China Economic Review 20 (2009) 303–315

Contents lists available at ScienceDirect

China Economic Review

Agricultural extension system reform and agent time allocation in China ☆

Ruifa HU [a,b,*], Zhijian YANG [a,b,c], Peter KELLY [d], Jikun HUANG [a,b]

[a] Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, Jia 11, Datun Road, Beijing 100101, China
[b] Center for Chinese Agricultural Policy, Chinese Academy of Sciences, Jia 11, Datun Road, Beijing 100101, China
[c] Graduate School of Chinese Academy of Sciences, Beijing 100039, China
[d] Department of Agricultural and Resource Economics, University of California, Berkeley, CA 94720, USA

ARTICLE INFO

Article history:
Received 24 January 2008
Revised 23 May 2008
Accepted 13 October 2008

JEL classification:
L33
O13
P25
Q16

Keywords:
Agriculture
Extension
Reform
Agent
China

ABSTRACT

We conducted a nationally representative survey to measure the impact of China's institutional reforms in public agricultural extension on the time allocation of its one million agricultural extension agents. We found that Chinese agents spent much less time than their titles would suggest on providing agricultural extension services, and that agents whose base salaries were funded fully or partially by commercial activities spent substantially less time serving farmers. The institutional incentives associated with the source of funding have a much larger effect on agent time allocation than do the levels of funding. We conclude that the recent government policy to separate commercial activities from extension services is a step in the right direction and should be expanded. The results also suggest that, at least for agricultural extension, the goal of many national governments and international donors to develop locally financing institutions to sustain development projects may be misguided.

1. Introduction

A major ideological debate in development centers focuses on whether the provision of local public goods in developing countries should be made financially self-sustaining. Should external international or national-government donors indefinitely fund activities that generate positive externalities, or can these activities be funded more effectively by establishing institutions that rely on local cost-recovery? Replacing dependency with self-sufficiency is attractive across the ideological spectrum, but empirical evidence from a number of contexts suggests that local financing may be ineffective in delivering public goods. For example, Kremer and Miguel (2007) observed that cost recovery measures for de-worming drugs in Kenya reduced uptake by 80%, and Meuwissen (2002) found disappointing results from cost recovery for health services in Niger. Morduch (1999) noted that microfinance institutions, when asked to be self-sustaining, focused less on the poor.

Few studies of local financing institutions have focused specifically on agriculture, which has been newly recognized as crucial to development and poverty alleviation (World Bank, 2007), or on China, where fiscal responsibilities have been decentralized on a massive scale (Zhang, 2006). A few papers (e.g., Anderson & Feder, 2004) do discuss the role of private contractors or fee-for-service

☆ This research is jointly funded by the National Natural Science Foundation of China (70325003), Chinese Academy of Sciences (KSCX2-YW-N-039), and the Canadian International Development Agency (CIDA).

* Corresponding author. Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, Jia 11, Datun Road, Beijing 100101, China. Tel.: +86 10 64889836; fax: +86 10 64856533.
E-mail address: rhu.ccap@igsnrr.ac.cn (R. Hu).

1043-951X/$ – see front matter © 2008 Elsevier Inc. All rights reserved.
doi:10.1016/j.chieco.2008.10.009

in agricultural extension, a crucial institution for farmers. However, to our knowledge none have used an econometric analysis of primary survey data, and none have used data from a transition economy, as we do in this paper.

China's government has implemented a series of self-sufficiency reforms for its public agricultural extension system since the late 1980s (Huang, Hu, Zhang, & Rozelle, 2000). These reforms, involving nearly one million agents and impacting several hundred million farmers, represent one of the largest-scale examples of a shift to public financing in a developing country. The reforms began in 1988, when China's central government encouraged public agricultural extension system (PAES) stations to earn their own income through commercial activities (Lu, 1999; Wang, 1994). These commercial reforms were intended to cover station budgets and offer appropriate input technologies. Several studies have found that the reforms have stimulated the PAES stations and their agents to sell more chemical pesticides and fertilizers, and to push farmers' to overuse of pesticides and fertilizers (Huang, Qiao, Zhang, & Rozelle, 2001). However, no studies have examined the effects of the reforms on PAES service levels to farmers.

This paper examines the impacts of the PAES reforms and government investment on the time that agents allocate to providing extension services to farmers. Our objectives are to address two primary questions: Have commercial reforms affected the time that agents put into agricultural extension services (AES)? And is it effective for the government to increase its investment in the agricultural extension system under current institutional and management arrangements? The paper is organized as follows. In the next section, we give a brief overview of China's public agricultural extension system and the recent reforms. Next, we describe the data used in our analysis, and present estimation results from an econometric model, to understand the time that agents allocate to AES. In the final section, we draw some conclusions for government policy.

2. Reforms of the agricultural extension system in China

The Chinese government re-established its PAES at the end of the 1970s. By the middle of the 1990s, the system employed an extension staff of more than one million (Lu, 1999); about 70% had graduated from technical high schools or colleges (Lu, 1999; Zang, 1989). More than 90% of them worked at PAES stations at the county and township levels, with most agents at the township level (Table 1). By the mid-1980s, China had established stations in every rural county and township, even in remote regions, and this large system provided high-quality AES.

PAES stations are organized by agricultural sub-sector. Most counties have crop, livestock, agricultural machinery, aquaculture, and economic management stations or centers (Table 1). Many counties have established specialized sub-stations, including crop management, plant protection, horticulture, and soil- and fertilizer-technology sub-stations with stations or centers, as well as establishing stations corresponding to locally important agricultural products (e.g., cotton).

The PAES stations became overstaffed, in part because of the proliferation of specialized stations (Huang et al., 2000), creating a financial burden for local governments (Hu, Huang, & Li, 2004). To improve efficiency, many counties restructured their PAES stations by merging different stations and establishing new agricultural extension service centers. For example, most counties have merged their crop-management technology station, plant protection station, and soil- and fertilizer-technology station to establish a single crop-technology extension service center (ESC).

The commercial reforms conducted since the late 1980s have deeply affected the development of the PAES and the government's investment in the system (Sun, 1993). In the early 1990s, the Chinese government formalized the commercial reforms by classifying agents by their source of funding: fully funded agents (government payroll), partially funded agents (government pays part of base salary), and self-funded agents (base salary comes from commercial activities and grants). Counties had flexibility in implementing the reforms. Most counties took some agents off the government payroll, and some counties all agents in certain specialties were taken off of the government payroll (Hu et al., 2004; Qiao, Zhang, & Hu, 1999; Sun, 1993).

