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Subsidy or market reform? Rethinking China's farm consolidation strategy ☆

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ABSTRACT

Chinese food security policy is anchored increasingly on the conviction that domestic grain production should be greatly enhanced, and the best way to do so is to expand farm production scale. To that end, an increasing stream of public investment has been directed to the grain sector, in the form for example of farm expansion subsidies. Our purpose is to assess the potential impacts of China's farm-scale expansion on both yields and per-hectare economic returns. Analysis of a large sample of farm household production data finds (with some exceptions) that grain yields likely will decline as farm size grows, compromising food self-sufficiency targets. More importantly, in only isolated cases would per-hectare economic returns decline with size. Thus, an emphasis on reducing farmland transactions costs may stimulate cropland consolidation and achieve the desired long-term structural transformation.

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Introduction

China has a long history of policies designed to guide the agricultural sector toward boosting productive capacity. Several decades of strong factor productivity improvement show the policies have borne fruit; China is the world's largest grain producer and second-largest coarse grain producer (ERS, 2014; FAO, 2014). Although these production and productivity gains were achieved on some of the smallest farm sizes in the world, a new government strategy looks to boost productive capacity through the promotion of larger-scale, more mechanized farms (NDRC, 2009). Focused on maintaining food security – defined as 95% grain self-sufficiency – in the world's most populous nation, policymakers have inaugurated a stream of new subsidy and other incentive programs to encourage the land recombinations and capital growth conducive to large-scale grain enterprise (CPG, 2013, 2014; Gale, 2013; MOA, 2013, 2014).

Yet the literature offers no evidence that expanding production scale will help China more consistently achieve its short- and medium-term food production targets. It suggests only in a broader way that farm-size expansion is necessary for improving long-term international competitiveness. With that in mind we examine here whether lifting farm size will indeed improve farm yield and, if it does, whether the incentives are in place for farmers to consolidate the necessary cropland. The latter – economic – question is as important as the former – technological – one. For in the absence of the right motivation, a consolidation policy would be expensive for any short-run food-security benefits it would provide. If sufficient consolidation incentives are already present, the government's new drive represents a misallocation of agricultural investment. Consolidation and mechanization subsidies may instead be distorting China's burgeoning land-lease markets and dulling technological innovation.

Our approach, at the national and provincial levels, is to estimate the impact on grain yields and farmer net returns of farm-size expansion using 2003–2007 Chinese farm-household data. The thrust of our findings is that larger-scale grain production would in most locales impair yields rather than lift them. In particular, yields would decline in provinces that presently produce a third of China's rice, a two-thirds of its maize, and just

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over a third of its wheat. Furthermore, in areas accounting for 4% of Chinese wheat production, 12% of its rice, and 16% of maize production, expansion-specific support would be needed to induce the farm consolidation the government seeks. Thus in most of China's grain farm land, farm-size subsidies are not necessary for consolidation provided transaction costs are minimal. Policymakers may therefore want to consider less distortive approaches to encouraging farm consolidation, such as deeper land-market reforms and stimulating technical change through investment in agricultural research and extension services. Deficient in short-term gains, the benefits of China's grain-farm consolidation likely reside in long-term international market competitiveness.

The remainder of the paper is arranged as follows. The 'Backgr ound' Section provides the arguments supporting China's farm-size expansion and reviews how various performance measures (yields, profit, and total factor productivity) have been found to change with farm size. The 'Agricultural production constraints' Section details the evolution of China's cropland consolidation policies as well as specific constraints to scale's effect on grain yields. The 'Data & empirical model' Section presents the approach used to estimate the impact of increasing farm scale on grain yields and per-hectare (per-ha) economic returns. The 'Results' Section discusses the estimation results, and the 'Conclusions' Section provides policy implications.

Background

Chinese authorities believe new policies to liberalize cropland transfer and consolidation represent the most important agricultural reform since the 1978–84 introduction of the Household Responsibility System (Xinhua.net, 2013). Indeed, China's Ministry of Agriculture has made "restructuring agriculture" its top priority for 2015. There also is support from within academia for China's new cropland consolidation efforts. Otsuka (2013) argues that significant farm-production technological inefficiency may arise if farm size remains small in a high-wage economy with relatively abundant labor. Specific to China, Otsuka warns that a failure to rapidly expand farm size may lead to diminishing international comparative advantage and enlarging food imports, driving prices up on the world market. Lacking the ability to benefit from large scale-dependent machinery, Otsuka argues, labor and machinery-service expenditures become burdensome for small farms, driving them to negative profits.

