

**No Razor's Edge:
Reexamining Alwyn Young's Evidence for Increasing Inter-Provincial Trade Barriers
in China**

Alwyn Young (2000) provided evidence for distortions begetting distortions in a partially reformed economy by examining barriers to inter-provincial trade in China. His findings of increasing barriers to inter-provincial trade are based on five arguments. This paper critically examines each of the five arguments and their evidence in turn, and concludes that in all five instances neither argument nor evidence are compelling. Furthermore, if inter-provincial trade barriers cause the specific consequences advocated by Alwyn Young, then evidence for the U.S. indicates a recent history of severe inter-state trade wars in the U.S.

JEL codes:

- P2 Economic Systems: Socialist Systems and Transitional Economies
 - P20 General
 - P23 Factor and Product Markets; Industry Studies; Population
 - P24 National Income, Product, and Expenditure; Money; Inflation
 - P27 Performance and Prospects
 - P31 Socialist Enterprises and Their Transitions
- D72 Microeconomics: Analysis of Collective Decision-Making: Economic Models of Political Processes: Rent-Seeking, Elections, Legislatures, and Voting Behavior

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I apologize to Alwyn Young for picking apart what must have been painstaking work, but the issue of inter-provincial trade barriers in China has been taken much more seriously, by Alwyn Young and others, than I think it deserves.

This paper comes with eight separate appendices, all available at <http://ihome.ust.hk/~socholz>.

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Introduction

Somewhere, far away, is a strange country. It is marked by inter-provincial trade embargoes, provincial governments trying to bid away each others' rents, silkworm cocoon wars, and a system of medieval roadblocks at which special charges are levied on trade. It is a country where local fiefdoms fiercely defend their enterprises against imports from other fiefdoms. At least that is what Alwyn Young (2000) wants us to believe. This scenario of all-out inter-provincial (trade) war competes with an alternative scenario of sporadic protectionist measures in some provinces in the case of some products in some years.

Alwyn Young (hereafter: AY) presents his argument of increasing local protectionism in China as an example of how new distortions are created in the process of transition:

“In a partially reformed economy, distortions beget distortions. Segments of the economy that are freed from centralized control respond to the rent-seeking opportunities implicit in the remaining distortions of the economy. The battle to capture, and then protect, these rents leads to the creation of new distortions, even as the reform process tries to move forward. In this paper I illustrate this idea with a study of the People's Republic of China.” (p. 1091, abstract)

AY's overall argument that distortions beget distortions, i.e., changes in a partially reformed economy lead to the appearance of new distortions, seems non-falsifiable. Changes to any economic system surely create *some new* opportunity for rent-seeking.¹

Precluding new opportunities for rent-seeking may not even be desirable. Qian Yingyi (2000) argues that the intentional creation of “transitional institutions” which are efficiency-enhancing and interest-compatible account for China's overall reform success. But “interest-compatible” is simply another word for the rent-seeking that in AY's view leads to the newly begotten distortions. Qian Yingyi's interpretation of China's economic reforms is one of a *feasible* transition path, even if that involves reliance on second-best approaches.² It is not an argument against fostering best-practice institutions, but against “simplistic and naïve views on institutional reform” (p. 330). In other words, a sequence of distortions may well be desirable.

If “distortions beget distortions” is a non-falsifiable statement, and new distortions may even be desirable in a larger reform context, then reexamining AY's finding of increasing local protectionism in China can only serve two purposes. One is to potentially invalidate this

¹ AY's point of being a “partially reformed” economy appears unnecessary to the argument. The extreme of “full” reforms in a distorted economy, presumably to a perfectly competitive market economy, would seem no more than a theoretical abstract.

² The existence of many feasible paths questions the razor edge analogy in the title of AY's paper (“The Razor's Edge: Distortions and Incremental Reform in the People's Republic of China”). The “path to salvation,” in a quotation by AY, would appear not necessarily “narrow and difficult to tread, narrow as the edge of a razor.”

particular piece of evidence for distortions begetting distortions. A second purpose is to potentially invalidate the argument of increasing local protectionism for its own sake. Local protectionism could, for example, hamper economic growth. It could have a negative impact on specialization and economies of scale, which in turn would impact on nationwide average living standards. It could have distributional consequences. These would seem important issues and a recent literature on local protectionism in its own right has developed.