Not only have local governments cut funding in the PAES; the central government and provincial governments also invest little in PAES, and cut funding as part of China's commercial reform. Our survey of 7 provinces, 28 counties and 363 PAES stations found that in 2002, except at a handful of national extension centers, most funding comes from county and township governments, and is often highly inadequate. The survey also found that 77% of stations had no project grants, which usually come from the provincial

Table 1
Distribution of extension agents (1000 persons) in China, 1996–2006.

Year	Total	By administrative level			By specialization				
		Above county[a]	County level	Township level	Crops	Livestock	Agricultural machinery	Aquatic products	Agricultural economics
1996	1025	69	375	581	421	332	139	24	109
1997	1013	66	378	570	417	312	161	30	94
1998	1058	60	358	640	407	338	183	34	95
1999	1035	65	356	614	411	329	168	33	94
2000	1013	71	353	589	415	320	153	32	92
2001	981	72	350	560	412	316	134	32	88
2002	934	68	343	523	401	299	119	30	84
2003	881	68	330	482	362	301	111	29	78
2004	832	66	320	446	345	292	95	29	72
2005	843	74	332	437	333	294	106	32	78
2006	788	73	318	397	326	266	97	28	70

Source: Ministry of Agriculture.
[a] Above county level refers to prefectural, provincial, or national level agricultural extension units and agents.

Table 2
Per capita budget for agricultural extension units, 2002.

	Yuan/agent/year			%		
	Mean	Township	County	Mean	Township	County
Budget item						
Total	14,304	9416	16,496	100	100	100
Government funds	11,197	6136	13,467	78	65	82
Operating budget	8990	4871	10,837	63	52	66
Project grants	2031	1111	2443	14	12	15
Other	176	154	186	1	2	1
Commercial	3107	3280	3029	22	35	18

Source: Authors' survey of 363 stations in 28 counties.

or central government, and 25% were sometimes unable to pay extension agents on time. Those that did have project grants often diverted them to pay regular salaries.

In an attempt to reinvigorate the PAES, the central government pushed another reform in the late 1990s. This reform shifted the administrative rights (including personnel, finance, and materials, or "three rights") from county agricultural bureaus to township governments. Although the reform shifted the budgetary burden from county agriculture bureaus to township governments, it cut the links between the county agricultural extension stations and the township agricultural extension stations (Hu et al., 2004). We found that agents are frequently called on for administrative duties that have nothing to do with agricultural extension, including family planning, budget management, elections, fire protection, legal matters, and so on. Given the ever-changing nature of central government mandates, specific duties outside of agricultural extension can be idiosyncratic at any particular time, including everything from studying ideology after a major political event to combating a disease outbreak.

3. Survey design

Our data come from a nationwide survey conducted by the authors at the end of 2002 and in early 2003. Stations were chosen according to a multi-stage cluster design with regionally stratified random sampling. From each of China's seven major geographic regions (northeast, northwest, north, east, south, central, and southwest), we randomly selected one province. All of the counties in each sampled province were divided into two groups according to farmers' per capita net income, and two counties were randomly selected from each group. Finally, all townships in the sampled counties were divided into three groups based on farmers' per capita net income, and one township was randomly selected from each group. In each county/township, we randomly selected three stations (or all stations where there were fewer than three). The sample includes 7 provinces, 28 counties, 84 townships, and 363 extension stations (198 at the county level and 165 at the township level).

We asked the station leader (or deputy leader) to participate in the survey, as well as a randomly selected one-third of the agents at each agricultural extension station in the sampled counties and townships.[1] In total, 1245 extension staff members (45 per county on average) were interviewed, including 423 station leaders (239 at the county level and 184 at the township level) and 822 agents (531 at the county level and 291 at the township level).

The interviews included questions about personal characteristics and time allocation. We asked staff members how many days in 2002 they spent on administration, providing AES, commercial activities; and non-work activities (days they did not go to work).[2] Most administrative days were spent on duties unrelated to agricultural extension; most days spent providing AES were *xiaxiang*, or going to the field, but we also counted days spent providing or receiving AES training under providing AES. We also collected information on government investments (specifically, operational budgets and project grant funding); on staff size; on the types of funding (full, partial, or self); and on other station characteristics (such as specific station policies and regulations).

4. Descriptive statistics

We found that funding levels per agent at China's agricultural extension stations were low, and that government-funded operating expenses represented the largest share of station budgets. In 2002, agricultural extension stations at the township level had an average budget per agent (inclusive of salaries and extension expenditures) of only 9416 *yuan*[3] (Table 2), with county-level stations only a bit higher at 16,496 *yuan*. This included 11,197 *yuan* of government funding (13,467 *yuan* for county stations and 6136 for township stations), 78% of the total. Income from commercial activities averaged 3107 *yuan* (3029 at the county level and 3280 at the township level), accounting for 22% of the total. Of the government funding, an average of 8990 *yuan* funded the operating budget (OB) and 2031 *yuan* funded project grants (PG), 63% and 14% of total funding, or 80% and 18% of government funding, respectively.

[1] The response rate was 100% except for a small number of agents who were traveling in other counties. Sampled agents who were in the field when the survey team arrived were called back to the office.

[2] A possible concern with this type of questionnaire is that respondents may fear a breach of confidentiality or otherwise be reluctant to report time allocations that are not in accordance with their employer's expectations. However, this did not appear to be a problem. There was no difference in the reported time allocation between agents at stations that had formalized time allocation expectations and those that had not (Hu & Huang, 2001).

[3] In 2002–03, 1US$ = 8.27 *yuan*. The current rate is approximately 1US$ = 7 *yuan*.

Table 3
Time allocation of agricultural extension agents by personal characteristics, 2002.

