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On the Trail of China's Phantom Farmers

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Summary. — Many studies of China's economy use standard yearbook data for China's farm labor force. These data massively overestimate the number of Chinese farm workers. Our calculations show that the number of "phantom farmers" actually working outside agriculture may easily surpass 100 million. This paper reveals the implausible implications of the standard data, uses information from cost surveys to derive new estimates of China's farm work force, and investigates the implications of the new, lower series for agricultural employment on the measurement and interpretation of recent Chinese growth. © 1998 Elsevier Science Ltd. All rights reserved

1. INTRODUCTION

Development economists know that specifying the sectoral attachment of workers in low-income countries is a challenging task, especially in the rural sector. Alwyn Young finds that labor force surveys in Hong Kong, Korea, Taiwan, and Singapore "can, on occasion, be grossly inaccurate" (Young, 1995, p. 653). This study draws attention to parallel .problems with Chinese data. We argue that labor force statistics published by official agencies of the People's Republic of China massively exaggerate the number of farm workers. Our objectives are to highlight the inconsistencies associated with the standard data, to provide alternate figures that show the approximate magnitude of measurement error, and to trace the implications of new, lower estimates of farm labor force for the measurement and analysis of economic change in China.

Table 1 contains standard time series for China's farm labor force. These data appear prominently in economic research both within and outside China. Chinese economists use these data as a cornerstone for studies of labor force structure, input–output analysis, and productivity change (Chen and Zhang, 1986, p. 192; Chen *et al.*, 1992, pp. 166, 223; Li *et al.*, 1993, p. 150). Economists writing for international journals use these figures to study China's agricultural growth (Fan, 1991; Lin, 1992; Carter and Zhang, 1994; Fan, 1997), productivity change (McMillan *et al.*, 1989; Stavis, 1991; Wen, 1993; Kalirajan *et al.*, 1996), and income distribution (Rozelle, 1996, p. 65). Ongoing discussions of rural surplus labor begin with the standard data on rural population and employment (Shi, 1990, pp. 65, 170–173). Efforts to project Chinese economic development over the next 15–20 years note the surplus or overhang of rural farm workers (Perkins, 1996; Cable, 1996).

These standard data, however, appear to be derived as residuals from information about population, labor force participation rates, and non-farm employment in rural areas.[1] We believe that, beginning in the early 1980s, the standard figures overstate actual farm employment by a large and growing amount. Our calculations indicate that the margin of error may exceed 100 million workers. These "phantom farmers" have

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moved from agriculture to other sectors, notably construction, transport, and trade, where their efforts remain unrecorded, leading to large underestimates of employment and output in these branches of China's economy.

The remainder of this paper lays out the argument supporting this proposition and pursues its implications. In Section 2, we describe several contradictions inherent in the standard figures. Section 3 develops our own estimate of agricultural employment. Section 4 examines the implications of our conclusion that published figures greatly exaggerate the size of China's farm labor force.

2. IMPLAUSIBLE IMPLICATIONS OF STANDARD CHINESE FIGURES FOR FARM LABOR FORCE

Careful examination of Table 1 reveals the implausibility of the standard data. The official figures in Table 1 indicate that the number of Chinese working in agriculture drifted upward throughout the 1980s and into the 1990s, with no sign of a downward trend until 1991. The figures show that the share of farm workers in the rural work force declined at a very slow pace, from a 1981 peak of 94% to 73% in 1994. The figures also show that the share of women in the farm labor force rose slowly, increasing from 47 to 52% over 1978–95. Each of these observations clashes with widely discussed changes in Chinese rural life.

(a) *The number of farm workers is falling, not rising*

Contrary to the trend shown in Table 1, there is abundant evidence of a substantial downward trend in the number of Chinese farmers. Many villagers have entered new employment in manufacturing, construction, trade, transport, and mining, particularly in coastal provinces. Numerous accounts point to large and growing flows of workers leaving farming, many of whom leave their villages to seek urban jobs (Lardy, 1985; Yu, 1989; Byrd and Gelb, 1990; Cohen, 1992). Chinese media portray these migrants as

Table 1. *China's agricultural labor force: official data (1000 people)*

Year	Rural social agricultural labor[a]	Agricultural sector employment[b]	Total rural social labor force[c]	Agricultural percentage share of rural social labor force[d]	Female percentage share of agricultural labor[e]
1978	284556	283180	306380	92.88	46.91
1979	291369[f]	286340	310250	93.91	——
1980	298084	291220	318359	93.63	46.33
1981	307146	297770	326720	94.01	——
1982	311857	308590	338670	92.08	——
1983	316451	311510	346898	91.22	46.57
1984	316850	308680	359676	88.09	47.00
1985	303515	311300	370651	81.89	48.42
1986	304679	312540	378898	80.41	48.63
1987	308700	316630	390004	79.15	48.93
1988	314557	322490	400667	78.51	49.27
1989	324410	332250	409388	79.24	49.06
1990	333364	341170	420095	79.35	49.78
1991	341863	349560	430925	79.33	49.82
1992	340370	347950	438016	77.71	50.33
1993	332582	339660	442557	75.15	51.04
1994	326903	333860	446541	73.21	51.55
1995	323345	330180	450418	71.79	51.99

