unless those services are integrated with the sale of inputs or other technical/marketing services (World Bank, 2006b).

Although the record of agriculture extension services is rather mixed, they can reduce the differential between potential and actual yields. They are a way to accelerate technology transfer and help farmers become better managers, but the impact is dependent on the delivery format and circumstances under which the recipients operate (Anderson and Feder, 2003). Recent work reviewing returns to R&D and extension services across a number of countries, found yearly rates of return of almost 60 percent for extension investments (Alston et al, 2000). Along these lines, research at IFPRI demonstrated that receiving at least one extension visit in Ethiopia reduced smallholders' likelihood of being poor by 10 percent and increased consumption growth by 7 percent (IFPRI, 2008). However, the literature also provides evidence of high variability in the returns to investment, highlighting the importance of good program design and implementation.

As in other countries, there is room for improving Indonesia's extension system, making it more cost efficient and effective. Worldwide trends indicate that national extension systems should shift their efforts towards organizing farmers into groups, and then focusing those groups on higher-value commodities and products. In addition, many examples of extension programs designed with a gender focus, which attempt to reduce the greater constraints faced by women,

can contribute to improve overall effectiveness. Decentralized service delivery and incentives structures that rely primarily on private provision (not funding) have also been identified as success factors behind extension services in many countries.

Infrastructure/Rural Roads

Inadequate rural infrastructure weakens the links between farmers to local, regional, and international markets, escalating marketing costs, and undermining productivity. As numerous examples worldwide have demonstrated, investing in rehabilitation and maintenance of rural roads can have a direct impact on the variety of goods sold in the market (Vietnam), increasing opportunities for off-farm female employment (Georgia), as well as reducing considerably travel time which has direct impact on agriculture productivity (Madagascar) (World Bank, 2008). Zhang and Fan (2001) find a positive and significant impact of infrastructure (measured by road density) on agricultural productivity in India. Finan et al (2002) in Kjoellerstroem (2006) find that the income of households with easy access to rural roads is twice to three times the income of households without access to rural roads in poor rural communities in Mexico.

Indonesia achieved remarkable results in improving access to infrastructure in rural areas until investments came to a halt during the financial crisis in 1997/98. Only now has Indonesia resumed investments at levels similar to those prior to that financial crisis. But development of infrastructure has been uneven, with areas outside Java and Bali lagging behind. As a result, the poor condition of roads and high transportation costs have been identified by firms in rural areas as a key constraint for growth (World Bank, 2006a). A common problem with rural roads and infrastructure is the neglect of operation and maintenance, leading to expensive rehabilitation. Around four-fifths of the total national road network falls under the responsibility of sub-national governments, which now account for almost two-thirds of all development spending on roads. There is evidence that provincial and district authorities are under-spending in the operation and maintenance of infrastructure (World Bank, 2007).

Subsidies to Private Inputs

There are instances where governments can use subsidies to address failures in agricultural markets, despite agriculture being primarily a private sector activity. Imperfect information and/or high transaction costs can lead to market failures. Financial constraints are more pervasive in agriculture. There are higher transaction costs and risks because of: (i) greater spatial dispersion of production, (ii) lower population densities, (iii) lower quality of infrastructure, and (iv) seasonality and high covariance of rural production activities. Financial constraints may lead farmers to be highly risk averse and forgo otherwise productive investment opportunities. Externalities (both positive and negative) can also provide justification for government intervention through taxes and subsidies, to align social and private returns to investments so that markets result in the socially optimal quantities being produced and consumed. Examples of positive externalities (and market under-provision) are investments in R&D or food safety, while examples of negative externalities are the unsustainable depletion of water resources or pollution from the excessive use of fertilizer.

International experience shows that subsidies for private inputs often lead to disappointing results because of the difficulty in designing an efficient subsidy system. If carefully targeted and at the appropriate level, in principle, subsidies applied on a temporary basis may correct for

failures in agriculture markets. However, when the subsidy is not temporary, the costs prevail over the benefits over time and rolling it back has high political costs and pressures that may prevent dismantling, even when governments are aware of their lack of effectiveness. When the goal is to pursue social objectives (e.g. consumption smoothing), other instruments, such as direct income support, food aid or cash transfers, have a better track record worldwide and are often more cost-effective. Subsidies on private inputs create disincentives to use scarce resources, such as water, efficiently, draw public funds away from potentially high return investments, such as R&D, extension, and infrastructure, and may have a high environmental cost (World Bank, 2006). Numerous studies show that subsidies are disproportionately captured by higher income farmers, so their social impact is often inequitable. Subsidies for agricultural inputs may not adversely impact production (unless in cases when over-using such input can decrease productivity), but given budget constraints their provision comes at the expense of investment for public goods and services with higher returns More so, because their public good nature requires government support for their efficient provision.

Despite this evidence, a number of public expenditure reviews conducted by the World Bank show that many governments continue to allocate large shares of their agricultural budgets to subsidizing private inputs, at the level of 37 percent in Argentina (2003), 75 percent in India (2002), and 75 percent in Ukraine (2005). The question of what has been the impact of public spending for agriculture in Indonesia is explored in the following section of this paper. It requires an empirical analysis that looks at the impact of Indonesian agriculture spending patterns and composition on growth in the sector. These empirical findings are the focus of this analysis.

II. The Impact of Agriculture Public Spending on Growth: An Empirical Analysis for Indonesia

The objective of this section is to assess whether the volume and the composition of public spending are having an impact on growth in the agriculture sector, as identified in the literature for other countries. To that end, we first present recent trends for public agriculture spending in relation to growth, followed by a time series quantitative assessment for Indonesia on the impact of public spending on per capita growth in the 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 2001-08, national spending on agriculture[12] increased from Rp 11 trillion to Rp 53 trillion, an average of 11 percent per year in real terms (Annex III provides more detail on spending on agriculture in Indonesia from 2001-08). This was the result of large budget increases and a big spending boost from decentralization across all sectors, but even greater for agriculture. As Figure 1 illustrates, the agriculture share of the budget doubled from 3 percent in 2001 to 6 percent by 2008 and, by that year, reached 1 percent of GDP. The bulk of this increase was on agriculture subsidies. This did not result in a corresponding rise in agricultural production, which increased an average of 3 percent between 2001 and 2008. Spending as a share of agriculture GDP grew from 11 percent to almost 40 percent. In other

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[12] National spending on agriculture includes central government spending on irrigation, the budget of the Ministry of Agriculture, sub-national government spending on agriculture and irrigation, and agricultural subsidies.

words, in 2001 each rupiah spent on agriculture generated almost 9 rupiah compared with only 2.5 rupiah in 2008. Low agricultural growth combined with a constant share of labor force participation in the sector has led to stagnant per-worker value-added.

Figure 1. Agriculture spending in Indonesia, 2001-08 (%)
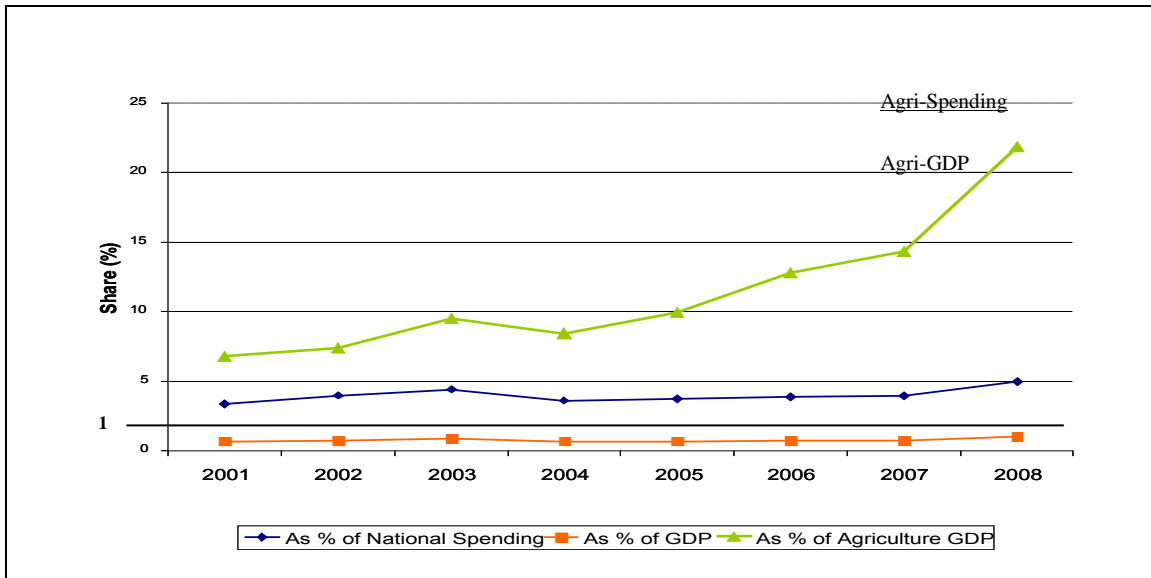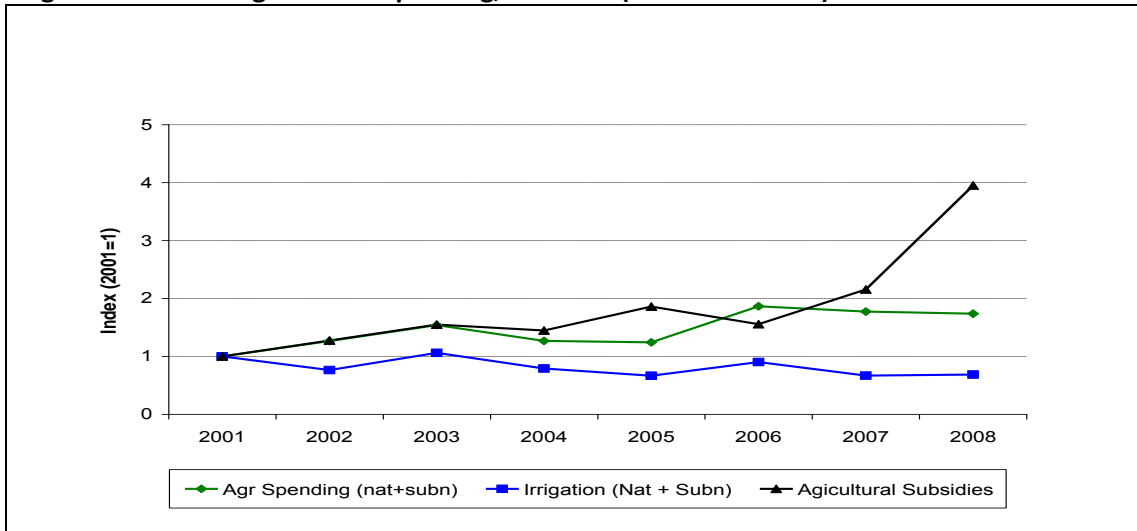