	Obs.	Days per year				
		Admin.	AES delivery	Comm. work	Non-work	Total
Overall	1245	135	81	56	92	365
Employment status						
Senior staff	84	138	107	29	90	365
Mid-level staff	424	129	94	50	92	365
Junior and other	737	139	71	63	93	365
Academic credentials						
BS and above	192	138	95	34	97	365
2 or 3 years Technical College	464	143	86	41	95	365
Secondary Specialized School and below	589	128	73	75	88	365
Position						
ESC leader	86	168	88	18	91	365
Station leader	488	130	95	57	82	365
Other	671	135	70	60	100	365
Province						
North	645	165	68	41	91	365
Hebei	188	137	87	47	94	365
Heilongjiang	265	188	46	29	101	365
Gansu	192	159	80	52	73	365
South	600	104	95	72	94	365
Zhejiang	128	149	89	23	104	365
Hubei	188	78	77	100	110	365
Guangdong	109	86	97	104	79	365
Sichuan	175	110	119	57	78	365
Administrative level						
County	770	136	86	39	103	365
Township	475	134	73	83	75	365
Government funding						
Fully funded	823	160	85	25	96	365
Partially funded	244	116	87	64	97	365
Self funded	178	48	58	190	70	365
Government investment for operating budget (per capita OB: 1000 Yuan/year)[b]						
per capita OB<=5	369	95	74	115	80	365
5<per capita OB<=9	278	146	83	36	99	365
9<per capita OB<=22	543	154	84	31	96	365
per capita OB>22	55	166	98	2	100	365
Government investment for extension projects (per capita PG: 1000 1000 Yuan/year)[c]						
per capita PG=0	953	137	77	60	91	365
0<per capita PG<=1.4	97	125	92	60	87	365
1.4<per capita PG<=5.0	98	126	91	43	105	365
per capita PG>5.0	97	142	100	22	101	365

[a]Government investment funds the OB (core funding), PG, and capital construction Any capital construction or cash-basis retirement-related expenses are excluded from this paper.
[b]The average per capita OB for the 1245 extension staff sampled was 9313 *yuan* in 2002.
[c]The average per capita PG for the 1245 extension staff sampled was 2040 *yuan* in 2002. $n=1245$; random sampling standard error = 1.4 percentage points or 5 days, larger for sub-groups. Source: Authors' survey.

Agents spent a relatively small share of their time offering AES in 2002 (Table 3). Agents averaged 273 working days per year, or slightly more than 5 days per week after vacations, sick days, and other leave. In most counties, the hours worked by extension agents were comparable to those worked by other local government employees. However, extension agents spent 135 days per year, or 49% of their working days, on administrative work. Most of this administrative work was unrelated to agricultural extension, particularly for township-level extension agents. Commercial activities consumed an additional 56 days per year (21% of working days). This left only 85 days (31% of working days) for providing AES. Extension agents, whose title suggests that their primary duty is to provide agricultural extension services to farmers, in fact spent less than 1/3 of their working time doing so. In contrast, in 1985, agents spent approximately 85% of their working time on extension-related activities, 11% on administration, and 2% on commercial activities (Huang et al., 2001).

Supervisory time in the office cannot explain the limited time that agents spend in the field providing AES (Table 3). In fact, more senior and better educated agents spend more time providing AES and less time on administration and commercial activities. Our survey found that time spent providing AES increased with seniority, from 71 days for junior staff, to 94 days for mid-level staff, to 107 days for senior staff. Likewise, commercial activities decreased from 63, to 50, to 29 days, respectively. More highly educated staff members also spent more time on AES than did less educated staff members. Time spent on delivering AES increased from 73 days for those with a secondary vocational-school or lower education, to 86 days for those with two to three years of technical college, to 95 days for those with a BS degree or above. Time spent on commercial activities decreased with education, from 75, to 41, to 34 days, respectively. Time spent on AES increased with staff position, from 70 days for ordinary agents, to 95 days

for station leaders, though it was slightly lower for ESC leaders (88 days). But station leaders spent nearly the same time on commercial activities (57 days) as did other agents (60 days), or actually slightly higher as a percentage of working days. Both station leaders and ordinary agents spend much longer on commercial activities than county agricultural bureaus customarily plan for.

Agents in northern provinces spent more time on administration than did their southern counterparts (Table 3). On average, agents in southern provinces spent 95 days on providing AES, 104 days on administration, and 71 days on commercial activities. Agents in northern provinces spent an average of 85 days providing AES, 165 days on administration, and 41 days on commercial activities. In Guangdong and Sichuan, agents spent more than twice as much time providing AES as in Heilongjiang. These differences likely result from a longer growing season and double and triple cropping. In contrast, we found no systematic differences between eastern and western provinces.

Time allocation differed greatly for agricultural agents at different administrative levels (Table 3). County-level agents spent 86 days providing AES, compared to only 73 days for township-level agents. County-level agents spent only 39 days on commercial activities, far less than did the township agents (83 days). This illustrates one of the problems resulting from the reform of agricultural extension stations: the township agents, who should be working most closely with farmers actually spent *less* time providing AES. This is the main reason why farmers often complained that they had not seen an extension agent for many years (Shi, Hu, & Erika, 2003).

Fully or partially funded agents spent more time offering AES (85 and 87 days, respectively) than did self-funded agents (58 days) (Table 3). In practice, stations where all of the agents were self-funded were operating virtually as private enterprises, in which the agents spent an average of 190 days on commercial activities. The comparable figures for the fully funded and partially funded agents were 25 and 64 days, respectively. Administrative time also varied: The fully funded agents spent more time on administration (160 days) than did either partially funded (116 days) or self-funded agents (48 days). Thus, without controlling for their personal characteristics, fully funded agents spent more time on administration, but about the same time on delivering AES as did partially funded agents.

Government investment in agricultural extension funds the OB (core funding), PG, and capital construction. OB funding is used primarily for staff salaries, office expenses, and routine extension activities; PG funding is used for special technical extension projects. Table 3 suggests that government investment is significantly associated with agents' time allocations. As per capita OB and per capita PG funding increase, agents allocate more time to AES and to administration, and less time to commercial activities. For example, when per capita OB funding was less than 5000 *yuan*, agents spent only 74 days on AES and 95 days on administration, but 115 days on commercial activities. When per capita OB funding was more than 22,000 *yuan*, agents spent 98 days on providing AES and 166 days on administration, but only 2 days on commercial activities. It should be noted that when per capita OB funding increased from 5000 *yuan* to 22,000 *yuan*, the time agents spent on offering AES increased only 6 percentage points (from 20% to 26% of total time). The time spent on commercial activities decreased 32 percentage points (from 32% to less than 0.5% of total time), and the time on administration increased 19 percentage points (from 26% to 46% of total time). Thus, based on the prevailing institutional practices, increasing government investment did not effectively stimulate agents to spend more time bringing AES to farmers; it mainly induced agents to shift from commercial activities to administration.