[a]Most of these figures are from Table 11—2 of 1994 and 1995 *Yearbooks*. 1995 figures are from Table 11—4 of 1996 *Yearbook*. For 1981 and 1982, figures are from 1985 *Rural Yearbook*, p. 224.
[b]Most of these figures are from Table 4—3 of 1994 and 1995 *Yearbooks*. 1996 figures are from Table 4—5 of 1996 *Yearbook*.
[c]Most of these figures are from Table 11—1 of 1994 and 1995 *Yearbooks* or Table 11—2 of 1996 *Yearbook*. Figure from 1979 is from Table 4—1 of 1992 *Yearbook*, p. 97. For 1981 and 1982, figures are from 1985 *Rural Yearbook*, p. 224.
[d][Column 1 Column 3] *100.
[e]From Table 5.
[f]Interpolated.

the source of difficult social problems. Chinese researchers express concern over the "human tide" (*mingong chao*) of migrants (Wang, 1994, pp. 32–33) or propose alternatives to the current pattern of labor migration (Chen, 1992, pp. 52–55).

If some people leave the land while others return, we could observe large gross outflows of workers without an actual decline in the farm work force. But this is not the case in China. Sample data collected by the Rural Survey Team of China's State Statistics Bureau show that 8.6% of farm workers moved to non-farm occupations in 1993, while 1.7% returned to agriculture, giving a net departure rate from farm work of 6.9% a sharp increase from the 3.1% figure recorded for 1992 (Chen, 1994, p. 22). These survey data imply a cumulative two-year decline of 9.3% in the farm labor force; the aggregate data in Table 1 decline by less than 4% during 1992–94.

Comprehensive evidence of farm workers' departure from the land comes from Table 2, which shows a striking drop in labor requirements per mu[2] of land for a broad array of agricultural operations. The decline in labor intensity is most rapid during the early 1980s, when "labour utilization plummeted" after the dismantling of collectives gave farm households "a greater incentive to economize on input use," leading them to squeeze surplus labor from farm work (Taylor, 1988, p. 749). Since there is ample evidence that cultivated and sown acreage, while understated in official statistics (Crook, 1992, pp. 27–32; Crook and Colby, 1996, p. 11; Paarlberg, 1997; World Bank, 1997), have declined slowly throughout the reform period,[3] only extreme shifts toward horticulture, tobacco, and other highly labor-intensive activities could prevent overall farm labor use from experiencing a considerable decline.

There is no evidence of such extreme restructuring. The 1993 share of food grains in sown acreage was 74.8%, down only slightly from 80.3% in 1978 (Yearbook, 1994, p. 342). Furthermore, there is corroborating evidence of a decline in farm labor: research by Chinese economists, summarized in Table 3, confirms a sharp downward trend in labor input per mu of cultivated or sown area during the 1980s. The implication that farm employment has fallen, and by a large amount, seems inescapable.

(b) *Large, not small reduction in the share of farm work in rural employment*

Many sources tell us that the allocation of labor within Chinese villages has shifted rapidly, with the relative importance of farm work in decline. A recent press account based on interviews with Chinese researchers concludes that "in most of the coastal regions, over 60 percent of [presumably rural] people do not work on the

Table 2. *Average labor input per mu selected crops and years (labor days)*[a]

Crop	1979	1984	1991	1993
Corn	25.4	16.7	13.8	15.27
Cotton	53.9	40.9	38.4	41.37
Fish Aquaculture	72.2	45.6	35.3	——
Millet	16.8	12.54[b]	——	——
Peanuts	30	25.6	20.4	21.12
Pork[a]	24.3	20.92[b]	16.2	——
Rapeseed	28.1	21.4	15.9	17.27
Rice	33.7 – Early 38.0 – Middle 28.9 – Late	21.2	18.2	19.19
Silk Cocoons	98.5	86.99[b]	22.8[c]	96.03
Sorghum	19.4	13.47[b]	——	12.71
Soybeans	17.1	10.1	8	11.18
Sugarcane	59.7	49.8	40.4	39.78
Tea	41.0	52.66[b]	39.8	49.13
Tobacco	75.2	48.28[b]	——	45.04
Wheat	24.3	14.8	12.3	13.0

[a]1979 Figures were obtained from Agricultural Technology (1983). Unless otherwise specified, 1984 and 1991 figures were obtained from 1986 and 1992 *Agricultural Yearbooks*.
[b]Figure is for 1986 and obtained from Cost Handbook (1986).
[c]Labor input per animal.
[d]22.8 is figure reported, but probably does not include same range of activity as for other years.

Table 3. *Average labor input per mu of sown area, 1980–88*[a]

Year	Average man years per *mu* (unadjusted)	Average man years per *mu* (adjusted)
1980	0.0995	0.1194
1981	0.0952	0.1143
1982	0.0850	0.1020
1983	0.0710	0.0852
1984	0.0648	0.0777
1985	0.0584	0.0701
1986	0.0566	0.0680
1987	0.0558	0.0670
1988	0.0557	0.0668

Shi (1990), p. 62.
[a]Adjustments were based upon "expert opinion."

land" (Xi, 1996, p. 4). But, the standard statistical sources on rural workers in China's coastal provinces show nothing of the sort. In Fujian, yearbook data show the share of agriculture in rural labor use declining during 1985–93, but only from 80.5 to 71.7% (Crook, 1995, p. 6). Table 4 presents 1993 data on the share of farm workers in the rural work force for several other coastal provinces. Outside of the cities of Tianjin and Shanghai, the figures are implausibly high, ranging from 58% in Jiangsu and Zhejiang to over 70% of rural workers reportedly employed in farming for Hebei and Fujian.