Source: World Bank staff calculations.

Analysis of recent public spending trends in agriculture shows that resources are being directed towards supporting private goods at the expense of providing public goods. In 2008, the Government directed 50 percent of agriculture resources (Rp 29.4 trillion) towards subsidizing private goods, where fertilizer subsidies (Rp 15.2 trillion) accounted for half, and the remainder was allocated to: seeds, Raskin,[13] and agriculture credit. As Figure 2 shows, by end-2008 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 (MoA) has increased significantly since 2001, but has grown at a slower pace than agricultural subsidies.

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[13] Raskin is not a subsidy to agricultural 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 agricultural subsidy as the Ministry of Finance does, but note that it is not entirely a subsidy to agricultural production.

Figure 2. Index of agricultural spending, 2001-08 (index 2001=100)

Source: World Bank staff calculations.

Public investment in public goods was largely behind Indonesia's success in increasing agricultural productivity through the 1970s and up to the early 1990s. During the years of the Green Revolution, Indonesia invested heavily in its irrigation network, research and development (R&D), extension services, and rural infrastructure, as well as subsidized private agricultural inputs (fertilizer, seeds, credit). By the early 1990s, Indonesia 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 and, exacerbated by declining levels of private and public investment, agriculture productivity growth remains sluggish today. (See Annex IV for an illustration of those trends on agricultural GDP and yields over the years.)

Spending as a share of GDP in agriculture averaged 10 percent and 8 percent in the 1970s and 1980s compared with the 40 percent of today. As discussed earlier, we argue that as a result of the composition of such spending, increases in spending, mostly to subsidize private goods, did not translate into a proportional increase in growth. This is the motivation for analyzing the relationship between public spending and growth in agriculture in Indonesia, focusing on both level and composition of public spending.

What Has Been the Impact of Public Spending on Agriculture in Indonesia?

To answer this question, we look at the relationship between agriculture public spending and the growth rate of agriculture GDP per capita using time series data with both OLS and GMM econometric techniques. The model chosen for this paper introduces specific characteristics and innovations to fit the Indonesian context as well as the PER broader analysis objectives.[14]

Empirically, the relationship between public spending and growth has been difficult to establish in the literature. The relationship between agriculture and non-agriculture GDP is likely to be

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[14] Different function specification were considered taking into account previous analyses of the impact of public spending in the agriculture sector. See for example Lopez and Galinato, 2007.

simultaneous rather than unidirectional, which 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 thorough rigorous use of instruments is considered by using the General Method of Moments (GMM) technique (see Annex II). Estimating the model with the GMM is a way to test the robustness of these empirical estimations by exploring the relationship within a dynamic setting. Also, while time series analysis would ideally 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:

$$\Delta \ln y_t = b_0 + b_1 \Delta \ln y2_t + b_2 \Delta APE_{t-1} + b_3 \Delta ATR_{t-1} + b_4 \Delta \ln l_t + b_5 \Delta \ln la_t + b_6 \Delta \ln GD_t + b_7 Dummy98 + \varepsilon_t$$

where:

t is the year

y is the rate of growth of agriculture GDP per capita

y2 is the rate of growth of non-agriculture GDP per capita

Fiscal variables:

APE is the ratio of total agriculture public expenditures to agriculture GDP

ATR is a ratio of 3% 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 (ha)

GD is an index of global demand for agriculture exports, total world demand for agriculture, crops, livestock, primary, and processed exports, in billions of US$.

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 of agriculture GDP per capita is the dependent variable. Two groups of independent variables are considered: <u>fiscal variables</u> and <u>control variables.</u> Regarding the former, the spending effect is initially aggregated into total

agriculture public spending APE[15] and then broken down into two components: development spending on agriculture and irrigation, and fertilizer subsidies. All fiscal variables include central government and sub-national 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.[16] This assumes implicitly that, under an earmarking hypothesis, there would be no fiscal deficit for the agriculture sector (period average).

The selection of <u>control variables</u> was made taking into account the factors affecting supply and demand of agriculture output in Indonesia. Non-agriculture GDP is used to capture the spillover synergies from growth in industry and services. Regarding the supply side, the labor and arable land variables are used as proxies for private inputs in order 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[17] is introduced for 1998 to control for those 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 growth rate (per capita) 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 will, most likely, determine the agriculture growth rate within the same year period.

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 non-stationary series can result in picking up a spurious effect. Annex II reports the stationarity tests of all series, and shows that all variables considered in this model are stable over time in first difference (see Table 3 in the annex).

Results

The overall results show that spending on agriculture public goods has an economically and statistically significant positive effect on the agriculture GDP per capita growth rate, after controlling for the effects of non-agriculture GDP per capita growth and for private inputs (arable land and labor). Table 2 in the Annex presents the results obtained with the OLS and

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[15] 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 BPS' publication 'Indonesia Statistical Yearbook'.

[16] As 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 agriculture public spending has represented about 3 percent of total public spending on average during the period of analysis.

[17] 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 percent in 1998 and agriculture 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 and 10 percent.

GMM econometric methods indicating that spending on public goods is a positive driver of the growth rate of agriculture GDP per capita, while spending on fertilizer subsidies appears to have a significant negative effect. Not surprisingly, the impact of total agriculture spending on agriculture GDP per capita growth is unclear, given the opposing direction of the effects from its two components: agriculture and irrigation vs. fertilizer subsidies. The GMM findings show a more significant effect than OLS that is in line with international evidence and the literature exploring the impact of public spending on growth in the agriculture sector.

Spending on public goods in the agriculture sector in Indonesia has had a positive impact on agricultural growth. This positive effect is associated only with the agriculture and irrigation public spending component. Given the opportunity cost of financing subsidies further at the expense of other agriculture spending and irrigation, which directly contribute to growth, the Government should consider reallocating spending from fertilizer subsidies to public goods such as agriculture extension services, R&D and irrigation, which could lead to faster sector growth.

### III. Trends in Public Spending in the Agricultural Sector

In an attempt to put these findings into context, this last section analyzes agriculture public spending trends in Indonesia for the past eight years. By analyzing the evolution of such expenditures by program, economic category, and function, the paper explores the prospects for further agricultural growth.

The Budget of the MoA by Program

The three main programs in the MoA, food security, farmer welfare, and agri-business, are loosely defined and their overlapping expenditures makes monitoring and evaluation at an aggregate (program) level more difficult. However, two trends are visible in the allocation of the budget across programs: (i) both the food security and the farmer welfare programs have seen significant budget increases; and (ii) the allocation to the agri-business development program has decreased both in real and relative terms.

Although these trends may be the result of the classification of expenditures rather than actual priorities (e.g. the Rural Agribusiness Development or Pengembangan Usaha Agribisnis Perdesaan/PUAP program under 'Farmer Welfare' includes some activities that aim at supporting small agri-business), they reflect the GoI priority towards food security, and the specific goal of achieving self-sufficiency in rice. To improve efficiency in spending, where outputs and outcomes are attained in the most cost-effective manner, a clear definition of program objectives is essential. There should be clarity on the outputs that are expected with a budget allocation. This becomes particularly relevant as the Government moves towards performance-based budgeting, given that clarity of outcomes is central in assessing performance.