The same pattern can be seen in the per capita PG funding. Of the 1245 extension staff we surveyed, 953 worked at stations with no PG funding; these agents spent 77 days delivering AES, 137 days in the office, and 60 days on commercial activities. When per capita PG funding was more than 5000 *yuan*, agents spent 100 days on AES, 142 days on administration, and 22 days on commercial activities. Raising either the OB or PG funding decreased the time spent on commercial activities, though increasing PG funding may be more effective at directing the time savings toward AES.

5. Model and variable description

The administrative process that determines how much time agents spend providing AES is complex and not directly observable, so we used a reduced-form model to measure the determinants of time allocation and to isolate those of most interest. To measure the impacts of government investment and reforms on the time agents spend offering AES, we propose the following agent-time-allocation model.

$$\text{Proportion of time spent on AES delivery} = f(\text{government investment},\ \text{institutional structure and reforms},\ \text{agent's personal characteristics},\ \text{regional characteristics})$$

The following variables represent the concepts of this model:

AES delivery time: proportion of time spent on providing technical advice to farmers and on conducting demonstrations and managing experimental field sites. This includes time in the field, as well as time spent providing and receiving training.
Government investment (continuous variables): per capita OB (Operating Budget funding) and per capita PG (Project Grants funding).
Institutional structure and reforms: administrative level of the station (0 = county-level, 1 = township-level) and type of funding (dummy variables for partially and self-funded agents, with fully funded as the omitted category).

Personal characteristics: Age; years of employment; sex (0 = male, 1 = female); leadership (two dummy variables for ESC leader/deputy leader and station leader/deputy leader, with non-leadership position as the omitted category); seniority (two dummy variables for senior and mid-level staff, with junior staff as the omitted category); educational level (two dummy variables for 2–3 years of technical college, and for bachelor's and above, with specialized secondary school or below as the omitted category); specialization (seven dummy variables for plant protection, horticulture, soil fertility, agricultural machinery, animal husbandry, agricultural economics, and other, with agronomy as the omitted category); and whether the job is suited to the agent's training (0 = no, 1 = yes). Regional characteristics: A dummy variable for southern China, which captures differences in cropping systems between the north and south.

Certain regressions also include checks on model specification. Funding levels in 1996 are included as a placebo test, and interaction terms are included in case the functional form of the model is mis-specified. Because of the possibility of multicollinearity among government investment and funding sources, we run five specifications with different combinations of variables and their interactions.

6. Results and discussion

The model was estimated as a cross-sectional[4] tobit (Table 4). Most of the signs of the estimated coefficients on the control variables representing personal characteristics are as expected. For example, when an agent's specialization does not match his training, he spends less time bringing AES to farmers. Likewise, higher levels of education and seniority are associated with greater AES delivery.

Most importantly, the coefficients for both government investment variables, for per capita OB and per capita PG, are positive (Rows 1 and 4), indicating that when the government increases its investment in the PAES, it stimulates the agents to spend more time delivering AES. However, the magnitude of this impact is small: The coefficient on per capita OB is statistically significant at the 5% level, but the estimated value is only 0.2 in the baseline specification (Row 1 Column 1). Controlling for other factors, each 1000 *yuan* increase in per capita annual OB will prompt agents to increase their time spent delivering AES by only 0.17% (0.6 days per year). Even at the upper limit of the 95% confidence interval, agents increased their time spent on AES by only 1.2 days annually for every 1000 *yuan* of annual increase in per capita OB.

The coefficient on per capita PG is even smaller and is not statistically significant, with a small confidence interval around zero (Row 4). These results suggest that, based on prevailing institutional arrangements, increasing extension project investment will not substantially increase the time agents spend providing AES. Column 2 suggests that project grants may increase time in the field for self-funded agents, but this coefficient is not significant under alternative specifications. Under current institutional practices, increases in government investment in PAES may be effective, but their impact is very limited.

The coefficients for type of government funding reveal the most notable results of the analysis (Rows 13 and 14). Compared to fully funded agents, controlling for levels of investment and other factors, partially funded or self-funded agents spend smaller proportions of their time delivering AES—6.0% (22 days) and 9.5% (35 days) of total time, respectively (Column 2). We see that the PAES commercial reforms significantly reduced the time that agents spend offering AES. This result is stable even when not controlling for the amount of expenditures (Column 3). Although the difference between fully and partially funded agents is small in our descriptive analysis, it is large and highly significant when controlling for agents' personal characteristics.

Because the above results rely on cross-sectional data, they may be subject to selection bias, since many of the same unobserved variables are likely to underlie differences in budgets, institutions, and personnel characteristics. To address this concern, we ran a placebo test, including 1996 funding levels in the regression. If current funding is simply a proxy for unobserved fixed-station characteristics, the coefficient for past funding should be similar to that for current funding, and introducing both variables into the same regression might make both coefficients insignificant due to multicollinearity. Similarly, if past funding is a proxy for unobservable past station characteristics that go into determining present institutions and agent characteristics, past funding would be expected to have a significant correlation with the time that agents currently spend on AES. Including coefficients for past funding (Columns 4 and 5) makes the results less significant, and calls into question the effectiveness of current project grants in increasing AES time for self-funded agents, but does not have a large effect on the coefficients or standard errors for current funding. In all specifications, the confidence intervals on the estimates of the impact of funding levels on time allocation form narrow confidence intervals close to zero. In all specifications, including one that excludes coefficients on funding levels entirely (Column 3), the effect of funding sources is large and significant. The above results are also robust under a wide variety of other specifications (see Appendix A).

7. Conclusions and policy implications

In 2002, Chinese agricultural extension agents spent an average of only 81 days actually bringing AES to farmers, and the township agents, who ought to be in closest contact with the farmers, spent even fewer days. This study found that the main factor determining how much time Chinese agricultural extension agents spent serving farmers was whether their agent's salary came from the government or from commercial activities. Increasing the total amount of financing, whether for the operational budget

[4] A difference-in-difference analysis with panel data is not possible because there was very little variation in time allocations in the 1980s before the reforms. According to a survey the authors conducted at other extension stations in the 1980s, agents spent almost all of their time providing AES.

Table 4
Tobit estimation of the agent time allocation model.