(c) *Feminization of farm work*

Farm work in China is increasingly the province of Chinese women. The *Wall Street Journal* reports that women "account for 70% of the rural labor force" (March 10 1994, A12). Chinese press accounts routinely mention the "burden on rural women," who "now have to undertake much of the heavy field work as well as doing almost all the housework" (*China Daily* October 27 1995, p. 4). Researchers find that "nationally, 2/5 of the prime village labor force has already entered non-farm occupations, leaving village women to shoulder 60–80% of the burden of farm work" (Peng and Xueli, 1996, p. 12). Field workers in Shandong province write of a "new gender division of labor" in which "women have assumed greater responsibility for farming" (Huang, Falk and Chen, 1996, p. 377).

Standard data, summarized in Table 5, show an increasing share of women in the farm work force, but once again, the statistical trend lags far behind the changes noted by informed observers. This deficiency can be documented in specific cases. During 1986–87, Cohen observed that most working age males were absent from villages in Xincheng county, Hebei, except at

Table 4. *Percentage share of rural labor in agriculture — China's coastal provinces: yearbook data 1985 and 1993*

Province	1985			1993		
	Total rural labor force	Agricultural labor force	Agricultural percentage share	Total rural labor force	Agricultural labor force	Agricultural percentage share
	(1000 persons)			(1000 persons)		
Shanghai	2685	1110	41.3	2350	630	26.8
Guangdong	22543	17425	77.3	24574	14648	59.6
Fujian	8642	6928	80.2	11313	8076	71.3
Zhejiang	18638	12618	67.7	21056	12392	58.9
Jiangsu	25993	17041	65.6	27893	16259	58.3
Shandong	30103	23656	78.6	35690	25970	72.8
Tianjin	1779	952	53.5	1743	865	49.6
Hebei	20598	16390	79.6	25118	18427	73.4
Liaoning	8197	5889	71.8	8533	5952	69.8

Source: 1985 Figures are from *Agricultural Yearbook* (1986). 1993 Figures are from *Yearbook* (1994).

Table 5. Percentage share of female labor in agriculture based on yearbook figures for selected years, 1978–93 (1000 persons)[a]

Year	Rural social labor force			Non-agricultural employment	Projected female non-agricultural employment	Rural social agricultural labor		
		Female	Percent female				Projected female	Percent female
1978	306380	140896	45.99	22433	7403	284556	133493	46.91
1980	318359	144562	45.41	19566	6457	298084	138105	46.33
1983	346898	157433	45.38	30447	10048	316451	147386	46.57
1984	359676	163043	45.33	42826	14133	316850	148910	47.00
1985	370651	169119	45.63	67136	22155	303515	146964	48.42
1986	379898	172974	45.53	75219	24822	304679	148152	48.63
1987	390004	177879	45.61	81304	26830	308700	151049	48.93
1988	400667	183390	45.77	86110	28416	314557	154974	49.27
1989	409388	187205	45.73	84983	28044	324410	159161	49.06
1990	420095	194577	46.32	86731	28621	333364	165956	49.78
1991	430925	199706	46.34	89062	29390	341863	170316	49.82
1992	438016	203517	46.46	97646	32223	340370	171294	50.33
1993	442557	206026	46.55	109976	36292	332582	169734	51.04
1994	446541	208001	46.58	119638	39481	326903	168521	51.55
1995	450418	210044	46.63	127074	41934	323345	168110	51.99

[a]1978 and 1980 figures are from Rural Yearbook (1985), p. 224. 1995 figures are from Tables 11—3 and 11—4 of 1996 *Yearbook*. Other figures are from Tables 11—1 and 11—2 of 1994 and 1995 *Yearbooks*. Projected female labor figures are based on Ho (1995), p.280, who places female employment in township and village enterprises at 32.4% in 1988 and 33.9% in 1993 (we use 0.33). Because some rural non—farm employment may use a smaller percentage of female labor, the projected female share of agricultural labor force may be slightly understated.

New Year and during the peak farming season. Published data for the same county, however, indicate that males comprised 55.8% of the agricultural population (*nongye renkou*) in 1984 and 51.9% of the village labor force (*xiangcun laodongli*) in 1990.[4]

We conclude that the standard data in Table 1 are suspect for a variety of reasons, and proceed to derive an alternate measure of Chinese farm employment during the reform period.

3. LABOR INPUT INTO CHINESE AGRICULTURE: NEW ESTIMATES

Our objective is to construct a time series of labor input into Chinese farming, by which we mean crop production, animal husbandry, horticulture, and fresh water aquaculture. We omit forestry, fisheries, and salt-water aquaculture, which are included in the standard Chinese figures.

Given the availability of information by crop, province, and year for labor requirements per crop-*mu* and for sown acreage, we could calculate labor requirements by simply multiplying these coefficients and summing over crops and provinces, using the formula given in equation (1).

$$L_t = \sum_i \sum_j m_{ijt} a_{ijt} \tag{1}$$

where L is the labor force in farming, m is the number of man days per crop-*mu*, a is the acreage devoted to a particular crop, i is an index that spans crops or activities, j is an index that spans China's provinces and t is an index of time.