Omitted from these considerations is evidence that yields, and thus short-run per-hectare production, improve with size. Indeed, a vast volume of empirical literature suggests otherwise (Bardhan, 1973; Chayanov, 1926; Eastwood et al., 2010; Lipton, 2009; Sen, 1975; Srinivasan, 1972). Several explanations have been put forward for the stylized negative relationship between yields and farm size. A prominent one revolves around market imperfections. Operators of smaller farms tend to be owners, who are more likely than hired labor to exert effort and process productivity-enhancing information (Frisvold, 1994; Rosenzweig and Wolpin, 1985). Even if all farms are operated by owners, a negative yield–size correlation may develop on account of labor, land, insurance, and credit market imperfections (Assunção and Ghatak, 2003; Barrett, 1996; Eswaran and Kotwal, 1986). Insurance market imperfections motivate small farms to cultivate more intensively rather than expand (Barrett, 1996).

Land quality is often cited as another reason why a negative farm size–yield or size–revenue per-ha relation may be encountered. Benjamin (1995) in Java, Indonesia, and Assunção and Braido (2007) in India, test the impact of accounting for soil quality and find the respective negative size–yield and size–revenue per-ha relations endure. Assunção and Braido find no impact from unobserved, time-varying household characteristics on the inverse yield–size relationship. Chen et al. (2011) examine grain production in China over the 1995–99 period and find the negative relationship disappears after controlling for unobserved land quality. Importantly, using a unique plot-level production dataset from Madagascar, Barrett et al. (2010) found that market imperfections only explain a small portion of the negative yield–farm size relation, while missing soil quality measures explain none of it.

A third explanation is farm-size measurement error.[1] Self-reported farm-size measures may be inaccurate (Carletto et al., 2013). In the presence of a fixed-effects model and time-invariant land measures, statistical noise may exacerbate measurement error bias (Lamb, 2003; Holden and Fisher, 2015). Moreover, the extent of that potential bias likely varies over farm sizes (Carletto et al., 2013; Holden and Fisher, 2015). Evidence from the literature, though, suggests that self-reported measures are a reasonable alternative to GPS-measured farm-size estimates (Carletto et al., 2013; Cohen, 2015).

The majority of studies investigating the inverse productivity–size relationship rely on yields, which is a partial productivity measure that accounts for only one factor of production (land). Thus, it is important to test for the profit-size as well as yield–size relationship when evaluating farm performance. Profit accounts for more production factors than do partial productivity measures and, because it arguably is a powerful production incentive, serves as a long-run food-security indicator. Recent evidence from India suggests that a positive relationship between farm size and per-acre-profit may arise in the presence of institutional barriers for land consolidation, and of farms too small for efficient application of scale-dependent machinery (Foster and Rosenzweig, 2011).

Total factor productivity (TFP) provides the best farm performance comparison because it is a volume-based measure that also accounts for multiple production factors. TFP comparisons across farm sizes are uncommon in the literature on account of their stringent data requirements. Two studies, however, do provide insight into how TFP correlates with farm size. Sheng et al. (2014) evaluate survey data of Australian broadacre farms from 1977 to 2007 and find TFP rises with size. They find differences in production technology, rather than returns to scale, explain why larger farms there are more productive. Helfand et al. (2015) evaluate Brazilian agricultural census data from 1985 to 2006 and find TFP growth has a U-shape distribution over farm-size classes. They find TFP growth is fastest in the smallest (0–5 ha) and largest (500+ ha) size classes, and slower in the middle classes. However, that national distribution varies widely by Brazilian region: in the North TFP declines with size, in the Center-West it rises with size, and in the remaining regions some form of the U-shape distribution is found.

Agricultural production constraints

Our purpose is to evaluate the yield impact of China's grain-farm scale expansion, and test for the presence of existing economic incentive for cropland consolidation. By doing so at the commodity and provincial levels, we provide new insight into its scale-expansion approach to 95% grain self-sufficiency, information presently unavailable from the literature. While some could draw conclusions from other analyses – eg, Chen et al. (2011) – they would be misguided because location and crop choice matter to farmers' expansion prospects. We first review China's cropland consolidation policies and the factors constraining scale's effect on yields.

[1] We thank the anonymous reviewers for bringing this to our attention.