Dependent variable: % of days spent providing AES	(1)	(2)	(3)	(4)	(5)
Standard deviations in parentheses					
Government investment					
Per capita OB 2002 (1000 yuan/person)	0.167	0.110		0.126	0.064
	(0.08)**	(0.08)		(0.09)	(0.09)
Per capita OB 2002 X Partially funded		−0.019			0.238
		(0.28)			(0.34)
Per capita OB 2002 X Self funded		−0.609			−0.076
		(0.43)			(0.55)
Per capita PG 2002 (1000 yuan/person)	0.076	0.031		0.066	0.035
	(0.06)	(0.06)		(0.07)	(0.07)
Per capita PG 2002 X Partially funded		0.178			0.143
		(0.20)			(0.21)
Per capita PG 2002 X Self funded		2.227			−0.778
		(0.91)**			(1.52)
Per capita OB 1996 (1000 RMB/person)				0.122	0.152
				(0.11)	(0.11)
Per capita OB 1996 X Partially funded					−0.491
					(0.36)
Per capita OB 1996 X Self funded					−1.176
					(0.87)
Per capita PG 1996 (1000 RMB/person)				0.003	−0.021
				(0.06)	(0.06)
Per capita PG 1996 X Partially funded					0.562
					(0.91)
Per capita PG 1996 X Self funded					5.897
					(2.42)**
Institutional structure and reform					
Nature of government funding (fully funded = 0)					
Partially funded		−6.039	−6.798		−5.189
		(2.91)**	(1.97)***		(3.08)*
Self funded		−9.540	−11.567		−7.856
		(3.03)***	(2.47)***		(3.30)**
Administrative level (county-level = 0):	−3.143	−2.003	−2.446	−3.073	−1.985
Township-level	(1.68)*	(1.71)	(1.68)	(1.69)*	(1.75)
Agent personal characteristics					
Position (no managerial position = 0)					
ESC leader	0.813	−0.039	0.619	0.874	0.309
	(2.96)	(2.94)	(2.92)	(2.97)	(2.94)
Station leader	3.708	3.318	3.667	3.734	3.488
	(1.60)**	(1.59)**	(1.58)**	(1.60)**	(1.59)**
Employment status (Junior and other = 0)					
Senior staff	6.767	6.295	5.972	6.618	6.107
	(3.19)**	(3.16)**	(3.17)*	(3.19)**	(3.16)*
Mid-level staff	2.669	2.750	2.605	2.600	2.647
	(1.73)	(1.71)	(1.72)	(1.73)	(1.71)
Education (secondary specialized school and below = 0)					
BS and above	5.036	3.331	3.585	5.117	3.522
	(2.34)**	(2.35)	(2.35)	(2.34)**	(2.35)
2 or 3 years technical college	4.559	3.582	3.716	4.641	3.715
	(1.71)***	(1.70)**	(1.71)**	(1.71)***	(1.70)**
Working specialization (crop management = 0)					
Plant protection	−0.535	−0.238	0.034	−0.453	−0.042
	(2.90)	(2.88)	(2.89)***	(2.90)	(2.87)
Horticulture	10.437	10.712	10.819	10.517	10.644
	(3.41)***	(3.38)***	(3.39)***	(3.41)***	(3.37)***
Soil fertility	−6.088	−4.824	−4.594	−6.048	−4.972
	(3.88)	(3.86)	(3.86)	(3.88)	(3.85)
Agricultural machinery	−15.481	−15.027	−14.800	−15.689	−15.209
	(2.39)***	(2.37)***	(2.37)***	(2.39)***	(2.38)***
Animal husbandry	−9.336	−7.217	−6.397	−9.342	−7.451
	(2.06)***	(2.15)***	(2.14)***	(2.06)***	(2.17)***
Agricultural economics	−11.828	−12.450	−11.916	−12.049	−12.727
	(2.99)***	(2.96)***	(2.96)***	(2.99)***	(2.95)***
Other	−11.427	−10.929	−10.342	−11.544	−10.983
	(2.80)***	(2.78)***	(2.77)***	(2.81)***	(2.79)***
Work specialization not matches training (yes = 0)	−3.138	−2.765	−2.802	−3.291	−2.866
	(1.71)*	(1.70)*	(1.70)*	(1.72)*	(1.70)*

(continued on next page)

Table 4 (*continued*)

Dependent variable: % of days spent providing AES	(1)	(2)	(3)	(4)	(5)
Standard deviations in parentheses					
Agent personal characteristics					
Years of employment	0.190	0.199	0.218	0.205	0.203
	(0.13)	(0.13)	(0.13)*	(0.13)	(0.13)
Female (male = 0)	−6.232	−6.176	−6.418	−6.079	−5.891
	(1.79)***	(1.77)***	(1.78)***	(1.79)***	(1.77)***
Age	−0.033	−0.036	−0.057	−0.035	−0.034
	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)
Regional dummy (North = 0): south	11.013	13.220	14.153	11.148	13.265
	(1.53)***	(1.68)***	(1.63)***	(1.53)***	(1.69)***
Constant	20.524	22.203	23.387	19.822	21.282
	(4.45)***	(4.43)***	(4.34)***	(4.48)***	(4.47)***
Pseudo-R^2	0.026	0.029	0.028	0.026	0.030
Number of observations	1245	1245	1245	1245	1245

Note: The symbols, ***, ** and * denote significance at the 1%, 5% and 10% levels, respectively.

or for specific projects, improved service provision only slightly. But partially funded agents provided 27 fewer days of AES to farmers than did fully funded agents, and self-funded agents provided even less controlling for other factors. In contrast, increasing either operating or project budgets by 1000 *yuan* per agent annually, an increase of approximately 11%, would increase time spent on AES by less than one day per year.

Likewise, the international literature has chronicled disappointing attempts to create local institutions that make the provision of public goods financially sustainable. In Chinese agricultural extension context, when commercial reforms encouraged stations to become more locally funded, the agents were distracted by profit incentives, and spent their time on commercial activities rather than on AES delivery. The present study measures only the quantity, not the quality, of services, but other studies have suggested that the commercialization of extension stations has also reduced the quality of their services by creating conflicts of interest between agents and farmers (Huang et al., 2001).

China's Ministry of Agriculture is aware of the problem of agents spending little time bringing AES to farmers, but in our opinion the reforms (i.e., merging stations and centralizing administrative rights at the county level) do not go far enough. We conclude that to improve the service of the PAES in delivering AES to farmers, the recent government policy to separate commercial activities from extension services is a step in the right direction and should be expanded.

China's agricultural extension system reforms also reveal a more general lesson for governments and international development agencies. It is unwise to expect miracles from either local institutions or additional funding for public services, and prudent to proceed cautiously when contemplating the privatization or local financing of basic public services.