The Chinese analyst Shi (1990) uses this method in his study of rural surplus labor (pp. 61–62). The difficulty with this approach is that, as noted above, China's acreage statistics understate actual figures, possibly by substantial amounts. If the acreage figures are too low, the labor inputs derived from equation (1) would also be too low. Since our objective is to show that the labor inputs are low and declining, we avoid data that harbor errors which add momentum to our argument. Second, animal husbandry is not acreage dependent, and with large increases in livestock production, we do not want to overlook the possibility of a simple labor reallocation between different farm activities.Instead, we choose an alternate calculation, summarized in equation (2), which avoids direct reliance on the dubious acreage data.

$$L_t = \sum_i \sum_j \frac{m_{ijt}}{y_{ijt}} Q_{ijt} \tag{2}$$

where m is the number of standard man days per mu or animal, y is the physical output per sown mu or animal, Q is the national (or provincial) output in physical units and i, j, and t are defined as before.

Using production cost data for 22 farm, horticultural, and animal husbandry activities,[5] we calculate China's farm labor requirements using both provincial and national figures. Since reconstruction of the labor requirements using either national or provincial data produces substantially identical results,[6] we conclude that our calculation is not sensitive to changes in the level of aggregation and focus on results derived from national totals for output, yield, and labor requirements for each crop. Details of calculations, including methods used to bridge data gaps, are contained in the Appendix A. We convert work days to man-years using alternative coefficients of 269 and 300 work-days per man-year.[7] The results of our reconstruction appear in Table 6. In Table 7, we find close (within 10%) agreement between our findings and the outcome of similar calculations by two groups of Chinese researchers, each led by input–output specialist Chen Xikang. This consistency between estimates should enhance confidence in the plausibility of the new series.

Table 6. *New estimates of agricultural labor input using national aggregates selected years, 1979–91 (1000's)*

Year	Calculated agricultural labor days [2]	Calculated agricultural labor years [3]		Agricultural labor (yearbook data) [4]	Overcount of farm workers (column 4–Column 3)	
		300 days/yr	269 days/yr		300 days/yr	269 days/year
1979	85051665	283506	316177	291369	7863	(24808)
1982	70135837	233786	260728	311857	78071	51129
1984	66492419	221641	247183	316850	95209	69667
1986	63157932	210526	234788	304679	94153	69891
1987	61772770	205909	229639	308700	102791	79061
1988	58493062	194977	217446	314557	119580	97111
1989	59577207	198591	221477	324410	125819	102933
1990	66000775	220003	245356	333364	113361	88008
1991	62557596	208592	232630	341863	133271	109233
1993	70074448	233581	260500	332582	99001	72082

[a] Data in Column [4] are *Yearbook* figures for rural social agricultural labor from Column 1 of Table 1.

Table 7. *Comparisons of computed farm labor requirements*

Year	Current study	Chen Xikang et al.[a]		Chen Xikang et al.[b]	
	Labor days (billion)	Labor days (billion)	Index (current study = 1)	Labor days (billion)	Index (current study = 1)
1977	—	88.863	—	—	—
1978	85.052	92.081	1.08	—	—
1979	—	91.092	—	—	—
1980	—	90.234	—	—	—
1981	—	81.152	—	—	—
1982	70.136	74.154	1.06	—	—
1983	—	67.358	—	—	—
1984	66.492	67.699	1.02	—	—
1985	—	66.059	—	—	—
1986	63.158	64.558	1.02	—	—
1987	61.773	61.335	0.99	62.73	1.02
1988	58.493	62.508	1.07	—	—

[a]Chen *et al.* (1992), p. 258.
[b]Chen *et al.* (1991), p. 357.

As expected, we find a conspicuous downward trend in China's farm labor requirements, which drop by 31% during 1979–88. Farm labor input declines steadily over 1979–88, increases during 1988–90 when a sharp cutback in the growth of rural industry stimulates a reverse migration of dismissed factory workers back to the villages, and declines again during 1990–91. During 1991–93, our calculation produces an unexpected increase in estimated farm labor use even though survey data noted above indicate a net departure rate of 6.9% for farm labor in the same year.

The contrast between the downward trend of agricultural labor input based on the new series, which is built upon data for output, crop yields, and unit labor inputs, and the standard figures is unmistakable. We show the difference numerically in Table 6 and graphically in Figure 1. There is a large and growing gap between the reconstructed labor force total and the much larger figures taken from standard statistical sources. Expressed in terms of man-equivalents (269 days/year), this gap grows to over 100 million in 1991; if we convert at 300 days/year, the gap is even larger.

These are China's phantom farmers, men and women who are recorded as working in the farm sector, but are actually engaged in other activities. Even when viewed against the backdrop of the world's largest labor force, a measurement error that mistakenly assigns over 100 million workers, or nearly one-third of the reported total, to the farm sector is startling. What are the consequences of this huge error? Where have China's phantom farmers gone?

4. ON THE TRAIL OF CHINA'S PHANTOM FARMERS

Our discussion began with the notion that sectoral attachment of rural labor is difficult to measure. From this perspective, the discovery of systematic errors in what appear to be residual

Figure 1. *China farm labor index (selected years, 1979–91).* [a]Present study series is the new estimate of agricultural labor input reported in Table 6; [b]standard series 1 is the Rural Social Agricultural Labor Series in Table 1; [c]standard series 2 is the Agricultural Sector Employment series in Table 1.

estimates of Chinese farm labor requirements is not entirely unexpected, nor, as the Chen Xikang calculations indicate, are we the first to discover a decline in China's farm labor force. No one, however, has considered the far-reaching implications of discarding the yearbook data on farm labor. We examine the impact of switching to the more plausible farm labor data shown in Table 6 and Figure 1 from two perspectives: the consequences of mistakenly assigning workers to farming; and the impact of the actual, non-farm activities of these misclassified workers on China's economy.