Following a World Bank (1994) study of internal market development in China, a dozen research articles have attempted to analyze local protectionism in China using a range of different measures, including production specialization (Albert Park and Yang Du, 2003; Xiaobo Zhang and Kong-Yam Tan, 2004; Chong-en Bai et al., 2004), the law of one price (C. Simon Fan and Xiangdong Wei, 2005; Sandra Poncet 2005b), marginal returns to production and to the factors of production (Xiaobo Zhang and Kong-Yam Tan, 2004), trade flows (Barry Naughton, 2000; Sandra Poncet, 2003 and 2005a), commovement of output or price variables across localities during the business cycle (Xinpeng Xu, 2002; Xinpeng Xu and J.P. Voon, 2003), or direct surveys (Shantong Li, Yunzhong Liu, and Bo Chen, 2005). The conclusion on protectionism is mixed, but mostly in favor of decreasing local protectionism in the reform period.³

Alwyn Young (2000) starts out by presenting an economic rationale for an increase in local protectionism in China in the reform period and providing anecdotal evidence of local trade barriers. This is followed by four types of quantitative evidence, on cross-provincial (i) output convergence, (ii) price divergence, (iii) the time trend of the variances of relative output, labor productivity, and labor allocations, and (iv) the relationship of grain yield or agricultural labor and a measure of comparative advantage. Denoting trade barriers by “p” and the evidence by “q,” the quantitative arguments run as follows:

$p \Rightarrow q_1 (q_2, q_3, q_4)$.
q₁ (q₂, q₃, q₄) is.
Therefore p is.

This is the fallacy of affirming the consequent. Ideally, a strong argument is made as to why the causal link between p and q is plausible, and alternative explanations of q are ruled out. AY in his quantitative analyses provides rather weak arguments, if any, for the causal links, and only limited attempts to rule out alternative explanations.

This paper proceeds in parallel to AY’s paper. The economic rationale for increasing local protectionism is contrasted with other economic rationales which would suggest a decrease in trade barriers, or the largely absence of trade barriers all along. Central government documents, furthermore, show that for policy makers trade barriers are a minor (if not negligible) issue,

³ Sandra Poncet (2003, 2005a, 2005b) finds increasing protectionism. Xiaobo Zhang and Kong-Yam Tan conclude on convergence in the labor market but fragmentation in the capital market; Shantong Li, Yunzhong Liu, and Bo Chen (2005) find exactly the reverse. Chong-en Bai et al. (2004) conclude that “history plays the most important role in determining the degree of regional specialization, followed immediately by protectionism” (with protectionism exerting a negative impact on specialization); specialization decreased between 1985 and 1987 or 1988, depending on the measure, and then increased through 1997.

whose relevance may furthermore have been limited in time to the years before or around 1990. I examine each of AY's quantitative arguments and evidence in turn by, typically, (i) questioning the causality from p to q; (ii) providing one or more alternative and equally (if not more) plausible explanation(s) of q; (iii) questioning the accuracy or relevance of his evidence q; and (iv) examining alternative evidence. In all four quantitative analyses, (v), I provide corresponding evidence for the case of the U.S.

Historical and Qualitative Evidence

AY's rationale for increasing provincial trade barriers is summarized in his own words as:

“Under the plan, prices were skewed so as to concentrate profits, and hence revenue, in industry. As control over factor allocations was loosened, local governments throughout the economy sought to capture these rents by developing high margin industries. Continued reform, and growing interregional competition between duplicative industries, threatened the profitability of these industrial structures, leading local governments to impose a variety of interregional barriers to trade.” (p. 1091, abstract)

This section examines AY's concept of trade barriers, questions AY's rationale for increasing provincial trade barriers, and provides qualitative evidence suggesting a decrease in inter-provincial trade barriers if not the largely irrelevance of such trade barriers.

When is local protectionism worth writing about?

Protectionism is not particular to transition economies. In international trade, governments impose trade barriers to protect one or more industries located in the territory they rule. Protectionism is also common *within* countries, although it may not always take the form it has taken in China in some provinces for some products at some points of time. When Boeing considers moving its world headquarters from Seattle to Chicago, governments in both cities offer incentives in an attempt to retain/attract the corporation. Local city councils may block large retailers from moving into town. Interstate banking was largely prohibited between 1927 and 1994, but not uniformly so across states (some states were less protectionist than others).