**Figure 3. MoA budget by program, 2003-09 (Rp trillion nominal)**
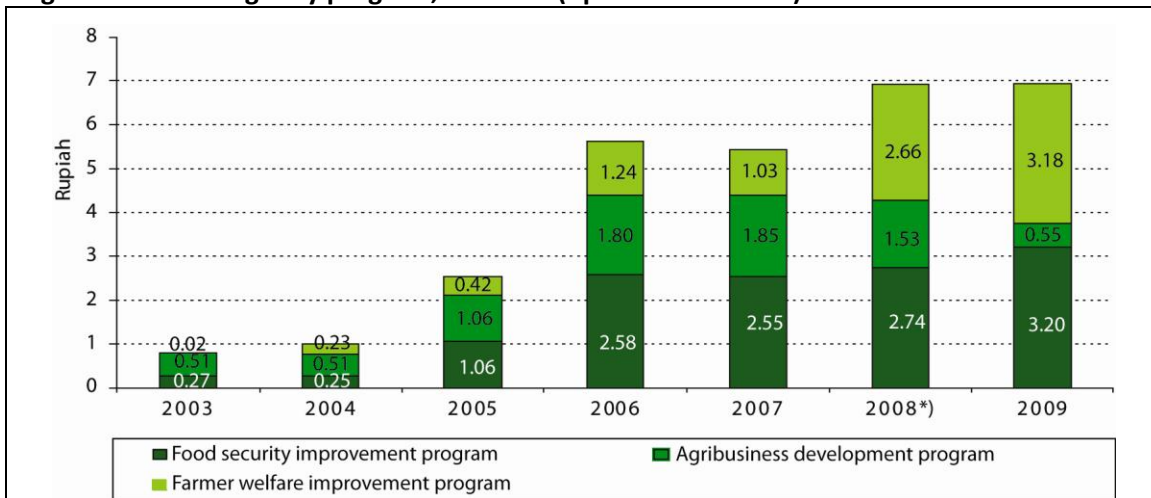
Source: MoA.

The Budget of the MoA by Economic Classification

Since 2007, the MoA has allocated 40 percent of its budget to "social aid" (Figure 4). Social aid has become an umbrella for many projects that transfer resources to farmers through farmers' associations, churches and community groups. Project implementation has improved, avoiding cumbersome procurement procedures that often delay project implementation, but it means that a large share of the budget is transferred to farmers directly and cannot be used to provide public goods (R&D, extension services, marketing assistance) — a responsibility of the public sector that cannot be delegated to farmers or farmers' groups. Although the central government still provides guidelines for the use of these funds, to a large extent the evaluation and allocation of funds to individual activities takes place at the district level, transferring the responsibility of allocating funds to the district governments, which often lack the capacity to do so effectively.

**Figure 4. MoA budget by economic classification, 2005-09 (%)[18]**
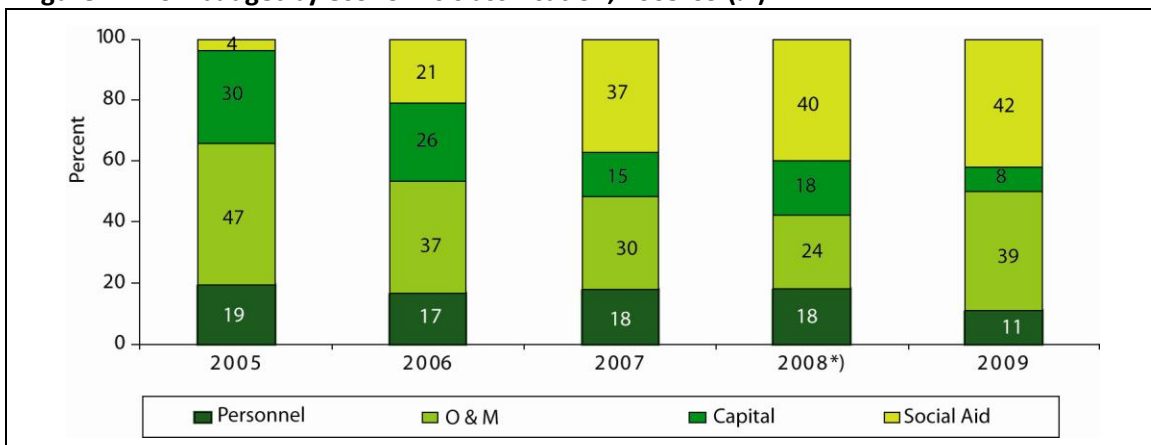
Source: MoA.

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[18] The reduction of personnel expenditures in 2009 is the result of the reclassification of salaries of contractors into the "O&M" goods category.

Together, the Secretary General of the Ministry of Agriculture and the Directorate General (DG) of Food Crops are responsible for half of the spending classified as "social aid" (Figure 5 and 6). About one third of the "social aid" is directed to the PUAP Program (Rp 1 trillion in 2008) under the mandate of the Secretary General. Other DGs that allocate a large share of their funds through social aid are DG Food Crops, DG Land and Water Management and DG Livestock.

**Figure 5. MoA: "social aid" planned budget, 2007-09 (Rp billion nominal)**
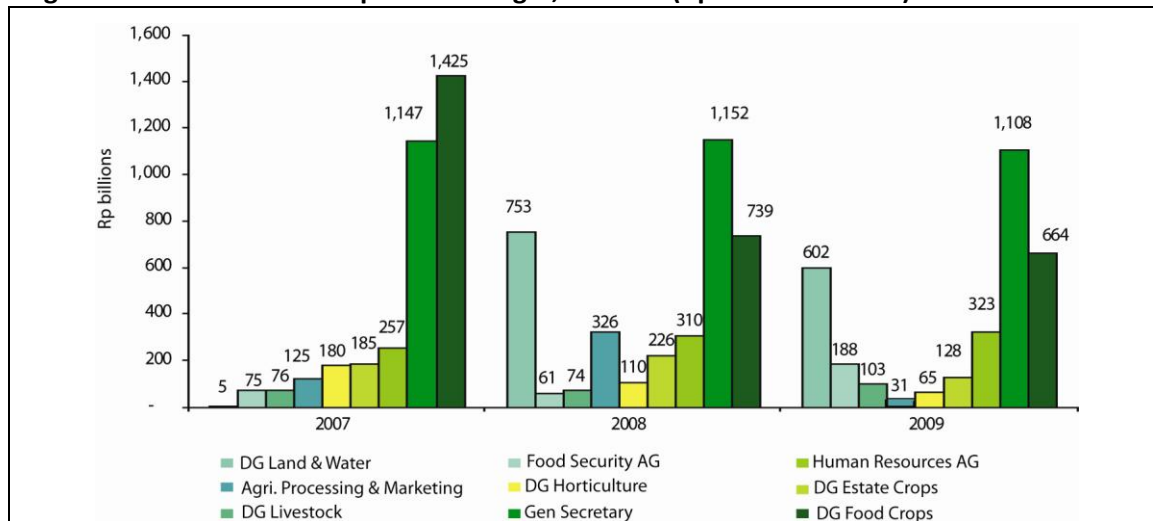
Source: MoA and MoF.

The MoA by allocating a large share of its budget through "social aid" spending is subsidizing private inputs at the expense of providing public goods. A closer look at the social aid spending at DG Food Crops shows that most spending was channeled to support seeds and agricultural equipment. In 2007, about Rp 1.1 trillion was spent on grants for rice and soya bean producers and Rp 394.5 billion in 2008. In the 2009 budget, the grants targeted to seeds and agriculture equipment account for Rp 314 billion. Other directorates similarly use "social aid" spending to subsidize or provide private inputs such as water pumps, cattle and other goods.

A strong monitoring and evaluation system is important to assess the efficiency of these projects and overall impact on agricultural productivity and farmer welfare. The stated benefits of quick project implementation, by avoiding cumbersome government procedures are real, but as discussed in earlier sections of this paper the impact of subsidizing private inputs on agricultural productivity is at best uncertain. Thus, the increasing trend in the allocation towards this "social aid" category could partly explain the flat productivity, despite increasing public spending for the agriculture sector. Understanding which public goods can be provided through such a mechanism (and its limitations), as well as the existing market failures that need to be addressed, could help improve the design of these projects and their effectiveness (Box 1 illustrates how effective M&E can help improve the outcomes of an income support program).