(a) *Downsizing China's farm labor force statistics*

Correcting errors in farm labor force data will change our reading of broad descriptive trends in Chinese agriculture. Even though cultivated acreage has declined, farm labor has fallen more rapidly, so that the supply of farmland per farm worker, which the yearbook figures show as declining during the reform period, has actually risen quite substantially. Trends in the availability of farm capital per worker require similar reevaluation.

Studies of rural productivity based on the yearbook figures require careful reinterpretation. In some cases, application of the new figures will strengthen previous conclusions. For McMillan, Whalley and Zhu (1989), who attribute much of the farm output spurt of the early reform period to an increase in effort, substitution of our revised labor data would reduce labor input and reinforce their conclusion by increasing the estimated contribution of effort to higher output. Elsewhere, the new figures might weaken or even reverse widely accepted results. For example, the standard periodization of China's recent agricultural development is based on work by Justin Y. Lin (1992) and more recent studies of farm productivity (Wen, 1993; Kalirajan, Obwona and Zhao, 1996) which posit a spurt during 1978–84 in output per worker and in total factor productivity, followed by slowdown or even decline. This picture might not survive a large revision in the labor data.

Studies of income distribution, particularly work focusing on urban–rural disparities and gaps between income growth in different regions, may also be sensitive to errors in the measurement of rural population and work force. Rozelle (1996), for example, finds "a fairly consistent picture of the patterns of income growth in China's post-reform rural economy" pointing to "rising disparities among households and regions" (p. 87). But with large numbers of unrecorded departures from farming communities, with close to 40% of these migrants moving into urban areas[8] and with the rate of outmigration undergoing "conspicuous acceleration" in China's western provinces, it seems imperative to subject such conclusions, which are derived in part from uncritical application of yearbook data on rural population, to careful sensitivity analysis.

Chinese discussions of rural policy consistently begin with the assumption of a large and growing rural workforce. Our findings indicate that concern about finding alternative employment for surplus farm workers is at least partly misplaced. A declining farm work force means that tens of millions of migrants have already obtained non-farm employment even as urban policy elites fret about disguised unemployment in the countryside.

Uncoordinated market activity may also begin to reduce the prevalence of fragmented land holdings, another issue of concern within Chinese policy circles. With the number of farm workers declining, with cultivated acreage per actual farm worker increasing, and with adult men absent from many farm households for much of the year, there is an obvious incentive for voluntary transfer of land use rights to households that choose to specialize in production of farm crops. This process has already begun in some localities where land "is concentrated in the hands of a small number of specialized grain-planting households," some of which cultivate plots of over 100 *mu* (i.e. six hectares) with hired labor (Zhao, 1996, p. 16). Market forces may push farmers to exploit opportunities for scale economies with little or no official intervention.

(b) *Where have the phantom farmers gone?*

If tens of millions of persons classified as farm workers have in reality abandoned farming, what are they doing? Suggestions that the government should "establish statistical indicators for villagers working in cities" (Cao, 1996) confirm that the work lives of informal migrants from farming are omitted from standard quantitative materials. Careful enumeration of employment and monitoring of wage bills in mining, manufacturing, and the organized segments of the transport, trade, and construction sectors make it very improbable that large numbers of unrecorded workers are concealed within these branches of China's economy. Where, then, can we find large numbers of unrecorded workers? We suggest three possibilities.

(i) *Construction*

We focus on the cyclical trough year of 1989, when falling profits and large numbers of bankruptcies in rural industry must have sharply reduced the pace of capital formation outside the cities. In that year, national figures show that construction enterprises in the township–village sector employed 7.69 million workers and obtained total receipts of ¥47.09 billion, implying sales per worker of ¥6126. Even if we apply this productivity figure to the far larger employment total of 14.037 million shown for township–village construction enterprises in the rural enterprise yearbook, neither the implied sales total of ¥86 billion nor the published figure of ¥91 billion (of which ¥11 billion is attributable to operations in 13 large cities) begins to account for the overall volume of building activity in rural China, which in 1989 included an estimated ¥79 billion worth of structures built by private individuals as well as ¥25 billion in fixed capital formation by enterprises at the village and township (*xiangcun*) levels.[9] Even in a recession year, it is clear that millions, perhaps tens of millions of unrecorded workers participated in rural construction as well as urban demolition work and unorganized segments of the urban building sector that employ rural migrants.

(ii) *Transport*

Any observer of China's economic scene recognizes increased circulation of people, goods, and information as a vital driving force in the recent growth spurt. Yet this reality is not reflected in available statistics. A World Bank (1994) study (p. 3) implausibly identifies domestic trade as a lagging sector of China's economy. Published statistics point to the same conclusion for transport. Taking the reported growth of real GDP during 1986–95 as 100, growth of freight volume (65.4) and turnover (75.0) as well as passenger volume (81.6) all lag far behind the expansion of real output (Yearbook, 1995, p. 32; Outline, 1996, pp. 8, 93–95).