The fact that protectionism is a characteristics of all economies and comes in a variety of ways, makes it impossible to establish a benchmark of “acceptable” or “normal” protectionism, except as theoretical point of zero protectionism. The only meaningful discourse, thus, centers on changes over time. Indeed, AY writes of continued reform “leading local governments to impose a variety of interregional barriers to trade.”

In order to examine the development of provincial trade barriers over time, these need to be defined and then operationalized. AY does not provide a definition of “protectionism” or “barriers to trade.” He provides a list of barriers to trade in form of “tariff barriers (i.e., special charges levied at roadblocks), nontariff methods such as physical barriers, outright prohibition, low-interest loans, and other financial benefits for commercial establishments marketing local

goods, fines for commercial establishments marketing nonlocal goods, legal restrictions on price differences between local and nonlocal goods sold in commercial establishments, local purchasing quotas, and administrative trivia (e.g., medical, sanitation, epidemic prevention, product quality, measurement, and other such licenses and certificates)” (p. 1102). AY’s subsequent measures of trade barriers (in his quantitative analyses) are not linked to the list. This means that a leap of faith is required between an unavailable definition of “trade barriers” or a list of examples of trade barriers, and what AY measures.⁴

Questioning the rationale for increasing provincial barriers to trade

If provincial trade barriers increased in the period examined by AY (approximately 1978/1985-1997, depending on the section of his paper), then this implies that provincial trade barriers are higher in the reform period than in the pre-reform period. AY illustrates the battle to capture rents in the segments of the economy freed from centralized control:

“Perhaps the most destructive element ... was the central regime’s policy on price controls. ... With each round of price liberalization, while the central government reduced the number of centrally mandated price controls, it simultaneously acquiesced to, explicitly allowed or, in some cases, even vigorously mandated, the local maintenance of price controls. In a planned economy, where state organs controlled the interregional movement of goods, price differentials could easily be maintained. In a market economy, however, with atomistic private arbitragers hard at work, large interregional differentials in the prices of traded goods could only be maintained with barriers to trade.” (pp. 1103f.)

The passage implies that state-controlled inter-regional movement of goods means *no* barriers to trade. But if a planner does not plan trade that would occur without plan, does that not constitute a trade barrier? Does AY assume that the planner plans exactly all trade flows which would occur in a market economy? And would the non-movement of goods by state organs not match the item “outright prohibition” in AY’s list of types of trade barriers, or the item “local purchasing quotas?” Or is AY’s point simply one of switching from *centrally imposed* provincial trade barriers to *provincially imposed* provincial trade barriers? Given the arguments in his quantitative analyses, that would still have to come with the implication of higher-impact provincially imposed trade barriers than the previously centrally imposed trade barriers. On both accounts, AY has to contend with a substantial body of literature that suggests that pre-reform, planned trade flows were far from market-oriented, and that in the pre-reform period locally imposed trade barriers were severe.

Thomas Lyons (1990, p. 59) assesses the pre-reform planning system and concludes, among others, on depressed inter-provincial trade among non-central agents and excessive inter-provincial trade among central agents, i.e., a highly distorted trading system. Comparing transportation and output growth, Thomas Lyons (1985) argues that China’s economic growth between mid-1950s and the late 1970s/ early 1980s was characterized by a tendency toward local

⁴ AY (as all other literature) focuses on inter-provincial trade only. However, “market blockades” as used in Chinese sources covers the behavior of supra-provincial regions, provinces, municipalities, and counties.

self-sufficiency.⁵ He also finds that in the Maoist period no more than a few hundred types of producer goods were ever centrally planned, with only about one-fourth of national income originating in units controlled by the central portions of the planning system (Thomas Lyons, 1986). Beyond the centrally and locally planned parts of the economy, perhaps half of nationwide output occurred outside the formal planning system and presumably was highly local.

Audrey Donnithorne (1972) provides concrete details of local trade barriers. Reporting on Tsunhua county in 1970, she writes that the county authorities were “in the position of a monopolist, able to give priority to local goods and keep out competing products, thus assuring a protected market for local commodities at local prices” (p. 616) and that, in general, “prices of most light industrial goods have been controlled by local authorities” and “often *hsien* [counties] are likely to get lower prices for goods sold outside the *hsien* [county] than they can charge in their protected home markets” (p. 616). She recalls an event “when the mayor of Shanghai asked Chiang Hua, first secretary of the Chekiang Party Committee for specified quantities of certain commodities, Chiang Hua is reported to have replied that “Chekiang is not a colony of Shanghai.” In 1962, a year of grave food shortages in many parts of China, “when some fraternal provinces asked Chekiang for certain amounts of supplementary food items, he turned down the request, saying, ‘I have pigs to feed.’” In general, she summarizes “the picture given” in Chinese reports as “of a large number of highly protectionist states” (p. 611) with the local “promotion of light industry for the deliberate purpose of generating profits to be used for the development of other sectors of the economy” (p. 617). It would seem hard for such local protectionism to increase yet further in the course of the reform period.

