Can China Feed Itself during Its Drive Towards Becoming a Modern Industrial State?

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Transformation Path

Percent of Pop’n in Ag. Sector

Income per Capita
In 2000: 45% of rural labor force have jobs off the farm … more than 80% of households have at least 1 person working off the farm.

In 1980: only 4% worked full time off the farm.
Overall Increase in Off-farm Work

In 2000: 45% of rural labor force have jobs off the farm … more than 80% of households have at least 1 person working off the farm.

In 1980: only 4% worked full time off the farm.
## Percent of Workforce Off-farm, by Age Range

<table>
<thead>
<tr>
<th>Age Range</th>
<th>1990</th>
<th>2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-20</td>
<td>23.7</td>
<td>75.8</td>
</tr>
<tr>
<td>21-25</td>
<td>33.6</td>
<td>67.2</td>
</tr>
<tr>
<td>26-30</td>
<td>28.8</td>
<td>52.5</td>
</tr>
<tr>
<td>31-35</td>
<td>26.9</td>
<td>47.6</td>
</tr>
<tr>
<td>36-40</td>
<td>20.5</td>
<td>43.3</td>
</tr>
<tr>
<td>41-50</td>
<td>20.8</td>
<td>37.6</td>
</tr>
</tbody>
</table>
Comparison of Off-farm work, by age range

Workers Aged 16-20

Workers Aged 41-50

Specialize in off farm work
Migration-fastest growing segment

Percent of Total Workforce

Year


TVE/Local wage earning

Migrant Wage Earners

Self employed

local

migrant
Why is rural growth/transformation important?

Annual growth rate

Total Inputs TFP

Alwyn Young, QJE
Because in rapidly growing Asian economies, a healthy rural economy is a driver of growth!

This is the effect of taking a poor, underutilized young son/daughter of a farmer and moving him/her into a factory
Productivity Rise in Picture

From tending a plot of land smaller than most of our gardens …
... to jobs in the heart of China’s industrialization zone ...

These things are truly: “Made in China”
Since 1980 … China has clearly begun the path of transformation …

But, with still only about 30-40 percent of population in urban areas … if it is to continue to be successful in developing … it needs to necessarily continue to move along this rural-urban transformation path …
Necessary but not Sufficient

• Shifting labor to off farm sector / shifting population from rural to urban is necessary ... key is job creation in cities in industrial/service sectors
• But not sufficient ...
  – Need to make sure those who are left behind are taken care of ...
  – Need to make sure those who do not get jobs off the farm are being invested in ...
  – So: process can continue ...
  – And, so: there is stability ...
    ... and so there is enough food!
What is China’s Record during Past 2 Decades?

Are those that have been left behind (so far) “being taken care of” and/or “getting invested in”?

*******

International Press ask it a different way:
Is Rural China a boiling cauldron of discontent?
The size of economy in 2004 was more than 10 times as that in 1978.

It took the US nearly 100 years from 1870 to 1970 … to grow by 10 times!
What does 10% growth get you?

[Shenzhen in 1980 and 2000]
Rural poverty incidence in China, 1978-2025

(Percent of Population)
Perhaps more worrying:
Enlarging income disparity

Per capita income (in constant 2000 yuan)
Also rising inequality: Within Rural Areas

Average: 330%; Bottom 10%: 180%; Top 10%: 407%
What is driving income gaps?
Sources of Income Growth: Late 1980s / Early 1990s

• Ag-based Income Growth was low or stagnant (prices and still highly constrained by policy)
• If your family got a job off the farm, life became much better
Rising Inequality

• Gini Ratio Rising
  (intrahousehold, within rural sector)

• Mostly driven by differences in access to off farm jobs
  (Rozelle, 1996; Khan, Risken and Li, 2000)
By the 2000s … things had changed …

Breakdown of the Rural Labor Force
by HOUSEHOLD

Farming – 95%
Wage-earning job – 59%
Self employment – 34%

84% of households have at least one member in off farm sector

21% 43% 2%
13% 17% 1%
3%
Inequality Trends May be Changing

- After 2000, Gini Ratio Begins to Attenuate (intrahousehold, within rural sector)
- Why? Because so many households have someone in off farm sector, access to off farm jobs is starting to drive inequality down (Khan, Risken and Li, 2005)
New Driver of Intrahousehold, Within Rural Sector Inequality