Appendix A. Robustness of results

We ran six types of robustness checks on the data:

1. Relaxing assumptions of the tobit specification. Two assumptions of our tobit specification are not precisely satisfied by the data: the statistical independence of the observations and the constant variance of the residuals. Because our data are derived from multi-stage cluster sampling, observations within each cluster may not be statistically independent, and therefore the standard errors in the tobit model may be biased. Correcting the tobit model for clustering and heteroskedasticity increased the standard errors slightly when clustering on provinces, but actually decreased the errors when clustering on counties (a result of a negative intra-county correlation of the independent variables), and neither procedure changed whether any coefficients of interest are significant.
2. Relaxing the implicit assumption of the non-concavity of the effect of funding levels on time allocation. An alternative to our linear model of the effect of funding on time allocation is a concave model, i.e., that increasing funding levels has a diminishing effect on time allocation. The coefficient for the square of funding is significant and negative (Appendix Table 1), implying concavity, but is no longer significant when we exclude large outliers (per capita funding more than three standard deviations above the mean).
3. Dropping control variables. Unconditional results without any control variables were similar to those shown with controls, as were results with selected control variables dropped. Dropping the south China dummy variable weakened the estimated impact of commercialization because stations in southern provinces were more likely to implement the commercial reforms, and agents in southern provinces spent more time offering AES. We speculate that this is a result of geography; stations in southern provinces have found more opportunities to commercialize stations that focus on the high-value specialty crops that grow in warmer climates, and their agents spent more time on AES because of a longer growing season. We believe that including the south China dummy variable is appropriate to produce unbiased estimates of the impact of commercial reforms and funding on AES time allocation.

4. Running the analysis on subsets of the data. To check the robustness of the results, the data were subdivided by province, type of station, type of position, or specialization, and the analysis was run on one category at a time. No such subset of the data yielded results that were of the opposite sign as the pooled results and statistically significant.
5. Dropping outliers. Among the variables of most interest in the model, only the per capita OB variable for 2002 contains a larger number of outliers than would be found in a normal distribution. If outliers in the per capita OB represent measurement error, attenuation may bias downwards the coefficient on this variable. Although the per capita OB data were derived from actual administrative records and therefore are not subject to measurement error, outliers in per capita OB that were created by a different data-generating process than the rest of the sample could also bias the coefficient downwards.
   Running the analysis without outlying values for 2002 per capita OB (more than 3 standard deviations from the sample mean) doubled its estimated coefficient to 0.39% per 1000 *yuan* annually, and had no meaningful effect on the levels or significance of any other estimated coefficients. Although the magnitude of this coefficient is somewhat sensitive to outliers, this sensitivity does not affect our general conclusion, for three reasons:
   First, neither quantitative nor qualitative evidence supports the idea that a different data-generating process for the outliers in 2002 per capita OB actually exists. Although 8 out of 1245 observations lie further than 3 standard deviations from the mean, the proportion of outliers is not high enough to reject the null hypothesis that only 0.3% of observations will lie outside of 3 standard deviations from the mean (equivalent to a normal distribution), even at the 10% level. In addition, a closer examination of the specific stations generating outlying values reveals no obvious qualitative evidence of a different data-generating process.
   Second, a quantile regression, an alternative method of reducing the influence of outliers, yields a coefficient on per capita OB of only 0.25%, similar to the original result of 0.17%.
   Third, even if 0.39% is a better estimate of the coefficient, increasing per capita OB is still not a very effective means of improving the delivery of AES, relative to reforming financing institutions.
6. Adding controls for per-capita financial income. Although our unit of analysis is the agent, who cannot control his source of funding, estimates of the effects of sources of funding are potentially subject to omitted variables bias and simultaneity bias. As a more exogenous measure of government support, we used per-capita financial income (total public employees divided by total local revenue). When we ran our regressions including per-capita financial income, we found that the coefficients on partial and self funding remained highly significant (see Appendix Tables 2 and 3).

Appendix Table 1
Tobit estimation of the agent time allocation model (OB and PG squared).

Dependent variable: % days spent providing AES	(1)	(2)	(3)	(4)	(5)
Standard deviations in parentheses					
Government investment					
Per capita OB 2002 (1000 RMB/person) square	0.001	0.000		0.000	0.000
	(0.00)	(0.00)		(0.00)	(0.00)
Per capita OB 2002 square X partially funded		−0.001			0.005
		(0.01)			(0.01)
Per capita OB 2002 square X Self funded		−0.025			0.012
		(0.03)			(0.04)
Per capita PG 2002 (1000 RMB/person) square	0.000	0.000		0.000	0.000
	(0.00)	(0.00)		(0.00)	(0.00)
Per capita PG 2002 square X partially funded		0.001			0.001
		(0.00)			(0.00)
Per capita PG 2002 square X self funded		0.203			−0.177
		(0.07)***			(0.22)
Per capita OB 1996 (1000 RMB/person)square				0.003	0.002
				(0.00)**	(0.00)**
Per capita OB 1996 square X partially funded					−0.011
					(0.01)
Per capita OB 1996 square X Self funded					−0.111
					(0.08)
Per capita PG 1996 (1000 RMB/person) square				−0.000	−0.000
				(0.00)	(0.00)
Per capita PG 1996 square X partially funded					0.055
					(0.09)
Per capita PG 1996 square X self funded					0.911
					(0.50)*
Institutional structure and reform					
Nature of government funding (fully funded = 0)					
Partially funded		−6.580	−6.798		−6.404
		(2.19)***	(1.97)***		(2.22)***
Self funded		−11.361	−11.567		−10.289
		(2.71)***	(2.47)***		(2.86)***
Administrative level (county-level = 0)					
Township-level	−3.770	−2.176	−2.446	−3.840	−2.295
	(1.67)**	(1.70)	(1.68)	(1.67)**	(1.72)

(continued on next page)

Appendix Table 1 (*continued*)