AY’s statement, in contrast, seems to build on the assumption of a perfectly *centrally* planned economy at the outset of the reform period, distorted in favor of industrial profits, but free of protectionism, or at least free of provincial protectionism.⁶ The trading system then came under attack due to reform policies: the removal of planned distortions begets new distortions in form of increasing provincial protectionism. AY goes as far as to conclude that “twenty years of economic reform in the People’s Republic ... *have resulted* [emphasis added] in a fragmented internal market” (p. 1128). The literature on China’s pre-reform period, in stark contrast, suggests that fragmentation and local protectionism were a defining characteristic of China’s economy at the end of the pre-reform period. Given the apparent prevalence of fragmentation and local protectionism in the pre-reform economy, it would seem that the only effect economic reforms can have is to *reduce* their levels.

⁵ This appears to be a both centrally and locally desired outcome. For example, the major iron and steel plants in Liaoning province were controlled by the (central) Ministry of Metallurgy and their output was shipped out of the province; Liaoning, to meet its own demand for development, was forced to build separate small plants under its control. On the other hand, he also quotes Chinese sources as reporting that every province “has become accustomed to shutting itself off from the rest of the economy, blindly seeking to build an independent system” (1986, p. 227).

⁶ AY at no point offers an argument of large-scale dismantling of pre-reform trade barriers in, say, the first year of the reform period, before the immediate imposition of new, provincial trade barriers in the reform period. AY also writes: “Fundamentally, this paper argues that the so-called “liberalization” and “transformation” of the People’s Republic over the past twenty years is perhaps best characterized as a process of devolution. Although the central government has released control over prices, outputs, and enterprise budgets, these functions have been taken up, albeit in a less systematic fashion, by local governments. Thus, China has moved from having one central plan to having many, mutually competitive, central plans.” (p. 1129) The literature just reported contradicts AY’s view of “one central plan.”

But suppose a reform period increase in trade barriers, or more specifically in provincial trade barriers, were still possible. AY's key rationale for localities to establish trade barriers is the generation of local revenue. "As control over factor allocations was loosened, local governments throughout the economy sought to capture these rents [profit, and hence revenue, in industry] by developing high margin industries. Continued reform ... threatened the profitability of these industrial structures, leading local governments to impose a variety of interregional barriers to trade" (p. 1091). The profitability of these industrial structures matters in that local government revenues are derived primarily from industry. In the pre-reform period, "industry was paramount as a source of revenue," and "the sector still accounted for almost half of all budgetary revenue in 1995" (p. 1096).

Any "paramount" role of industry as a source of revenue appears to have vanished by about 1990. In 1978, industry accounted for 42.27% of GDP but for 75.38% of government budgetary revenues. By 1985, the two percentages were 38.47% and 64.01%, by 1990 36.97% and 41.19%, and by 1995 42.27% and 43.98%. I.e., by 1990-1995, the share of government budgetary revenues from industry roughly corresponded to the share of industrial value added in the economy. This revenue trend suggests that AY's incentives for provincial trade barriers diminished continuously over the reform period. Alternatively, if the establishment of new provincial trade barriers were indeed motivated by revenue generation, and if provincial trade barriers were indeed established, they were not successful in increasing revenues.⁷

Evidence against provincial trade barriers (or an increase in provincial trade barriers)

AY presents the silkworm cocoon war story as anecdotal evidence of new trade barriers. But stories can be found—as AY admits (p. 1106)—on growing inter-regional cooperation.⁸ More systematic evidence against an increase in trade barriers, or perhaps even against the existence itself of substantial trade barriers, can be found in central government regulations. If the central government is interested in rapid economic growth (as seems to be the unifying theme of China's various leaders in the reform period), then it will want to act against local protectionism and promote a domestic free trade zone. A State Council (SC) circular of 10 April 1982 states: "regional or departmental (trade) blockages ... are extremely harmful to China's economy in total." But even though the central government clearly recognizes the negative effects of trade barriers, it only saw the need to act three times in the reform period, in 1982, 1990, and 2001.⁹

⁷ Locally owned enterprises hand over their income taxes (since 1994, or a share of profit prior to 1994) to the local government, while centrally owned enterprises do so to the central government, but that is not particular to the industrial sector. It is also not the case that the share of industrial output under local control increased significantly in the period examined by AY. For the value added (GDP) and revenue data see the *Statistical Yearbook 1993*, pp. 215, 217, 1996, p. 225, and 2003, p. 55.