Figure 6. Social aid planned budget, 2008-09 (%)
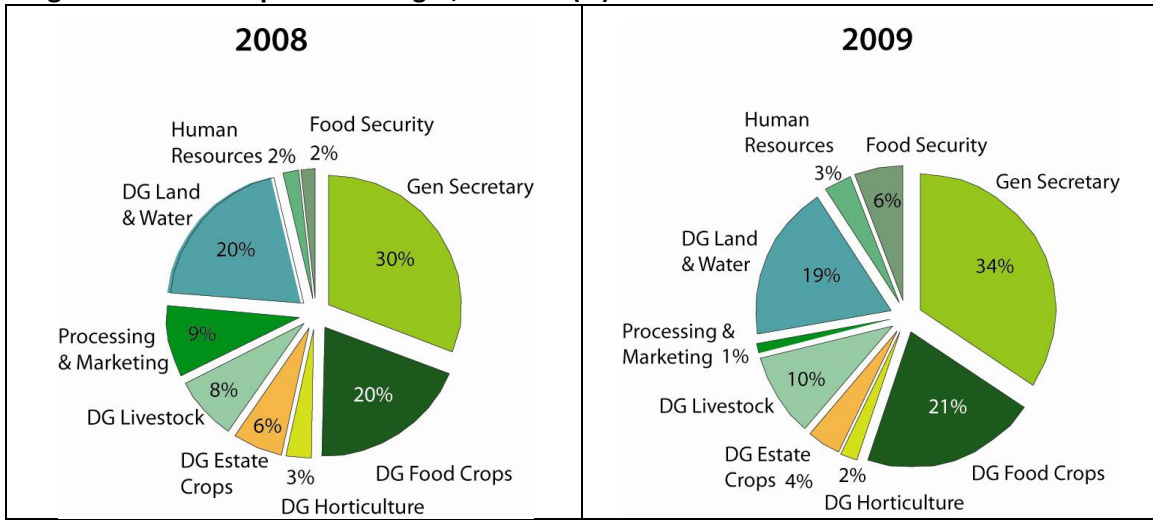
Source: MoF.

Box 1. Income Support Program PROCAMPO and the power of impact evaluation

Procampo is an income support program (in the form of cash transfers) launched by the Mexican government in 1994 to compensate grain farmers for income losses due to the liberalization brought by NAFTA. The program, worth US$1.3 billion in 2005, accounts for over 40 percent of all public spending for agriculture and reaches up to 85 percent of the *ejidatarios*, which are often the poorest farmers in the country. Some features of the program have contributed to its evident success: (i) the program, which provides eligible farmers a fixed payment per hectare, is decoupled from current production, and the only conditionality is to have grown certain crops in the three years prior to 1994 and to continue working the land (cropping, livestock, forestry or for environmental purposes); (ii) the subsidy is given to the user of the land, not necessarily the owner; (iii) the subsidy is given on a seasonal basis, so farmers that were double cropping receive the subsidy twice in a year; (iv) important multiplier effects[19] by providing a stable and predictable income source, addressing credit market constraints of many farmers that had land but no capital and enabling farmers to invest in riskier and higher yielding investments; and (v) the use of the commercial banking system to distribute the subsidy has improved access of farmers to financial services.

The same program features that contribute to its success also present challenges: (i) by hectare payments means that the largest farmers who may not need the subsidy in the first place are capturing a large share of the subsidy;[20] (ii) landless farmers (often the poorest in rural areas) are bypassed by the program; (iii) seasonality also means that farmers that were better off (double-cropping, access to irrigation) receive today the largest subsidies; and (iv) payments are tied to farmers continuing to work the land, increasing the opportunity costs of beneficiaries to diversify away from agriculture into higher value activities.

The program's M&E system, with yearly surveys of recipients and non-recipients across the country, allows for yearly detailed impact evaluations. These evaluations have shown that the program has been successful in supporting farmers' welfare, accounting for a significant share of the income of the poorest farmers. However, it has not been successful in diversifying cropping patterns. Only 5 percent of all beneficiaries had switched crops after 12 years of PROCAMPO. The evaluations have been used to improve the program over the years. The coverage of farmers was amended from those who had grown grains to other crops to expand the reach to other poor farmers. The regressive nature of the program has been widely criticized, which led to paying a higher per-ha subsidy to farmers with farms below 5 ha. To maximize the impact of the subsidy on farmers' credit constraints, the subsidy is paid before the planting season. Qualification certificates can be used as collateral with banks, using future payment streams for productive investments (although so far a low share of farmers is using it as collateral).

The success of such a program depends on complementary policies that can maximize multiplier effects, such as facilitating access to land and markets. PROCAMPO failed in its objective to help farmers diversify and improve their cropping patterns. Additional assistance might have been needed to fulfill this objective, such as technical assistance to access new technologies and market information or access to credit programs. Some conditionality on the use of funds favoring productive investments may have increased the results in terms of diversification. Improved targeting (e.g. through cash for work programs) to exclude the larger and richer farmers would have addressed the criticized regressiveness of PROCAMPO and increase its efficiency.

Source: World Bank 2004, Cord and Wodon 2001, GEA 2006, Sadoulet et al 2001.

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[19] Cord and Wodon 2001 estimate that 1 peso of PROCAMPO translates into 2 pesos for the household.
[20] The 45 percent smallest farmers (with farms below 5 ha) capture only 10 percent of the total subsidy.

The Budget of the MoA by Function

The MoA allocates a large and increasing share of its resources towards increasing the production of food crops. A significant amount of public resources is invested to increase the production of food crops through the DG Food Crops and DG Food Security Agency (Figure 7). In addition, spending in other directorates (DG Land and Water Management, DG Agricultural Research or the Secretary General) is often guided by the objective to increase productivity of food crops, particularly rice. This focus often comes at the expense of other high-value products, as the decreasing share in the budget of DG Horticulture (from 6 percent in 2003 to 3 percent in 2009) or the Quarantine Agency (from 8 percent to less than 5 percent in 2009), which is key for exports, illustrate.

Figure 7. MoA budget by function, 2003-09 (Rp trillion nominal)
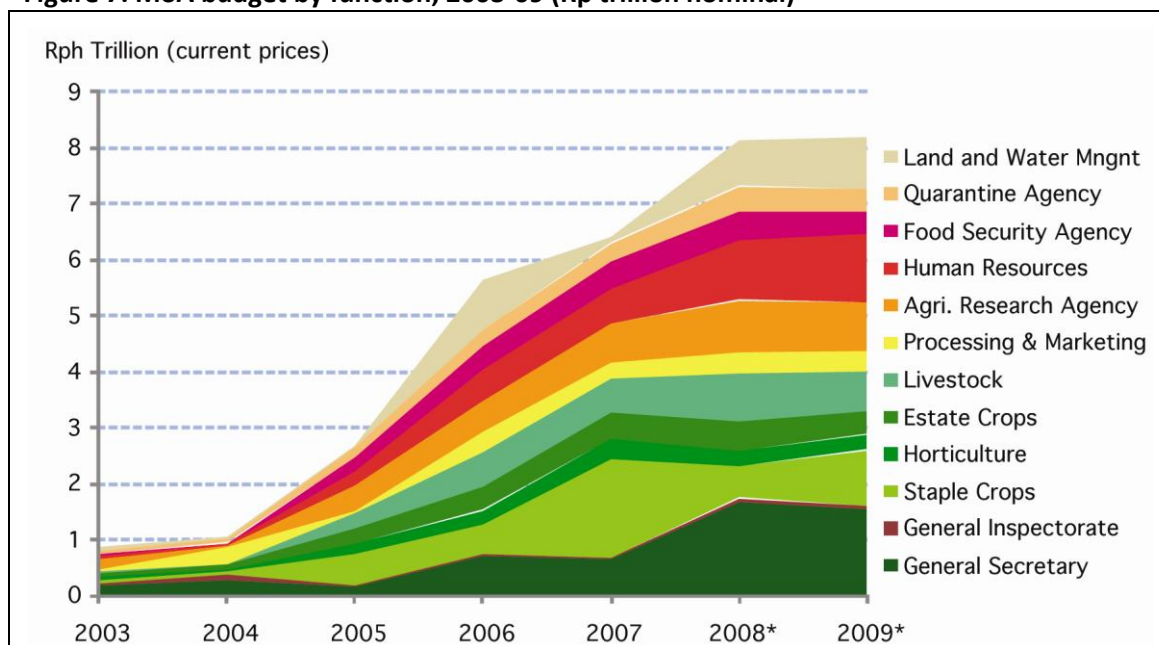
Source: MoA, World Bank staff calculations.
Note: *) budget figure.

These allocation trends may have contributed to increasing rice production in 2008. Rice production has increased in the past few years, allowing Indonesia to avoid the pressures that many neighbors felt as food prices spiked in 2008. Preliminary analysis suggests that this was mostly the result of increasing cropping intensity from existing farmland. While rice yields and farmland statistics reflect little changes on previous years, better irrigation management, in addition to relatively good weather, allowed rice farmers to increase the number of harvests in 2008.

The focus on increasing production of staples may hinder support for other higher-value products. Global agriculture trends and projections show the demand for higher-value commodities increasing significantly. Since 2000, the global domestic consumption of meats and horticulture in developing countries accelerated considerably. Consequently, economies with this export base profited more than exporters of cereals and other traditional crops, such as rice

(Figure 8).[21] *These consumption trends are visible in Indonesia as well*. The higher income levels have translated into increased demand for higher value commodities, such as fresh fruits and vegetables. Thus, the production value of fresh fruits and vegetables in Indonesia doubled between 1994 and 2004 (World Bank, 2007b). Indonesia's focus on food crops translates into limited support to Indonesian farmers trying to benefit from these new markets and opportunities.