• Self employment

• In other words, because so many families have jobs off the farm, the intrahousehold within rural sector Gini should have fallen more … except for emergence of this new source of inequality-increasing economic activity
Self-employed—another important off-farm employment sector

Self employment accounts for 13+3=16% of the rural labor force … or approximately: 0.16*500 million = 80 million (in 2000 … and rising)

Almost as many migrants … growth rate almost as great as migration
While in some countries the rise of a self-employed sector is seen as symptomatic of the failure of the formal wage sector, in China there is evidence, the self employed sector is healthy, growing and increasingly sophisticated …

Relatively capital intensive … growth rate of profits and capital stock exceed that of TVEs
From petty traders and marginalized street vendors ...
... to manufacturers and ...
… to high-end tradesman!
### Hourly Earnings for Self Employment and Wage Earners

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Median</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wage Earning</td>
<td>2.0</td>
<td>1.4</td>
<td>3.9</td>
</tr>
<tr>
<td>Self Employment</td>
<td>7.8</td>
<td>2.4</td>
<td>36.8</td>
</tr>
</tbody>
</table>

Self employed rural enterprise employ nearly 100 million people in 2005!

Therefore, it can be seen self employment is entrepreneurial; employment-creating; and engine of growth …
Does this add up to Rural Unrest?

“Way overstated” [my opinion]

• I have never seen it  [nor have my collaborators]
• All based on anecdotes

I could write a book on the environment of schools in America … and fill it with 1000s of citations:

“Drugs … guns … gangs … sex … violence … cheating … break-down of learning … etcetera”

[Is this typical of all US education system? Most?]
Empirical of Rural Unrest? NO!

- Survey by British Economists:
  - Are you better off now than 10 years ago?
  - Do you think you will be better off 10 years from now?
  - Are you happy?
This is not to say that a migrant’s life is easy
But it often is better than where most people came from …
And, there are dreams of a better life in the future—especially for their children.
Summary

• China is growing very fast …
• The fabric of the nation is being transformed …
  – Urbanization
  – Industrialization
  – Increasingly wealthy

• But, what does this mean for China’s food economy? With hundreds of millions of farmers leaving the land and vast tracts of land being changed into houses + factories + freeways
• Can China feed itself? Will it starve the world?
Rest of Presentation

• Examine how China’s farmers (and the government) are adapting to this changing environment

• Focus on 2 part of the Agricultural Sector
  – Technology
  – Markets

• Ultimate questions:
  – Will China be able to feed itself?
  – If so, how?
Does China have the “technology tools”?

Agricultural Productivity and the Technology that is Driving it
Growth of Wheat, Rice and Maize TFP in China, 1979 to 1997 and beyond …

First 7 year period: > 7% annually
Since 1985 … 2% per year

Continued at 2% per year between 1995 and 2005
Contributions to Productivity

• Before 1984:
  – MOST: property rights reform (decollectivization)
  – SOME: technology
  – a bit to extension and education

• After 1984
  – ZERO: property rights reform (decollectivization)
  – a bit to market emergence and education
  – none to extension
  – MOST to technology
Rise of “Yield Frontier” in China’s Experiment Stations for Rice, Wheat, and Maize

Sown area weighted of sample provinces

Around 2 percent per year growth
Plant biotech research expenditure

(million yuan in 1999 price, 22 institutes)

Total—1999: $100 million US

Total—2003: $300+ million

Total—2006: $500+ million
Non-Bt cotton

Bt cotton

Source: CAAS
Bt cotton areas in China, 1996-2003 (thousand hectares)

More than 5 million farmers adopted Bt cotton in 2003
**Major findings on Bt cotton impacts in 1999-2001 (per hectare)**

- **Reduce pesticide use:** 34 kg, 923 yuan
- **Increase yield:** 9.6%, 930 yuan
- **Increase seed cost:** 570 yuan
- **Reduce labor input:** 41 days, 574 yuan
- **Increase net income:** 1283-1857 yuan (US$ 155-225)

A net increase of about 20-30% … this is a HUGE increase in productivity!
GM technology’s benefits surpass the direct profitability metrics
But Bt cotton is more than productivity-enhancing …
Percentage (%) of poisonings reported as numbers of farmers interviewed in Henan in 2000