⁸ In an appendix, as all appendices posted at <http://ihome.ust.hk/~socholz>, I recount one personal experience of burgeoning inter-provincial trade in 1994, when local protectionism should be running strongly following AY's accounts.

⁹ The two circulars of 1982 and 1990 and the 2001 regulation, as well as a follow-up circular of the State Administration of Industry and Commerce in 1990, are provided (in Chinese) in an appendix. Another piece of evidence that the center fully understands the importance of a domestic free trade area for the economy (or economic growth), if any further evidence were needed, would be the "Grand International Circulation" policy of the second half of the late 1980s that focused on using regional comparative advantages within China in an international context.

In 1982 the SC clarified that as long as enterprises fulfilled the plan, they now had the authority to sell their above-plan output anywhere in the country they wanted; local governments and central government departments were not to interfere in the distribution of the above-plan output. But *central* government departments in planning industrial production were also asked to, if quality and price were the same, meet local demand with *local* production; this appears a move away from excessive inter-regional trade between centrally controlled enterprises and thereby a reduction in inter-provincial trade that would have nothing to do with trade barriers. Minority areas and underdeveloped areas were explicitly given the right to, for an unspecified but supposedly fixed period of time (*zai yiding shiqi nei*) “appropriately” (*shidang*) control purchases of basic consumer goods and light industrial goods from outside the area; the passage reads as if these were controls against *new* trade flows possibly newly occurring in response to the new right for enterprises to freely sell above-plan output.

For the next eight years, neither the SC nor any of its departments saw any need for further action. Only in 1990 did the SC issue a second circular, now on breaking inter-regional blockades (SC, 10 Nov. 1990).¹⁰ First, all purchases and sales related to the mandatory plan must be fulfilled; once enterprises have completed their obligations under the plan, they have the right to sell their additional output anywhere in the country, subject to the relevant government policies and regulations. Second, all current trade checkpoints must be rectified. Those that need to be retained must be approved by the provincial-level government. In the case of some minority areas, the State Planning Commission (SPC) can approve short-term controls for imports if the local supply is sufficient and meets quality standards, but imports of same-quality goods must be allowed at least up to a certain share of local sales. Third, differential tax rates (or tax exemptions) based on product origin are not allowed. Fourth, banks may not differentiate in their lending behavior and their interest rates between commercial institutions that sell local vs. imported products. Fifth, the price bureaus are to supervise the commercial activities of enterprises and to strictly implement price regulations; the prices of imported products may not be manipulated without authorization. Sixth, all local and ministerial regulations which contradict the spirit of this circular are to be cancelled without exception.¹¹

If blockades continue after promulgation of this circular, the relevant leaders will be held responsible. Provinces and ministries are to immediately upon receipt of the circular pass it on to the local levels. They are also to implement a one-time inspection and to report on the implementation of this circular to the SC by 25 December 1990. Implementation of this circular is to be supervised by the Supervision Ministry and its local counterparts.¹² A follow-up circular by the State Administration for Industry and Commerce (SAIC), issued on 3 Dec. 1990, provides

¹⁰ The Chinese term for “inter-regional,” *diqujian*, is not limited to inter-provincial but equally covers inter-municipal/ prefectural and inter-county, etc.

¹¹ In between the lines, the circular reveals just how little of a market economy China was by 1990, with the mandatory production plan still occupying center stage, unspecified government policies and regulations “legally” restricting free trade, and the local tax authority and banking system discriminating operating along geographic lines.

¹² The Supervision Ministry is not a light-weight institution. While it may not have as much clout as the CCP Disciplinary Commission, it comes an immediate second. It is likely to be far more effective than the SPC would have been as supervising institution, and the SPC itself is not exactly light-weight.

further details on the manning of checkpoints and the long-distance transport of agricultural goods (and inspections for fake goods, sold illegally under another company's brand name).