In summary, Indonesia's focus on increasing rice production and achieving rice self-sufficiency have resulted in significant production increases in 2007 and 2008, helping Indonesia avoid the pressures on other countries in the region that resulted from high food prices. But this focus has trade-offs in the long run, as rice is being promoted over other commodities that produce higher returns and that are driving the global agriculture markets in other countries. In the previous section we looked at the relationship between per capita agriculture GDP growth and several determinants. One of the more striking results was the negative and significant relation between global demand for agricultural products and per capita agriculture GDP, suggesting that Indonesian farmers have not been able to capitalize on the opportunities that global supply chains offer, and of which many of its peers in other countries are already benefiting. As Indonesia modernizes and income levels increase, a different focus that combines production of higher-value agricultural products with ensuring the population has access to food at affordable prices may bring higher returns.

Figure 8. Global agriculture trends, 1985-2000 (index 1980=100)

Source: http://faostat.fao.org, accessed June 2007, and http://comtrade.un.org.
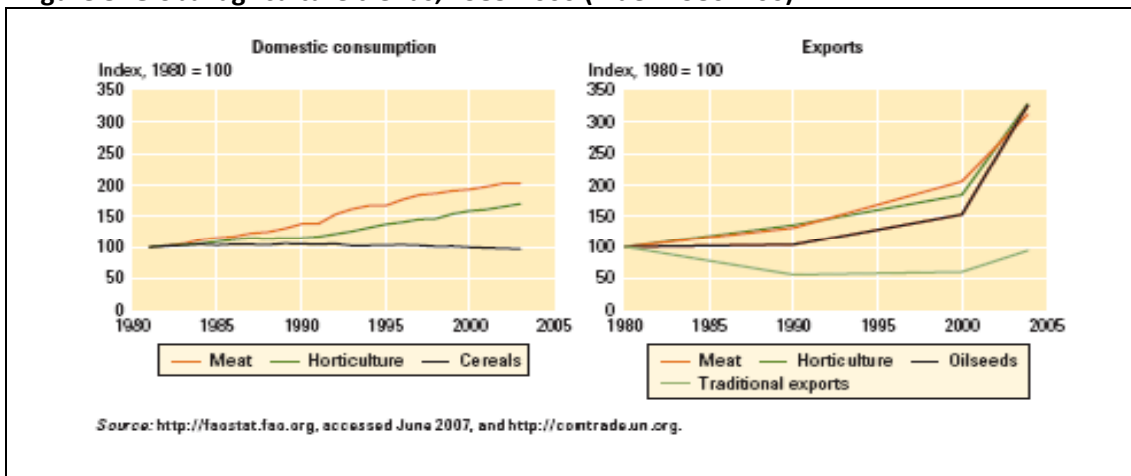
Source: World Development Report, World Bank, 2008.

IV. Conclusions

Spending on agriculture has increased significantly in Indonesia over the past decade. This trend reverses the low public investment in the sector visible during the 1990s, which was largely

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[21] Grain prices (including rice) spiked in 2008 resulting in what many called the 'Global Food Crisis'. The price of rice, maize and other staples grew significantly. Mitchell, 2008, analyzes the causes behind such an increase and he as well as a variety of agricultural and forecasting agencies (FAO, IFPRI, USDA) project prices for cereals, rice and other staples to stay stable or decline slightly in the short and medium term.

behind the sector's relatively poor performance. However, a large share of this increase is being allocated to subsidizing private inputs, which raises concerns over the effectiveness of this spending.

Using data going back to the 1970s, we test empirically the impact of public spending on agriculture per capita growth over the past 30 years. Thus, we find a positive and significant impact of spending on public goods on per capita agriculture GDP growth, which confirms other findings of the literature and the international evidence on agriculture spending. As in other countries, we find that both the volume and the composition of spending matter for growth. While spending on public goods has a positive and significant impact on agriculture growth, our estimation indicates that the impact of subsidizing fertilizer on agriculture GDP per capita growth is negative.

Spending patterns in the MoA show a significant increase of the 'social aid' category over the past few years, with over 40 percent of all spending in the 2009 budget classified under this category. This type of spending allows the MoA to avoid cumbersome government procedures to implement projects and reach farmers quickly. However, it also means that a large share of the budget is primarily financing private inputs at the expense of providing public goods and services, which should be the main responsibility of the MoA.

Going forward, it is important to allocate resources according to a strategy that maximizes spending effectiveness and that can translate into increasing growth for the agriculture sector, while paying attention to the welfare of farmers. Some suggestions, derived from our analysis, to improve public spending on agriculture in Indonesia, are as follows:

- Reallocating public spending from subsidizing private inputs (fertilizer, seeds, and grants to farmers and farmers' groups) towards providing agriculture and irrigation public goods and services.
- Reorienting government support to help small farmers and farmers' groups to gain access to global value chains and to meet the domestic demand for higher value-added products. This would entail a shift in the current support that prioritizes food or estate crops (the focus of the current agricultural policy).
- Continuing the government's income support to small and poor farmers, but also providing incentives for them to pursue productive investments. Indonesia has extensive experience in the area of cash transfers, which could be useful for this purpose. Conditional cash transfers, providing incentives to put these cash transfers to productive use, may result in increased investment and productivity in the agricultural sector. Also, careful targeting will be key to ensure the efficiency of the program as well as its fiscal viability.
- Putting in place a comprehensive M&E system that allows the GoI to evaluate the impact of its transfer programs. Such a system would be instrumental to prevent/correct mistakes in program design and maximize effectiveness in bringing about the necessary increases in agriculture productivity, as well as alleviating poverty in rural areas.

References

Adam, Christopher S. and David L. Bevan. 2006. "Aid and the Supply Side: Public Investment, Export Performance, and Dutch Disease in Low-Income Countries." *The World Bank Economic Review*, Vol. 20/2, pp. 261-290. Washington, D.C.: The World Bank.

Afonso, Antonio and Davide Furceri. 2008. "Government Size, Composition, Volatility and Economic Growth." European Central Bank Working Paper Series 849. Frankfurt: European Central Bank.

Agenor, Pierre-Richard. 2004. *The Economics of Adjustment and Growth.* Harvard University Press. Massachusetts.

Agenor, Pierre-Richard and Blanca Moreno-Dodson. 2007. "Public Infrastructure and Growth: New Channels and Policy Implications." in Maura Francese, Daniele Franco, and Raffaela Giordano (eds.) *Public Expenditure*. Rome: Banca d'Italia.

ADB/IFPRI. 2003. "Irrigation Investment, Fiscal Policy, and Water Resource Allocation in Indonesia and Vietnam." Summary Synthesis Report. Washington, D.C.: International Food Policy Research Institute.

Allcott, Hunt, Daniel Lederman and Ramón López. 2006. "Political Institutions, Inequality, and Agricultural Growth: The Public Expenditure Connection." World Bank Policy Research Working Paper 3902. Washington, D.C.: The World Bank.

Alston, Julian M., Connie Chan-Kang, Michele C. Marra, Philip G. Pardey and T.J. Wyatt. 2000. "A Meta-Analysis of Rates of Return to Agricultural R&D: Ex Pede Herculem?" Washington, D.C.: International Food Policy Research Institute.

Anderson, Jock R. and Gershon Feder. 2003. "Rural Extension Services." World Bank Policy Research Working Paper Series 2976. Washington, D.C.: The World Bank

Barro, Robert J. 1990. "Government Spending in a Simple Model of Endogenous Growth." *Journal of Political Economy*, 98(October 1990), s103-s25.

Barro, Robert J. 1998. *Determinants of Economic Growth: A Cross-Country Empirical Study*. 1st Ed. Massachusetts: The MIT Press Book. 0262522543.

Barro, Robert J. and Xavier Sala-i-Martin. 2003. *Economic Growth*. 2nd Ed. New York: McGraw-Hill.

Bleaney, Michael, Norman Gemmel and Richard Kneller. 2001. "Testing the Endogenous Growth Model: Public Expenditure, Taxation, and Growth Over the Long Run." *Canadian Journal of Economics*, Vol. 34, pp. 36-57.

Bose, Niloy, M. Emranul Haque and Denise R. Osborn. 2007. "Public Expenditure and Economic Growth: A Disaggregated Analysis for Developing Countries." *Manchester School*, 75 , pp. 533-56.

Cord, Louise and Quentin Wodon. 2001. "Do Agricultural Programs in Mexico Alleviate Poverty? Evidence from the Ejido Sector." *Cuadernos de Economía*, Año 38, No. 114, pp. 239-256.

Devarajan, Shantanayan, Vinaya Swaroop and Heng-fu Zou. 1993. "What Do Government Buy? The Composition of Public Spending and Economic Performance." World Bank Policy Research Working Paper Series 1082. Washington, D.C.: The World Bank.

Fan, S. and P. G. Pardey. 1997. "Research, Productivity, And Output Growth In Chinese Agriculture." *Journal of Development Economics*, v53 No. 1, pp. 115–137.

Feder, Gershon, Rinku Murgai and Jaime B. Quizon. 2004. "Sending Farmers Back to School: The Impact of Farmer Field Schools in Indonesia." *Review of Agricultural Economics*, Vol. 26, No. 1.