These data are rife with inconsistencies. The State Statistics Bureau (SSB), contradicting subsequent yearbook figures, reports declines in freight and passenger traffic for part of 1993 and all of 1994 and 1995 (Qu, 1993; Xiao, 1995; Tong, 1996). On the same newspaper page that describes China's road network as "roaring ahead," the SSB announces that "road freight dropped 8.3% over the previous year" (Tong, 1996; Shen, 1996). While the Ministry of Communication "has suspended approval of new shipping companies to slow uncontrolled growth in waterway transportation," the SSB reports that "water freight slipped 1.5 percent" (China Daily, 1996; Tong, 1996). China's statistical system has lost track of transport growth. We speculate that substantial unrecorded and "uncontrolled" growth has occurred, that China's national income accounts grossly understate the level and growth of transport activity, and that migrants from the farm sector are responsible for much of the unrecorded activity.

(iii) *Trade*

China's 1992 census of the service sector provides an opportunity to trace the activity of unenumerated workers with considerable precision. We focus on the example of retail sales of food, drink and tobacco. The census, which was intended to provide a comprehensive enumeration, lists 1992 employment of 2.877 million for retail sales of food, drink, and tobacco and 2.072 million for food establishments. The figures include both permanent employees (*zhigong*) and workers (*congye*) without the tenure connotation attached to the term *zhigong*. These figures are suspiciously low — China's railways were found to employ 2.26 million — more than all the restaurants and food stalls in the country! The census also gives 1992 sales revenue for service establishments: the combined total for food establishments and retail sales of food, drink, and tobacco is ¥59.9 billion (Census, 1995, pp. 7, 34).

Budget studies for urban and rural residents demonstrate the total inadequacy of these figures. In 1992, the average urban resident spent ¥883.6 on purchases of food; for rural residents, average cash outlay on food was ¥170.8. Assuming 324 million urbanites and 848 million rural residents, we can derive total 1992 spending on food, drink, and tobacco at ¥431 billion, or 7.2 times the revenues shown in the 1992 census.[10] Where the census found five million workers in food establishments and retail outlets selling food, drink, and tobacco, we expect to find roughly 35 million at work, with ex-farmers dominating the ranks of unenumerated retail workers. Here again, we find a big deficiency in China's national income accounts.

5. SUMMARY AND CONCLUSIONS

Standard data for China's farm labor force form the starting point for a wide range of research and policy studies. These data, seemingly derived as residuals from data for rural population, participation rates, and organ-

ized non-farm employment, systematically overstate China's agricultural work force. The standard data conflict with widely accepted information about the departure of farmers from the land, the declining share of farm work on the rural labor scene, and the growing prominence of women in China's farm economy.

We use national and provincial information on labor requirements per crop-acre, output of agricultural commodities, and crop yields to construct alternative estimates of China's farm labor force during 1979–93. The new series for agricultural labor, summarized in Table 6, shows a generally falling trend. Moreover, this withdrawal of labor from farm work is a national trend that is not confined to China's coastal provinces. The difference between the yearbook figures and the new series provides a rough count of the people whom Chinese official data mistakenly classify as agricultural workers. Our calculations show that the number of these phantom farmers may exceed 100 million persons.

The conclusion that the transfer of farm labor into non-agricultural occupations has occurred on a much larger scale than is portrayed in official statistics is implicit in the work of Chinese specialists. These researchers, however, have not pursued the implications of a declining farm work force. What are these implications?

By exaggerating the size of the farm work force, current research consistently misconstrues trends in factor proportions, overstates the labor intensity of farming, and understates the growth (or exaggerates the decline) of single- and multi-factor productivity in Chinese agriculture. Policy studies concerned with income distribution, poverty alleviation, surplus labor, and the productive potential of Chinese agriculture build on the misinformation conveyed by standard yearbook estimates of China's farm population and work force. Replacing standard data with more realistic alternatives may alter the conclusions of many such studies.

Most observers continue to view Chinese farming as a classic case of "minifundia" based on the cultivation of tiny plots with surplus household labor. But, the proliferation of non-farm occupations and the resultant feminization of farming raises the possibility of an unexpected transition in which the objectives of growing numbers of rural households shift from raising farm yields toward maximizing labor productivity even at low levels of income per capita. With millions of farm households experiencing significant changes in their land–labor ratios and activity portfolios, both the incentive and the potential gain from expanding the market for rural land-use rights appear to be large.

If tens of millions have left the land, where are they working? We find inconsistencies in the national figures for construction, transport and trade — all of which can be explained by the presence of large numbers of unrecorded workers. We conclude that standard national income estimates understate the level and growth of output in these sectors (and perhaps others). The margin of understatement, especially in trade, appears large. The implied downward bias in measures of the level and growth of aggregate output may offset or overbalance the overstatement widely believed to exist in the industrial output totals (Woo *et al.*, 1994, pp. 419–421; Jefferson *et al.*, 1996, pp. 160–166).

Fluctuations in estimated farm employment since 1988 suggest that labor flows to and from informal markets for non-farm labor are related to broader patterns of long-term growth and short-run fluctuation in China's economy. The labor-market behavior of farm households contributes to an emerging national market that links supply and demand for urban as well as rural workers.

Finally, our results lead us to question the picture of slow non-farm employment creation conveyed by Chinese statistical publications. Standard sources show that annual growth of non-agricultural employment has fallen from more than 10 million during 1980–85 to less than one million in 1986–90 and only two million during 1991–95.[11] Inclusion of the productive efforts of unrecorded migrants from farming upsets these statistical findings and calls into question the notion that slow emergence of labor markets has retarded China's transition from plan to market.