The tone of the SC circular, and the extent to which it requests action and assigns supervision authority and responsibility for implementation, match that of other central documents at the time, such as, for example, the macroeconomic control measures of 1988-1990 (which suffer from a similar local free-rider problem as open markets and which were successful in the end).¹³ The power to approve checkpoints is located at a very high level, the provincial level, and exceptions to open markets need to be approved at the central level, by the State Planning Commission. This allows clear assignment of responsibility to provincial leaders and central ministers, all appointed under the central nomenklatura. Localities are not given any leeway to decide on how, and to what extent, to implement the center's instructions. The SC never issued any follow-up circular. Either local governments obeyed its original circular, or the SC perceived whatever trade barriers continued to exist as having little or no substantial impact on economic growth.

For the next eleven years, the topic of local trade barriers vanished from the center's agenda. The term "inter-regional blockades" (*diqu fengsuo*) appears in numerous circulars but usually only as one item in some longer list of undesirables, never as a key issue. The standard phrase is "ministerial and sectoral monopolies, and inter-regional blockades."¹⁴

When the issue resurfaces, on 21 April 2001, it is in form of a long-term SC regulatory framework, a "stipulation" (*guiding*) that must have been developed over some period of time, possibly years. It could probably have been issued at any point of time, except that in 2001 the overarching issue of the malfunctioning of the "market order" provided an opportune moment.¹⁵

The stipulation spells out in eight points what is prohibited and what is not. This is followed by eleven articles listing in great detail which institution is to revoke (*chexiao*) what kinds of barriers. The SC departments in charge of the economy and trade (presumably the SETC), of industrial and commercial administration (presumably the SAIC), and of quality supervision, are free to, at any time, examine possible digressions at the provincial level. Any work unit or individual can lodge complaints with any of these three government departments at the provincial or central level. They are guaranteed anonymity and promised rewards for valid complaints; any later revenge by the local government is to be penalized with demotion if not the dismissal of the local cadre. The regulation lists specific response times to complaints and also penalties (demotion, dismissal) for cadres who are responsible for barriers to inter-regional trade. This SC regulation is taken up at the local and at the central ministerial level, mostly as part of the campaign for rectifying and standardizing the order of the market economy.

¹³ The center, in order to lower the economy-wide inflation rate, asked for a reduction in investment; some localities initially disobeyed. See Carsten Holz (1999) for a detailed analysis of the central-local interactions.

¹⁴ For further details on the appearance of the topic of local protectionism see the appendix on government regulations, which also provides details on regulations in one locality.

¹⁵ A SC regulation of 27 April 2001 on rectifying and standardizing the market order addresses a wide range of issues from brand name imitations to excessive administrative procedures; trade barriers appear in a standard phrase referring to "breaking local blockades and sectoral monopolies." China Infobank carries regulations only of Guangdong and of Hebei Province that directly address barriers to interregional trade.

Of the three regulations, only that of 1990 appears to address an issue of some current importance, which was either quickly resolved or not regarded as important later. The 1982 regulation seems to promote a reduction in *existing* trade barriers more than prohibiting the establishment of new trade barriers. None of the three regulations are linked, i.e., the 1990 regulation does not mention that of 1982, and the 2001 regulatory framework does not refer back to 1982 or 1990, suggesting that the 1982 and 1990 regulations are isolated events, and even the regulatory framework of 2001 does not happen as part of a two-decade campaign against local protectionism.

In AY's view, "the central regime railed, in a number of circulars, against interprovincial trade wars" (p. 1103). He refers to a Chinese source (Chen Yongjun, 1994) as noting "circulars and directives against interregional trade barriers ... issued by the State Council, Party Congress, People's Congresses, etc. in 1980, 1981, 1982, 1984, 1985, 1987, 1988, 1989, and 1990" (p. 1103, note 17). Following up on the details in Chen Yongjun, only the 1982 and 1990 SC regulations directly address interregional trade barriers. The evidence for all other years consists of some marginal mentioning, on the order of half to one sentence, in otherwise lengthy regulations on other topics, or in the annual (particularly lengthy) government work reports. The 1990 SC circular would not seem to justify a portrayal of *prolonged* central regime *railings* against *inter-provincial* trade wars.