Folster, Stefan and Magnus Henrekson. 2001. "Growth Effects of Government Expenditure and Taxation in Rich Countries." *European Economic Review*, vol. 45(8), pp. 1501-20.

Fuglie, K.O. 2004. "Productivity Growth in Indonesian Agriculture, 1961-2000." *Bulletin of Indonesian Economic Studies*, Vol. 40, No.2, pp. 209-25.

GEA (Grupo de Economistas y Asociados). 2006. "Estudio sobre la Evaluación del Desempeño del Programa de Apoyos Directos al Campo (PROCAMPO): Año Agrícola 2006."November 2006.

Gemmel, Norman. 2007. "Long-run Growth and the Composition of Government Spending and Taxes." Power point presentation at New Zealand Treasury.

Haque, Mohammad E. and Dong H. Kim. 2003. "Public Investment in Communication and Growth: A Dynamic Panel Approach." The School of Economics Discussion Paper Series 0324. The University of Manchester.

IFPRI. 2006. "Agricultural R&D in the Developing World." Washington, D.C.: International Food Policy Research Institute.

IFPRI. 2008. "Impact of Agricultural Extension and Roads on Poverty and Consumption Growth in Fifteen Ethiopian Villages." Discussion Paper No. 840. Washington, D.C.: International Food Policy Research Institute.

Kjoellerstroem, Mónica. 2006. "Gasto Público en el Sector Agricola y las Areas Rurales: América Latina en la Década de los Noventa." in Soto Baquero, Fernando, Józimo Santos Rocha y Jorge Ortega (eds.) *Políticas Públicas y Desarrollo Rural en América Latina y el Caribe – El papel del gasto público*. Santiago de Chile: Food and Agriculture Organization of the United Nations.

López, Ramón and Gregmar I. Galinato. 2007. "Should governments stop subsidies to private goods? Evidence from rural Latin America." *Journal of Public Economics*, v91, pp. 1071–1094.

Makki, S., Tweeten, L. and Thraen, C. 1996. "Returns To Agricultural Research: Are You Assessing Right?" In Conference proceedings for global agricultural science policy for the twenty-first century. 16-28 August 1996, Melbourne, Australia.

Mitchell, Donald. 2008. "A Note on Rising Food Prices.", Policy Research Working Paper 4682. Washington, D.C.: The World Bank.

Moreno-Dodson , Blanca. 2008. "Assessing the Impact of Public Spending on Growth. Lessons from Seven Fast Growing Countries." Policy Research Working Paper 4663. Washington, D.C.: The World Bank.

Pushak, Tearas, Erwin R. Tiongson and Aristomene Varoudakis. 2007. "Public Finance, Governance, and Growth in Transition Economies." World Bank Policy Research Working Paper 4255. Washington, D.C.: The World Bank.

Sadoulet, E., Alain de Janvry and Benjamin Davis. 2001. "Cash Transfer Programs with Income Multipliers: PROCAMPO in Mexico." *World Development*, Vol. 29, No. 6, pp. 1043-1056.

Salmon, D.C. 1991. "Rice Productivity and the Returns to Rice Research in Indonesia." in R.E. Evenson and C.E. Pray (eds.) *Research and Productivity in Asian Agriculture*., Ithaca, USA, Cornell University Press.

Santos Rocha, Józimo and Jorge Ortega. 2006. "Crecimiento, inversión privada y eficiencia del gasto público en las áreas rurales de América Latina y el Caribe." in Soto Baquero, Fernando, Józimo Santos Rocha y Jorge Ortega (eds.) *Políticas Públicas y Desarrollo Rural en América Latina y el Caribe – El papel del gasto público*. Santiago de Chile: Food and Agriculture Organization of the United Nations.

Tanzi, Vito. 1997. "The Changing Role of the State in the Economy: A Historical Perspective." IMF Working Paper WP/97/114. Washington, D.C.: The International Monetary Fund.

Tanzi, Vito and Howell Zee. 1997. "Fiscal Policy and Long-Run Growth." International Monetary Fund Staff Papers. Washington, D.C.: The International Monetary Fund.

Vandenbenbussche, Jérome, Philippe Aghion and Costas Meghir. 2005. "Growth, Distance to Frontiers and Composition of Human Capital." Centre for Economic Policy Research. London.

World Bank. 1994. *Indonesia. Stability, Growth and Equity in Repelita VI.* Jakarta.

World Bank. 2004. "Mexico Public Expenditure Review – Volume Two (Main Report)." Washington, DC: World Bank.

World Bank. 2006a. "Revitalizing the Rural Economy: An Assessment of the Investment Climate faced by non-farm enterprises at the District Level." Consultative Draft. Jakarta: The World Bank.

World Bank. 2006b. "Agriculture Investment Sourcebook." The World Bank.

World Bank. 2007a. "Indonesia Public Expenditure Review 2007 – Spending for Development Making the Most of Indonesia's Opportunities." Jakarta: The World Bank.

World Bank. 2007b. "Horticultural Producers and Supermarket Development in Indonesia." Jakarta: The World Bank.

World Bank. 2008. "World Development Report 2008 – Agriculture for Development." Washington, D.C.: The World Bank.

Zagler, Martin and Georg Durnecker. 2003. "Fiscal Policy and Economic Growth." *Journal of Economic Surveys*, 17 (July 2003), pp. 397-418.

Zhang, Xiaobo and Shenggen Fan. 2001. "How productive is infrastructure? New approach and evidence from rural India." Environment and Production Technology Division Discussion Paper No. 84. Washington, D.C.: International Food Policy Research Institute.

Annex I: Empirical Estimation and Methodology

Annex Table 1. Data

	Variable	Source:
y	Agriculture GDP per capita	FAOSTAT
	Fertilizer subsidies	Statistical Yearbook of Indonesia 1980-2008, Presidential Address to the Republic of Indonesia 1793, 1978, 1983, and LKPP 2004-2008
	Agriculture and irrigation spending	Statistical Yearbook of Indonesia 1980-2008, Presidential Address to the Republic of Indonesia 1793, 1978, 1983, and LKPP 2004-2008
ATR	Tax revenues to agriculture GDP	Statistical Yearbook of Indonesia 1980-2008, Presidential Address to the Republic of Indonesia 1793, 1978, 1983, and LKPP 2004-2008
APE	Total agriculture public expenditures to agriculture GDP	Statistical Yearbook of Indonesia 1980-2008, Presidential Address to the Republic of Indonesia 1793, 1978, 1983, and LKPP 2004-2008
l	Agriculture labor force	Statistical Yearbook of Indonesia
la	Arable land	FAOSTAT
GD	Index of global demand for agriculture exports	FAOSTAT
	Population	World Bank WDI, 2008

The basic model is as follows:

$$\Delta \ln y_t = b_0 + b_1 \Delta \ln y2_t + b_2 \Delta APE_{t-1} + b_3 \Delta ATR_{t-1} + b_4 \Delta \ln l_t + b_5 \Delta \ln la_t + b_6 \Delta \ln GD_t + b_7 Dummy98 + \varepsilon_t$$

where:

t is the year

y is the rate of growth of agriculture GDP per capita

Fiscal variables:

APE is the ratio of total agriculture public expenditures to agriculture GDP

ATR is a ratio of 3% of total tax revenues to agriculture GDP

Control variables:

y2 is the rate of growth of non-agriculture GDP per capita

l is the agriculture labor force (in thousands)

la is the arable land, as an asset of the farmers (ha)

GD is an index of global demand for agriculture exports, total world demand for agriculture, crops, livestock, primary, and processed exports, in billions of US$.
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.

Estimation

The model was estimated with time series data for 1976-06 in first difference using OLS and a one-year lag of the fiscal variables. This is because fiscal variables impact agriculture GDP growth with a lag, as today's output is dependant on last year's net public spending. However, the control variables enter the specification contemporaneously, reflecting the assumption that their impact occurs within the same fiscal year. All variables enter the specification in first difference ensuring that they are stationary and that the model is stable overtime. As can be seen from the Augmented Dickey Fuller tests for stationarity (Table 3 below), the control variables where non-stationary in levels as well as the log of non-agriculture GDP, but all were stationary in first differences. On the other hand, the fiscal variables and the log of agriculture GDP per capita are stationarity in both levels and first difference.