NOTES

1. One author outlined the thesis of this paper to a group of officials from China's State Statistics Bureau. Although the audience did not confirm the derivation of farm labor force data as residuals, their effort to defend the yearbook figures ceased abruptly when confronted with the assertion that the standard data appear to be residuals.

2. One *mu*, the standard Chinese measure of crop area, is roughly equal to one sixth of an acre or 1/15 hectare.

3. Chen *et al.* (1991), p. 258, show a decrease of 3.6% in cultivated area and a decrease of 3% in sown area during 1977–88. Data from Yearbook (1994), p. 329 indicate a decrease of 4.3% in cultivated area over 1978–93. Sown acreage figures (Yearbook, 1994, p. 342) show a decrease of 4.3% over 1978– 85, but sown acreage figures steadily increase until 1992, so the decrease during 1978–93 is only 1.6%.3

4. Personal communication from Professor Cohen, supplemented by data from Hebei (1985), p. 581, and Hebei (1992), p. 655.

5. Crop and farm activities used are apple, chicken/poultry, citrus, corn, cotton, freshwater fish, milk, millet, peanut, pear, pork, poultry egg, rapeseed, rice, silk/silk cocoon, sorghum, soybean, sugar cane, sugar beet, tea leaf, tobacco, and wheat.

6. Calculations using provincial data for 1979–91 differ from the reconstructed national totals by less than 5% and often by less than 2%.

7. Chen *et al.* (1991) converts at 269 workdays per year (p. 141). The 300 day figure is from Yu (1992), p. 328) and Shi (1990), p. 61. Rawski (1979), p. 115 estimates a range of 215–284 work days per man-year for 1975.

8. Chen (1994), p. 23 notes that in 1993, 26.5% of those leaving agriculture moved to urban areas within their home provinces and 13.3% moved to cities in other provinces.

9. Data in this paragraph are from Yearbook (1990), p. 394; Rural Industry (1991), pp. 137, 138, 148, 180: and Investment (1991), p. 275.

10. Data are from Yearbook (1993), pp. 81, 288, and 317. We assume that expenditures on "food" (*shipin*) include beverages and tobacco. If not, the number of unenumerated workers becomes larger.

11. Labor, 1995 (1996, p. 18) and Outline (1996), p. 23). Both sources include small numbers of agricultural "workers and employees," principally employees of state-owned farms.

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APPENDIX

Data

Much of the national and provincial data on agricultural labor input and crop production were obtained from the *Agricultural Yearbooks* for the years 1980–91. These data are available in electronic form from the Economic Research Service (ERS) of the USDA. Other data not included in the ERS database come from a variety of sources. 1980–82 crop production figures are from the *Agricultural Yearbooks*. 1993 crop production figures are from the 1994 *Yearbook*.

1979 labor input data are from *Agricultural Technology* (1983) and 1982 labor input data is from the agricultural section of *Technology Handbook* (1986). Other labor input figures not collected or reported in the *Agricultural Yearbook* (various) during the 1980s come from the *Cost Handbook* (1988, 1989, 1991). For 1991, labor input and crop production figures come from the 1992 edition of the *Agricultural Yearbook*. 1993 labor input figures were only available at the national level and come from the 1995 *Rural Yearbook* (various).

Methodology

Computational equations

We have a choice between two methods in constructing our own farm labor profile. The simplest formula would be to derive labor input by summing the product of man-days per acre and total acres for each crop, as shown in equation (1). We discard this approach for two reasons. First, we wish to avoid biased acreage figures which are thought to be understated (Crook, 1992). If the acreage figures are too low, the derived labor inputs would be too low. Since our objective is to show that the labor inputs are low and declining, we avoid data with errors that add momentum to our argument. Second, animal husbandry is not acreage dependent, and with large increases in livestock production, we do not want to overlook the possibility of a simple labor reallocation between different farm activities.

Instead, we use cost of production and yield statistics for various farm activities to obtain our estimate. The formula shown in equation (2) is used to derive the results in Table 6.

For 1979–91, the reported values for m (man-days per crop *mu*) and y (physical output per sown *mu* or per animal) were obtained by rural survey teams. We are aware of no strong evidence of bias in their collection. Some of the provincial level sample sizes, however, are quite small and may not be truly representative. Nonetheless, both small and large provincial samples show the same general time trends. In some cases, the provincial data include physical output figures for a specific crop or activity but provide no corresponding data on labor requirements. As explained below, we use the larger of two possible national average figures to fill the resulting gaps in our labor statistics.

For 1993, the only available figures for m and y are the national aggregates reported in the 1995 *Rural Yearbook*, which provides no details about their origin.

Estimates of Q (national output in physical units) also present problems. By using cost of production and yield estimates for both crops and animal husbandry activities, we avoid missing a labor transfer from one agricultural activity to another. As noted in the text, Chinese acreage figures understate the actual amount of farmland in use. Field research by specialists at the US Department of Agriculture indicates that China's *State Statistical Bureau* takes this underreporting into account when estimating crop output. Crook's investigation of Chinese corn statistics finds that "the reported crop area is less than actual and the reported unit yields are higher than actual" (Crook, 1994, p. 44). Crook and other specialists believe that officially-reported production totals include adjustments for the bias resulting from underreporting of farmland (personal communication). We make use of equation (2) rather than equation (1) to avoid acreage figures that are known to contain a downward bias.