Only Bt cotton

Both Bt and non-Bt cotton

Only non-Bt cotton
Bt rice: approved from “environmental release trials” in 2001 and 2002

Source: Zhu Zhen
GM rice: Pre-production Trials
(2001-2004)

175 households, 812 plots

Hubei: 2001-2004
Fujian: 2002-2004
Performance of GM Rice in Field Trial

• Reduce pesticide use: - 40-50%
• Reduce labor input: - 6-9%
• Impacts on yield: + 6-8%

15 to 20% increase in productivity
Scenario B: Bt cotton + GM rice

Impacts on Welfare (EV, million US$) in 2010

RoR for Bt cotton investment: >1000%
Projected RoR for GM rice: HIGH
How good are China’s Domestic Markets?
Market distribution with province

Corn and Soybean Marketing Regions and Flows
Changes in corn price across China as markets increase its distance from port, 2000
Port—New Orleans

Location of Major Corn Markets in Greater Mississippi Valley

St. Louis

Port—New Orleans
Percentage change in price for every 1000 kilometers of distance from port

<table>
<thead>
<tr>
<th></th>
<th>Corn</th>
<th>Soybean</th>
<th>Rice</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>-4%</td>
<td>-10%</td>
<td>-10%</td>
</tr>
<tr>
<td>1999</td>
<td>-4%</td>
<td>-9%</td>
<td>-9%</td>
</tr>
<tr>
<td>2000</td>
<td>-3%</td>
<td>-4%</td>
<td>-7%</td>
</tr>
<tr>
<td>US – 1998</td>
<td>-5%</td>
<td>-3.5%</td>
<td>8%</td>
</tr>
</tbody>
</table>
## Soybean Market Integration between Regions

<table>
<thead>
<tr>
<th>Year</th>
<th>AH=&gt;SD</th>
<th>AH=&gt;SaX</th>
<th>AH=&gt;NX</th>
<th>JL=&gt;TJ</th>
<th>HLJ=&gt;DL</th>
<th>GD=&gt;SaX</th>
<th>GD=&gt;GS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>-5.36*</td>
<td>-5.87*</td>
<td>-4.84*</td>
<td>-3.93*</td>
<td>-4.01*</td>
<td>-4.33*</td>
<td>-4.83*</td>
</tr>
<tr>
<td>1997</td>
<td>-3.88*</td>
<td>-4.33*</td>
<td>-5.21*</td>
<td>-4.15*</td>
<td>-3.21*</td>
<td>-3.82*</td>
<td>-3.84*</td>
</tr>
<tr>
<td>1998</td>
<td>-4.13*</td>
<td>-5.56*</td>
<td>-4.84*</td>
<td>-4.72*</td>
<td>-4.67*</td>
<td>-4.85*</td>
<td>-4.05*</td>
</tr>
<tr>
<td>1999</td>
<td>-3.57*</td>
<td>-3.73*</td>
<td>-4.02*</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
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Dicky-Fuller Test critical value rejecting null of no integration @ 5% (10%) level is -3.3 (-3.0)
### Integration in China’s Markets (percent of market pairs that have integrated price series)

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>46</td>
<td>93</td>
<td>100</td>
</tr>
<tr>
<td>Soybean</td>
<td>56</td>
<td>95</td>
<td>98</td>
</tr>
</tbody>
</table>

More than \((45*44)/2 = 800\) pairs of markets
Rise of specialization (entire nation)

• In a recent survey of 650 communities in China, we asked the leaders:
  – Do farmers in your village specialize in the production of a field crop, tree crop or livestock commodity?

Data source: China National Rural Economy Survey (CCAP)
Agricultural Trade Balance by Factor Intensity, 1984 to 2002 (mil US$)
So where is China? What might make it stall? What does it need to do to keep moving?

Percent of Pop’n in Ag. Sector

Income per Capita
Problems and Responses

• Challenges:
  – Small Farm Size / Little Cooperation
  – Little Land (and falling??)
  – Little Water

• Response by Gov’t and Individuals
  – Increased investment (lots and more planned)
  – Rise of Subsidies and Welfare Programs (still small but growing)
  – Policy Innovation (including continued property rights reform)
Thank you
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MADE IN CHINA

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