Annex Table 2. Impact of Agriculture Public Spending on Per Capita Agriculture Growth

Dependent Variable: Agriculture GDP Growth	OLS(1)	OLS(2)	OLS(3)	GMM(1)	GMM(2)	GMM(3)
Constant	-0.03	-0.03	-0.04	-0.01	-0.06	-0.06
	(-1.64)	(-1.21)	(-1.97)+	(-0.38)	(-2.43)*	(-2.87)**
D(APE (-1))	0.46			5.90		
	(0.56)			(2.29)*		
D(Agriculture and Irrigation Public Spending(-1))		2.36	2.72		8.20	4.68
		(2.17)*	(2.41)*		(-3.07)**	(2.90)**
D(Fertilizer Subsidies Spending(-1))		-5.14	-6.38		-33.31	-15.62
		(-1.83)+	(-2.24)*		(-4.41)**	(-3.92)**
D(Log non agri-GDP per capita, US Dollar)	0.89	0.84	0.93	0.15	0.97	0.83
	(6.04)**	(7.52)**	(12.28)**	(0.51)	4.31	(6.10)**
D(Log Agriculture Labor)	0.79	0.52	0.30	3.52	-0.03	-1.62
	(2.44)*	(1.34)	(0.72)	(2.23)*	(-0.05)	(-2.61)*
D(Log *Arable Land*)	-0.37	-0.0005	-0.16	-1.88	0.99	0.82
	(-0.61)	0.000	(-0.30)	(-2.05)+	(1.30)	(1.56)
D(ATR (-1))			-6.65			-24.93
			(-1.43)			(-3.53)**
D(Log GD)			0.0000			-0.0002
			(-1.25)			(-3.22)**
Dummy98	-0.19	-0.19		-1.46	0.36	
	(-1.18)	(-1.23)		(-3.11)**	(0.89)	
Observations	29	29	29	27	27	27
R-squared	0.89	0.92	0.90	0.38	0.59	0.79
Durbin Watson Stat.	2.41	2.60	2.80	1.47	2.57	2.22

Source: WB Staff estimates.
Note: The estimations corrected for heteroskedasticity using robust standard errors.

Annex Table 3. Augmented Dickey Fuller Tests and Stationarity

| Variable | Interpolated Dickey -Fuller Test | | | |
| | Critical Value: 1% = -3.716; 5% = -2.986; 10% = 2.624 | | | |
	Test Statistic variable in levels Z(t)	Unit Root Process	Test Statistic variable in first difference Z(t)	Unit Root Process
(1)	(2)	(3)	(4)	(5)
Tota l Agriculture Public Spending (t -1)	-3.391	I(0)	-8.082	I(0)
Agriculture and Irrigation Public Spending to Agriculture GDP (t-1)	-3.482	I(0)	-7.623	I(0)
Fertilizer Subsidy Spending to Agriculture GDP (t -1))	-2.667	I(0)	-8.458	I(0)
Growth of Agriculture G DP per Capita (US Dollar, log)	-3.380	I(0)	-7.008	I(0)
Growth of Non Agriculture GDP per Capita (US Dollar, log)	-1.519	I(1)	-6.361	I(0)
Arable Land (log)	-0.404	I(1)	-3.674	I(0)
Labor force in the agriculture sector (log)	-1.788	I(1)	-5.725	I(0)
Agric ulture private machinery input (log)	0.130	I(1)	-3.515	I(0)
Agriculture tax revenue (log)	-0.158	I(1)	-5.082	I(0)
Index of global demand for agriculture export (log)	-1.899	I(1)	-3.592	I(0)

Source: WB Staff estimates.

Annex II. Robustness: Estimating with the General Method of Moments (GMM)

We look at the impact of public spending on agriculture growth with the GMM to conclude that the results are not dependant on the choice of model specification (hence, as reported in Table 2 in the annex GMM(1), (2), and (3)) . Our findings are generally consistent across specifications and changes to the econometric technique, and in line with the findings from the literature exploring the impact of public spending on growth. However, there are some interesting points to highlight from these empirical estimations.

To control for possible endogeneity between the public spending components and other right hand side variables, the (GMM) regression technique includes instrumental variables that are the lagged values of the regressors, it creates a dynamic setting that can capture endogeneity. [22] Thus, it uses as instruments the second and third lags of Agriculture and Irrigation Public Spending, Fertilizer Subsidy Spending, ATR and residuals, as well as the first and second lags of growth rate GD, non agriculture GDP per capita, and the first and second lags of Arable land, and Labor force in the agriculture sector.

The results indicate that most fiscal variables have a statistically significant effect on the growth rate of agriculture GDP per capita, while the impact is more statistically significant within the GMM setting. Thus, the positive and statistically significant effect on the agri-GDP per capita growth rate comes from agriculture and irrigation spending. This can be seen across the estimations in Table 2, but OLS(3) and GMM(3) are particularly interesting, for they capture the composition effect while considering the impact of taxation and the global demand for agriculture. By contrast, fertilizer subsidy spending has a negative effect on the growth rate of agriculture GDP per capita like in the OLS results.

As in OLS, the growth rate of non agriculture GDP has a positive and highly significant impact implying that spillovers effects from the other sectors are complementary and contribute to growth. With the exception of GMM(1), the effect from the time dummy variable for 1998 is not significant and negative, but serves to control for any disturbances to growth that could be attributed to economy's contraction following the Asian financial crisis.

There are also some differences between the OLS and GMM results worth mentioning. Total agriculture spending (combining development spending and subsidies) is only significant in the GMM setting. The agricultural tax variable is negatively associated using OLS and it becomes statistically significant in the dynamic setting of the GMM technique (GMM(3)). Also, the impact from the change in world demand for agricultural products is negative and significant in the GMM results, suggesting a lack of response of agriculture production in Indonesia to changes in global demand.

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[22] Durbin Wu Hausman test is used to determine endogeneity problem. The test result is rejecting the null hypothesis that the "regressors are exogenous".

Annex III. Public Expenditure on Agriculture

Annex Table 4. Agriculture Public Expenditure (Rp billion)

Item	2001	2002	2003	2004	2005	2006	2007	2008
1. Agriculture:	3,619	4,851	6,258	5,590	6,228	10,678	13,835	16,001
- Central	1,227	1,922	3,091	2,537	2,661	5,618	6,385	8,091
- Sub national	2,393	2,930	3,167	3,053	3,567	5,060	7,450	7,909
2. Irrigation:	4,785	3,866	5,765	4,641	4,418	6,819	6,822	8,213
- Central	3,971	2,815	4,595	3,602	3,355	5,311	4,232	5,463
- Sub national	813	1,051	1,170	1,038	1,063	1,508	2,590	2,750
3. Subsidies	3,518	4,742	6,085	6,175	9,071	8,651	13,371	29,398
Total Agriculture Spending	**11,922**	**13,460**	**18,108**	**16,405**	**19,716**	**26,148**	**34,028**	**53,611**
National Agriculture Spending as % of National Spending	3%	4%	4%	4%	4%	4%	4%	5%
National Agriculture Spending as % of GDP	1%	1%	1%	1%	1%	1%	1%	1%
Central Agriculture Spending as % of Agriculture GDP	5%	5%	7%	6%	8%	10%	11%	19%
Sub National Agriculture Spending as % of Agri-GDP	2%	2%	2%	2%	2%	3%	5%	5%
National Agriculture Spending as % of Agriculture GDP	7%	7%	10%	8%	10%	13%	16%	24%

Source: World Bank staff calculations based on data from MoF and MoA.

Annex Table 5. Agriculture Public Expenditure (% of Total Agriculture Spending)

Item	2001	2002	2003	2004	2005	2006	2007	2008
Agriculture	**30%**	**36%**	**35%**	**34%**	**32%**	**41%**	**41%**	**30%**
- Central	10%	14%	17%	15%	13%	21%	19%	15%
- Sub national	20%	22%	17%	19%	18%	19%	22%	15%
Irrigation	**40%**	**29%**	**32%**	**28%**	**22%**	**26%**	**20%**	**15%**
- Central	33%	21%	25%	22%	17%	20%	12%	10%
- Sub national	7%	8%	6%	6%	5%	6%	8%	5%
Subsidies	**30%**	**35%**	**34%**	**38%**	**46%**	**33%**	**39%**	**55%**

Source: World Bank staff calculations based on data from MoF and MoA.

Note:
1. Agriculture Spending consists of spending on sub-sector: (1) Food crops, (2) Estate/horticulture crops, and (3) Livestock.
2. Agricultural Spending at Central Level comprises of spending on sector: (1) Agriculture, (2) Irrigation, and (3) Agricultural Subsidy.
3. Agricultural Spending at Sub National Level comprises of spending on sector: (1) Agriculture and (2) Irrigation.
4. Agricultural Spending at Central Level, source: Audited Financial Report of MoA, 2005-07, and 2008 Plan Budget.
5. Nominal GDP including oil and gas.

Notes on Budget Classification:

Economic classification: The classification changed in 2003 and 2005 and the new format is considerably different. Currently, the budget is broken down into: personnel expenses, operations and maintenance costs, travel expenses, and subsidies. However, it can be tracked to the pre-2005 classification to see the breakdown by routine (recurrent) and by development (capital) expenditures. At the provincial and district level, development expenditures are classified into: sector, subsector, and functional classification only. The data by routine consists of: personnel expenses, recurrent materials and good costs, subsidies, and miscellaneous. It can be disaggregated by sector or sub sector and by project/program and department/unit

level/executing agencies. Yet, APBD data lacks detail on projects or programs attributed to individual provinces or district governments.