Quantitative Evidence 1: Provincial Specialization

Alwyn Young's first piece of evidence in favor of increasing trade barriers in China is the "widespread convergence in the structure of output during the reform period, as the different provinces duplicated each other's industries" (pp. 1093f.). He measures convergence or divergence of the structure of output as sum of the "absolute and [or] squared deviations of sectoral output shares of China's different provinces from the group average" (p. 1106). In other words, he takes one province at a time and for each sector in this province calculates the sector's share in provincial output. He then contrasts the share of a particular sector in a particular province with the average share of this sector across all provinces (average across provinces, or, separately, share in national data); this is the deviation. Deviations in absolute values are summed across all sectors and provinces to yield a sum of absolute deviations; or deviations are first squared, then summed, to obtain a sum of squared deviations. The sum of absolute (or squared) deviations is calculated for each individual year in the period 1952-97.

Using data on primary, secondary, and tertiary sector value added since 1978, AY finds a steady 25% decline in the sum of absolute deviations between 1978 and 1992, and a steady 39% decline in the sum of squared deviations. Between 1992 and 1997 the measures of deviation are constant.¹⁶ This implies increasing barriers to inter-regional trade between 1978 and 1992.

¹⁶ Alwyn Young also reports the results of two variations: weighting provincial shares by provincial output (which yields even more convergence), and dividing provinces into coastal and interior (no difference in results). He also provides data for 1952-1992 based on the net material product of the five material production sectors in the traditional, socialist accounting system (the Material Product System). The sum of absolute (or squared) deviations of this time series shows a first, temporary decline around 1969, then begins a long-time decline in the mid-1970s, and in the reform period follows a similar pattern as the time series based on value added.

Conceptual issues

AY argues: “Trade barriers tend to lower the internal prices and real outputs of products in which a region has a comparative advantage. This leads to a convergence in the nominal output shares of different sectors” (p. 1111). But one could also argue that trade barriers lead to a divergence in the nominal output shares of different sectors over time. For example, if provinces apply trade barriers selectively—as the anecdotal evidence would suggest—each province could choose to protect only those industries in which it has a high comparative advantage. The trade barriers would ensure that this province’s comparative advantages are not eroded. Provinces then specialize on those industries in which they have the highest comparative advantage. The result of trade barriers is *divergence* over time in the nominal output shares of different sectors.

Alternative explanations

Convergence in the nominal output shares of the three economic sectors examined by AY could also be the result of economic transition. Central planning is likely to have implied the pre-reform concentration of central production activities in a small number of firms (in a few provinces), at possibly decreasing returns to scale, in order to facilitate planning. Military reasons in the pre-reform period led to the “Third Front” construction of the late 1960s, which concentrated capital-intensive firms in interior provinces (the third front) that were considered safe from foreign attack.¹⁷ Such distortions disappear once production and investment decisions become more market-oriented in the reform period.

To illustrate the Third Front example, the share of capital construction investment in the five major Third Front provinces Sichuan, Guizhou, Hubei, Shaanxi, and Gansu rose from 17.51% in 1957, the inception of the First Five-Year Plan, to 19.01% in 1960 before exploding to 27.16% in 1965 and 34.85% in 1970; thereafter it fell to 28.26% in 1972, 19.85% in 1975 and 18.93% in 1978. By 1985 it had dropped to 13.67%, where it remained for the next decade (with 12.87% in 1995).¹⁸ In other words, the share of the five interior provinces in capital construction fell by two-thirds between 1970 and 1985, from one third of the nationwide total to one eighth.¹⁹ Regional adjustments in sectoral *output* may take longer, depending on new investment and the decommissioning of old fixed assets.

¹⁷ In case of an attack by the U.S. or the Soviet Union, the attacker would overrun the Chinese first front and then be stopped in the second front. Important industries in the third front would be save from attack.

¹⁸ For the data see *Investment Yearbook 1950-95*, pp. 16, 20, and 79-85. In 1957, capital construction accounted for 94.77% of the total of capital construction, technological updating and transformation, and real estate development; this (limited) total presumably was the total of all investment covered by the statistical authority. By 1995, the share of capital construction in this “limited” total was 53.45%, and in the since 1980 newly published “society” total 36.98%.

¹⁹ Alwyn Young notes a “secular downward trend [in the sum of absolute or squared deviations] appearing around 1969 [also see note 16], i.e., during the Cultural Revolution, when the central government promoted industrial diversification” (p. 1108); i.e., for the pre-reform period he relies on a non-trade-barrier argument to explain convergence, but then in the reform period interprets convergence as evidence of trade barriers.