Dependent variable: % days spent providing AES	(1)	(2)	(3)	(4)	(5)
Standard deviations in parentheses					
Agent personal characteristics					
Position (no managerial position = 0)					
ESC leader	1.364	0.280	0.619	1.649	0.837
	(2.95)	(2.93)	(2.92)	(2.96)	(2.93)
Station leader	3.536	3.236	3.667	3.529	3.401
	(1.60)**	(1.59)**	(1.58)**	(1.59)**	(1.58)**
Employment status (Junior and other = 0)					
Senior staff	6.754	6.251	5.972	6.479	5.978
	(3.20)**	(3.16)**	(3.17)*	(3.19)**	(3.16)*
Mid-level staff	2.820	2.873	2.605	2.624	2.681
	(1.73)	(1.71)*	(1.72)	(1.73)	(1.71)
Education (secondary specialized school and below = 0)					
BS and above	5.568	3.416	3.585	5.832	3.774
	(2.34)**	(2.35)	(2.35)	(2.33)**	(2.35)
2 or 3 years technical college	4.686	3.488	3.716	4.919	3.738
	(1.71)***	(1.70)**	(1.71)**	(1.71)***	(1.70)**
Working specialization (crop management = 0)					
Plant protection	−0.590	−0.027	0.034	−0.478	0.182
	(2.91)	(2.88)	(2.89)	(2.90)	(2.87)
Horticulture	10.607	10.872	10.819	10.623	10.786
	(3.42)***	(3.38)***	(3.39)***	(3.41)***	(3.36)***
Soil fertility	−6.041	−4.602	−4.594	−6.089	−4.713
	(3.88)	(3.85)	(3.86)	(3.88)	(3.83)
Agricultural machinery	−15.304	−14.834	−14.800	−15.519	−14.788
	(2.39)***	(2.36)***	(2.37)***	(2.39)***	(2.37)***
Animal husbandry	−9.306	−6.861	−6.397	−9.475	−7.104
	(2.06)***	(2.14)***	(2.14)***	(2.06)***	(2.15)***
Agricultural economics	−11.401	−12.126	−11.916	−11.656	−12.285
	(2.99)***	(2.95)***	(2.97)***	(2.98)***	(2.94)***
Others	−10.749	−10.564	−10.342	−10.820	−10.546
	(2.80)***	(2.77)***	(2.77)***	(2.80)***	(2.78)***
Work specialization not matches training (yes = 0)	−3.242	−2.869	−2.802	−3.574	−3.170
	(1.71)*	(1.70)*	(1.70)*	(1.71)**	(1.70)*
Years of employment	0.190	0.200	0.218	0.205	0.204
	(0.13)	(0.13)	(0.13)*	(0.13)	(0.13)
Female (male = 0)	−6.488	−6.305	−6.418	−6.210	−6.007
	(1.79)***	(1.77)***	(1.78)***	(1.79)***	(1.76)***
Age	−0.044	−0.040	−0.057	−0.039	−0.033
	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)
Regional dummy (North = 0): south	11.041	13.656	14.153	11.262	13.793
	(1.52)***	(1.65)***	(1.63)***	(1.52)***	(1.65)***
Constant	22.516	23.314	23.387	21.813	22.521
	(4.37)***	(4.34)***	(4.34)***	(4.37)***	(4.33)***
Observations	1245	1245	1245	1245	1245
Standard errors in parentheses					

* significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix Table 2
Tobit estimation of the agent time allocation model with per capita financial income (2002).

Dependent variable: % days spent providing AES	(1)	(2)	(3)
Standard deviations in parentheses			
Government investment			
Per capita financial income 2002 (1000 RMB/person)	0.258	0.136	0.188
	(0.11)**	(0.11)	(0.12)
Per capita financial income 2002 X partially funded			−1.108
			(0.38)***
Per capita financial income 2002 X self funded			0.746
			(0.45)
Institutional structure and reform			
Nature of government funding (fully funded = 0)			
Partially funded		−6.191	1.745
		(2.03)***	(3.51)
Self funded		−11.036	−16.771
		(2.50)***	(4.46)***

Appendix Table 2 (*continued*)

Dependent variable: % days spent providing AES	(1)	(2)	(3)
Standard deviations in parentheses			
Institutional structure and reform			
Administrative level (county-level = 0)			
Township-level	−4.013	−2.592	−3.145
	(1.66)**	(1.68)	(1.68)*
Agent personal characteristics			
Position (no managerial position = 0)			
ESC leader	1.772	0.747	0.878
	(2.93)	(2.92)	(2.91)
Station leader	3.735	3.757	3.591
	(1.59)**	(1.58)**	(1.58)**
Employment status (Junior and other = 0)			
Senior staff	6.231	5.768	5.144
	(3.20)*	(3.18)*	(3.17)
Mid-level staff	2.690	2.519	2.290
	(1.73)	(1.72)	(1.71)
Education (secondary specialized school and below = 0)			
BS and above	5.046	3.379	3.898
	(2.35)**	(2.36)	(2.36)*
2 or 3 years technical college	4.702	3.766	3.841
	(1.71)***	(1.71)**	(1.70)**
Working specialization (crop management = 0)			
Plant protection	−0.972	−0.194	−0.598
	(2.91)	(2.89)	(2.88)
Horticulture	9.487	10.229	9.713
	(3.44)***	(3.42)***	(3.41)***
Soil fertility	−6.364	−4.918	−5.385
	(3.88)	(3.86)	(3.85)
Agricultural machinery	−15.913	−15.187	−15.183
	(2.40)***	(2.39)***	(2.38)***
Animal husbandry	−9.343	−6.599	−6.082
	(2.06)***	(2.14)***	(2.14)***
Agricultural economics	−11.834	−12.144	−12.093
	(2.99)***	(2.97)***	(2.95)***
Others	−11.418	−10.862	−11.232
	(2.81)***	(2.80)***	(2.79)***
Work specialization not matches training (yes = 0)	−3.241	−2.849	−2.763
	(1.70)*	(1.70)*	(1.69)
Years of employment	0.187	0.212	0.228
	(0.13)	(0.13)*	(0.13)*
Female (male = 0)	−6.662	−6.486	−6.727
	(1.79)***	(1.78)***	(1.77)***
Age	−0.043	−0.052	−0.046
	(0.13)	(0.13)	(0.13)
Regional dummy (North = 0): south	10.362	13.513	13.620
	(1.55)***	(1.71)***	(1.74)***
Constant	21.214	22.529	21.870
	(4.41)***	(4.39)***	(4.41)***
Observations	1245	1245	1245
Standard errors in parentheses			

* significant at 10%; ** significant at 5%; *** significant at 1%.

Appendix Table 3
Tobit estimation of the agent time allocation model with per capita financial income (2002) and province dummies.