Functional classification: Currently, the budget consists of 11 functions, by which the agriculture sub-function is clustered under the "economy" function. In this sense, the development expenditures are organized by *bidang* (21 sections) and *dinas* (executing agency), while the routine spending was aggregated into apparatus and public expenditure.
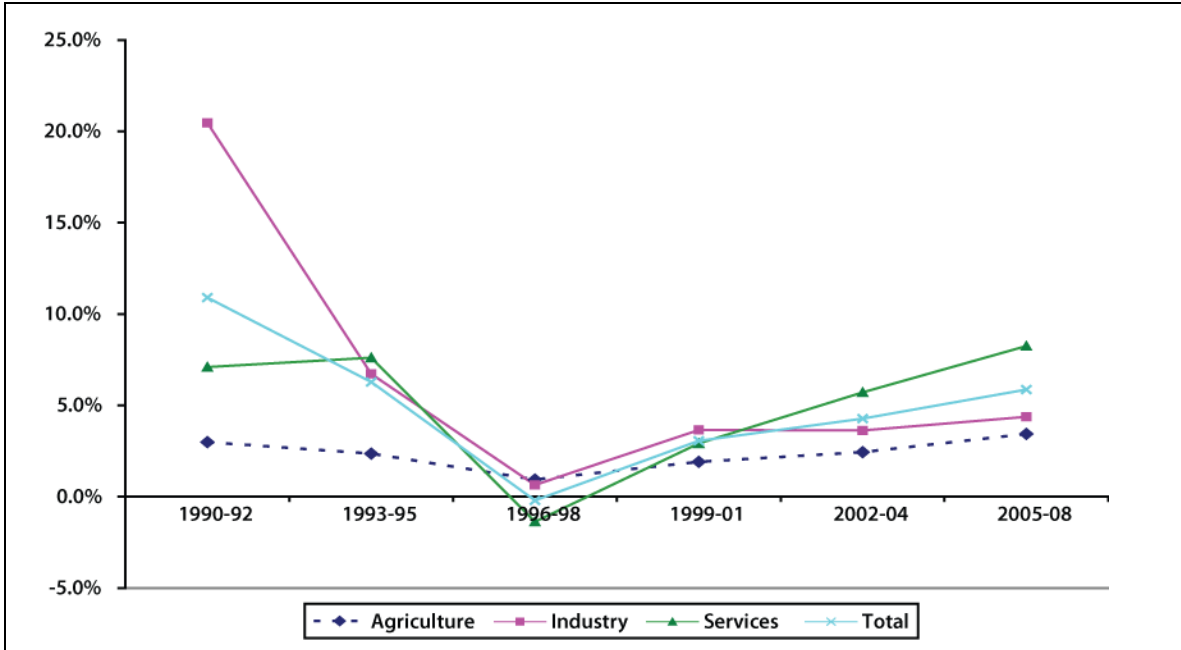
Annex IV. Indonesian Agriculture At A Glance

Annex Figure 1. Yield Increases in Indonesia 1975-2007
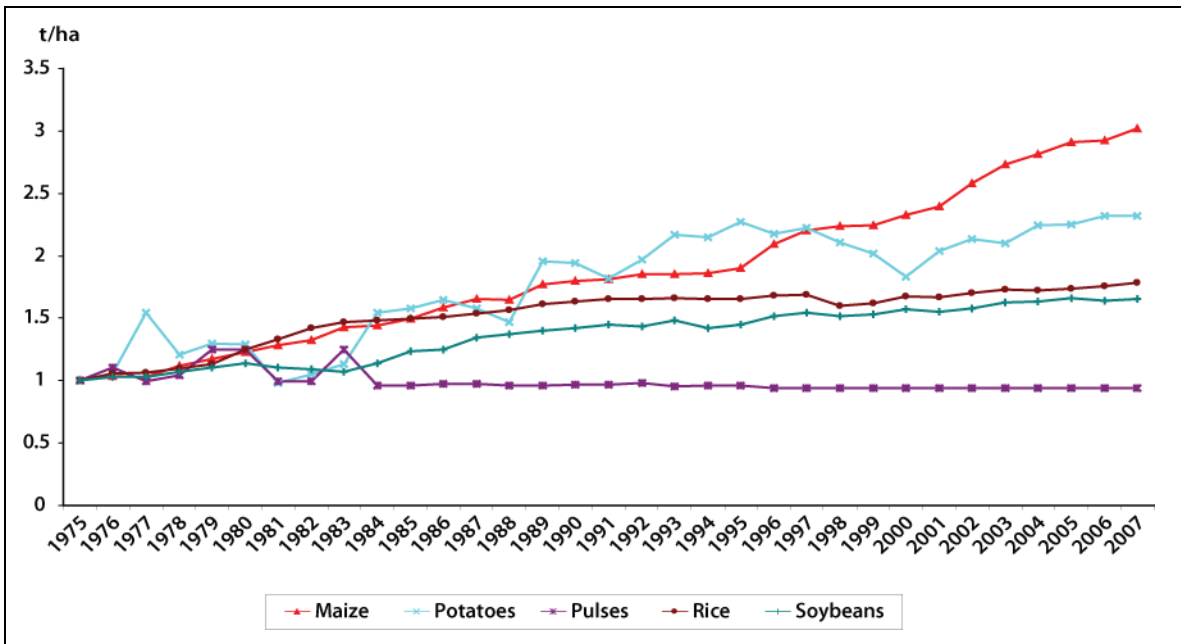
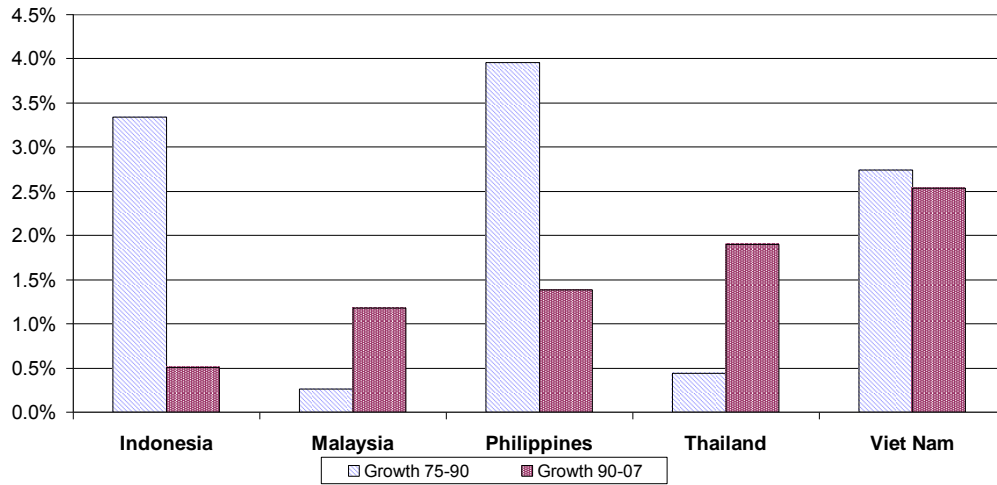*Source*: FAO and World Bank staff estimates.

Annex Figure 2. Comparison average growth rates by sector in Indonesia, 1990-2008

Source: FAO and World Bank staff estimates.

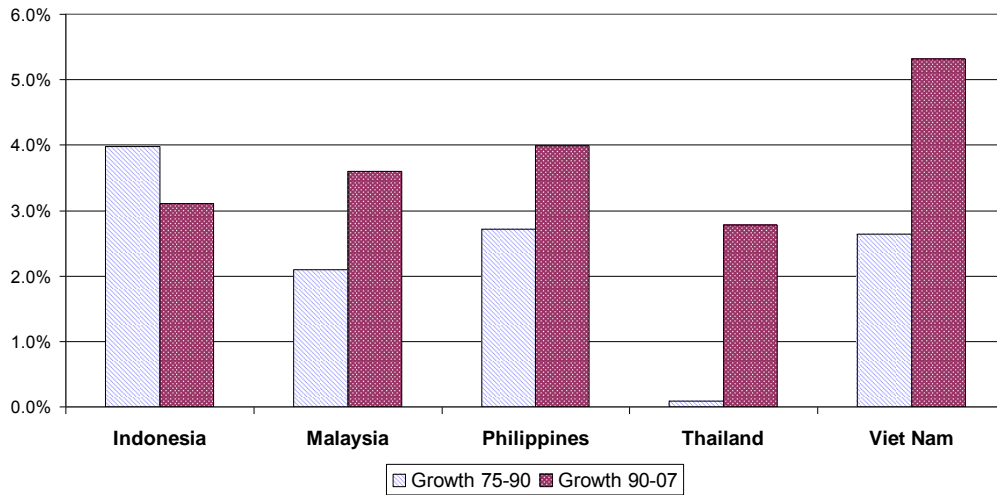**Annex Figure 3. Comparison Rice Yields Growth in Asia**

Comparison Rice Yields Growth 1975-90 and 1990-07

Source: FAO and World Bank staff calculations.

Annex Figure 4. Comparison Maize Yields Growth in Asia

Comparison Maize Yields Growth 1975-90 and 1990-07

Source: FAO and World Bank staff calculations.