The superiority of equation (2) depends on the accuracy of unit yield figures obtained by Chinese survey teams. If the yields presented in Chinese statistical sources are actual survey results — what Crook (1994), p. 44, calls "concrete measured unit yield," our approach should escape the influence of unreported land. Since, with the exception of 1993, the yield data used in this study come from survey reports that present data for the number of households, *mu* of cultivated or sown area, and per *mu* costs and yields, we feel justified in assuming that these data measure actual yields obtained in the field with no upward adjustment to offset the existence of hidden land. If, however, the unit yields published in Chinese sources and used in our calculations are what Crook calls "forecast unit yield," which equals the measured yield times factors intended to adjust for under-reporting of land (and also local measurement variations), substitution of equation (2) for equation (1) may not suffice to avoid a downward bias in our estimation of farm labor requirements.

Computational procedures

We have provincial data on production costs for various farm activities in different years. For each activity, individual households were surveyed to obtain production costs which are then reported as provincial and national averages. The cost data include the labor input (measured in standard labor days per crop-*mu* or per animal) and the output (measured in kilograms per crop-*mu* or weight of product per animal). Using these figures, we divide labor by output to obtain the number of labor days necessary to produce a kilogram of each type of output.

Our sources show average production costs for various crops in each province. These figures are based on household surveys. The sources also give national cost average for various crops. In many cases, the national figures incorporate more households and more acreage than the combined total for all provinces. We cannot specify the location of these extra survey observations. In order to guard against the possibility that these extra data points might skew the reported national figures, we calculate alternate national cost figures that are simply the unweighted arithmetic average of all available provincial figures. These alternate figures make no adjustment for differences in the size of various provinces or in the number of households sampled in each province.

For some crops and years there are a number of missing values. Prior to 1984, our sources provide separate input figures for several types of rice. Since we also have output figures for the various types of rice, we calculate unit labor inputs for each type of rice but no single overall average labor figure in rice production for 1978–83. Beginning in 1984, we obtain a single overall figure for unit labor input in rice-growing with no separate coefficients for different types of rice.

Prior to 1984, cost data for silk, tea, pork, and fish are available only at the national level. For these years, the cost figures for tea, pork, and fish are broken down into several product categories, but the output figures are not. In these cases, we use the lowest figures for unit labor input (greatest labor productivity); this imparts a downward bias to estimated farm labor requirements in these early years, and tilts the data against our hypothesis of declining farm labor inputs.

For some provinces we have output figures but no survey cost or input data. For these provinces, we had a choice to use either of two national averages for the required input: reported national values or our alternate national average, which is the unweighted mean of the reported provincial values. In each case, we chose the larger of the two, representing the lower level of labor productivity, and in most cases, the provincial average value is selected. This method was also used for 1991 rice production in Jiangsu province, for which available data contain a typographical or computational error. The yields shown in the production cost figures are only one-tenth of historical levels and are far below yield figures for other provinces; however, the national yield and acreage figures in the 1992 *Agricultural Yearbook* indicate that Jiangsu rice yields were above the national average.

Choosing the larger labor coefficient biases the total labor force upward, but since both reported national and computed provincial averages tend to move together and the number of such adjustments is small, we do not expect these choices to affect or reverse the overall trend of our calculations.

For several farm activities, we are missing the production input and cost figures for certain years. For millet, sorghum, and tobacco, we filled data gaps for 1989–91 by applying the 1988 cost figures. Since labor input for most crops showed a declining trend, we expect this method will weigh against our hypothesis of declining labor. For other crops and animal husbandry activities, including apples, pears, and milk, our sources

provide no input data for the early years. We filled these data gaps by applying the earliest available cost figures. Finally, there are a number of instances, particularly for 1984, of missing values within the time series of input coefficients. When production input figures between two years are missing, we use the earlier and typically larger input coefficient to fill the data gap.

A few final comments apply to several specific farm activities and years. We find no output data for poultry or eggs in 1979 or for poultry in 1982. Consequently, the estimated farm labor requirements for 1979 and 1982 do not include workers in these activities and are underestimated accordingly. In addition, input cost figures for chicken and eggs are specific to chickens, but egg and poultry output figures include other fowl. Similarly, input figures after 1986 were provided for both tangerines and mandarin oranges, but output is simply reported as citrus production. In this case, tangerine input costs were used because they were available for more years. Finally, 1979 freshwater fish production figures do not distinguish between aquaculture and other fish harvesting, so the 1982 weighting where aquaculture accounts for 77% of total freshwater fish production is used to obtain an estimate of 1979 aquaculture production.

Results

After calculating the required labor input to produce a kilogram of output for each farm activity, we compute the annual farm labor requirement for each activity. The unit labor input coefficients for each province are multiplied by the provincial output (in 1000 metric tons) for each activity. The farm labor for each province is then summed to obtain a measure of national farm labor requirements for each activity. Totaling the national labor requirements for each activity then gives us an overall total of farm labor input. In addition to totaling provincial labor requirements, we also perform the calculations at the national level using national level unit labor input coefficients multiplied by the national output (also in 1000 metric tons) for each activity. Since both totals display the same overall trend, we report only the first set of figures, which require fewer arbitrary assumptions.