Dependent variable: % days spent providing AES	(1)	(2)	(3)
Standard deviations in parentheses			
Government investment			
Per capita financial income 2002 (1000 RMB/person)	0.486	0.455	0.514
	(0.18)***	(0.18)**	(0.19)***
Per capita financial income 2002 X partially funded			−1.060
			(0.37)***
Per capita financial income 2002 X self funded			0.512
			(0.45)

(*continued on next page*)

Appendix Table 3 (*continued*)

Dependent variable: % days spent providing AES	(1)	(2)	(3)
Standard deviations in parentheses			
Institutional structure and reform			
Nature of government funding (fully funded = 0)			
Partially funded		−7.164	0.557
		(2.08)***	(3.51)
Self funded		−13.488	−17.291
		(2.59)***	(4.50)***
Administrative level (county-level = 0)			
Township-level	−3.624	−2.147	−2.651
	(1.64)**	(1.65)	(1.65)
Agent personal characteristics			
Position (no managerial position = 0)			
ESC leader	3.702	2.624	2.730
	(2.89)	(2.87)	(2.86)
Station leader	3.247	3.067	2.960
	(1.57)**	(1.56)**	(1.55)*
Employment status (Junior and other = 0)			
Senior staff	4.943	4.186	3.680
	(3.17)	(3.14)	(3.13)
Mid-level staff	2.783	2.594	2.436
	(1.73)	(1.71)	(1.70)
Education (secondary specialized school and below = 0)			
BS and above	5.801	4.167	4.691
	(2.31)**	(2.31)*	(2.31)**
2 or 3 years technical college	5.384	4.319	4.408
	(1.68)***	(1.67)***	(1.67)***
Working specialization (crop management = 0)			
Plant protection	−0.658	0.287	−0.144
	(2.86)	(2.84)	(2.83)
Horticulture	6.831	7.812	7.346
	(3.40)**	(3.40)**	(3.36)**
Soil fertility	−7.007	−5.504	−5.973
	(3.81)*	(3.78)	(3.77)
Agricultural machinery	−16.265	−15.112	−15.107
	(2.36)***	(2.35)***	(2.34)***
Animal husbandry	−10.618	−7.142	−6.681
	(2.03)***	(2.12)***	(2.12)***
Agricultural economics	−11.698	−11.919	−11.904
	(2.93)***	(2.90)***	(2.89)***
Others	−10.896	−10.204	−10.551
	(2.76)***	(2.74)***	(2.73)***
Work specialization not matches training (yes = 0)	−4.087	−3.797	−3.726
	(1.68)**	(1.67)**	(1.66)**
Years of employment	0.224	0.243	0.256
	(0.12)*	(0.12)**	(0.12)**
Female (male = 0)	−7.101	−7.132	−7.300
	(1.76)***	(1.75)***	(1.74)***
Age	−0.064	−0.064	−0.059
	(0.13)	(0.12)	(0.12)
Province dummy (Hebei province = 0)			
Heilongjiang province	−10.669	−11.586	−11.242
	(2.66)***	(2.65)***	(2.64)***
Zhejiang province	−2.347	−3.148	−2.683
	(3.62)	(3.59)	(3.63)
Hubei province	5.132	10.287	10.457
	(2.76)*	(2.96)***	(2.96)***
Guangdong province	6.538	10.198	10.640
	(3.18)**	(3.25)***	(3.24)***
Sichuan province	10.292	11.763	11.755
	(2.80)***	(2.81)***	(2.80)***
Gansu province	0.349	−1.453	−1.105
	(2.82)	(2.82)	(2.82)
Constant	24.583	26.052	25.105

* significant at 10%; ** significant at 5%; *** significant at 1%.

References

Anderson, J. R., & Feder, G. (2004). Agricultural extension: good intentions and hard realities. *World Bank Research Observer*, *19*, 41—60.

Hu, R., & Huang, J. (2001). Agricultural technology extension investment and its impact in China. *Strategy and Management*, *3*, 25—31.

Hu, R., Huang, J., & Li, L. (2004). *Zhong Guo Nong Ji Tui Guang: Xian Zhuang, Wen Ti Ji Jie Jue Dui CeGuan Li Shi Jie*, *vol. 5*. (pp. 50—57).

Huang, J., Hu, R., Zhang, L., & Rozelle, S. (2000). Zhong Guo Nong Ye Ke Yan Tou Zi Jing Ji. *Beijing, China: Zhong Guo Nong Ye Chu Ban She* (pp. 169—203).

Huang, J., Qiao, F., Zhang, L., & Rozelle, S. (2001). Farm pesticides, rice production, and human health in China. *Research Report 2001-RR3: International Development Research Centre (IDRC)* (pp. 49—52).

Kremer, M., & Miguel, E. (2007). The illusion of sustainability. *Quarterly Journal of Economics*, *112*(3), 1007—1065.

Lu, M. (1999). Zhong Guo Nong Ye Ke Xue Ji Shu 50 Nian. *Beijing, China: Zhong Guo Nong Ye Chu Ban She* (pp. 206—216).

Meuwissen, L. E. (2002). Problems of cost recovery implementation in district health care: A case study from Niger. *Health Policy and Planning*, *17*, 304—313.

Morduch, J. (1999). The microfinance promise. *Journal of Economic Literature*, *37*, 1569—1614.

Qiao, F., Zhang, L., & Hu, R. (1999). *Nong Ye Ji Shu Tui Guang Ren Yuan De Tui Guang Xing Wei Fen XiNong Ye Ji Shu Jing Ji*, *vol. 3*. (pp. 12—15).

Shi, X., Hu, R., & Erika, M. (2003). *Cai Yong Can Yu Shi Fang Fa Yan Jiu Nong Min Guan Zhu De Wen TiNong Ye Jing Ji Wen Ti*, *vol. 11*. (pp. 54—57).

Sun, Z. (1993). NongYe Ke Ji Cheng Guo Tui Guang Yan Jiu. *Zhong Guo Ke Xue Ji Shu Chu Ban She. Beijing* (pp. 39—41).

Wang, W. (1994). *Shi Jie Nong Ye Tui Guang Zhi Yan Jiu, Beijing, China: Zhong Guo Nong Ye Ke Ji Chu Ban She* (pp. 41—78).

World Bank (2007). *World Development Report 2008: Agriculture for Development.* Washington, D.C. (USA): World Bank xiii.

Zang, C. (1989). Zhong Guo Nong Ye Ke Ji Gong Zuo Si Shi Nian, 1949–1989. *Beijing, China: Zhong Guo Ke Xue Ji Shu Chu Ban She* (pp. 23—29).

Zhang, X. (2006). Fiscal decentralization and political centralization in China: Implications for growth and inequality. *Journal of Comparative Economics*, *34*(4), 713—726.