Convergence in nominal output shares of the three economic sectors is also a sign of general development. Local governments, under pressure to achieve rapid economic growth, have no choice but to develop the secondary and tertiary sector. Not only are unemployment and under-employment problems being addressed, but the much higher labor productivity in the secondary and tertiary sector also leads to rapid economic growth. The less developed provinces, perhaps most desperate to catch up, have a larger growth potential in the secondary sector and in the tertiary sector. In the secondary sector, this growth could occur in those industries in which transportation costs make local production profitable everywhere.²⁰

AY, in a later section of his paper (discussed below), offers two alternative explanations of output convergence (pp. 1115f.). First, once China opened to the international market, each Chinese province found its comparative advantage in a common industrial structure vis-à-vis the world. Second, the inter-provincial patterns of comparative advantage may have converged during the reform period (with no reason given why this should be the case).

Questioning the relevance of AY's evidence, and alternative evidence

With AY's focus in his economic rationale for trade barriers on *industrial enterprises*, and given the general economic development argument, it would appear appropriate to examine the changing output structures *within industry* rather than by focusing on the output shares of the primary, secondary, and tertiary sector.

Figure 1 shows that within industry, production patterns across provinces diverged steadily over time; this is what AY would expect them to do if there are *decreasing* trade barriers. The data are available for three different periods, 1988 through 1992, 1993 through 1997, and 1999-2002, with exhaustive data on near-all approximately three dozen individual industries in the first two periods, but in the third period data on only two dozen individual industries. In each period the pattern is one of increasing divergence, independent of whether gross output value or value added is used as output measure, independent of whether the criterion is absolute deviations or squared deviations, and independent of whether the average share from which the deviations are measured is calculated as the average share across provinces or as the share of this sector in total output at the nationwide level. If one were to interpret regional specialization as a sign of decreasing trade barriers, these patterns of specialization within industry over time imply decreasing trade barriers from 1989 through 2002.²¹

The U.S. experience

²⁰ Albert Park and Yang Du (2003) formalize an economic development argument: they repeat AY's sectoral exercise controlling for development level and provincial characteristics and find increasing specialization over the reform period. (I came across their work ex-post, after completing the calculations and explanations in this section.)

²¹ Xiaobo Zhang and Kong-Yam Tan (2004), focusing on the four (non-exhaustive) sectors farming, urban industry, urban service, and rural nonfarm in 1978-2001, calculate the Hoover coefficient of localization for each sector in each year, and find, in the aggregate, increasing specialization between 1991 and 1996, and otherwise little change; the sector-specific time trends vary. Chong-en Bai et al. (2004) also calculate a Hoover coefficient of localization, for individual industries in 1985-97, and find slightly decreasing specialization in 1985-87/88 and then increasing specialization thereafter.

Figure 2 reports the results of AY's exercise, only now conducted for the U.S. for the years 1977, the first year for which these data are available from the Bureau of Economic Analysis (BEA), to 2001, the most recent year for which the data are available. Between the high point of 1981 and the final year of 2001, the sum of absolute deviations fell by 23.07%, and the sum of squared deviations by 42.44%; over the whole period (between 1977 and 2001), the sum of absolute deviations fell by 15.03%, and the sum of squared deviations by 24.67%. Following Alwyn Young's logic, thus, the U.S. experienced increasing barriers to inter-state trade over the past two decades, at a rate matching that of China. In contrast to China, the U.S. *also* experienced increasing convergence in *industrial* output structures over time (Figure 3); i.e., the increase in inter-state trade barriers is even more pronounced in the U.S. than in China.²²

Quantitative Evidence 2: Provincial Price Dispersion

AY's second test for barriers to inter-provincial trade is based on prices. He writes that, "ceteris paribus, trade barriers, which segment markets, will increase the variation of prices across those markets" (p. 1112). He proceeds by first calculating the standard deviation of the natural logarithm (ln) of the prices of a particular product across China's provinces; this is done for a number of products. Second, the ln of the standard deviation is regressed on product dummies and time dummies. He reports the coefficients of the time dummies as a measure of price dispersion.

He uses four data sets (for four separate calculations):

- (i) 1986-93: annual retail prices of 305 consumer goods in 30 cities,
- (ii) 1986-93: annual procurement prices of 130 agricultural goods in 30 provinces,
- (iii) 3/90 – 5/99: monthly market prices of 49 industrial materials in 36 cities, and
- (iv) 6/93-5/99: monthly market prices of 33 agricultural products in 36 cities.²³

Using the annual data for the period 1986 through 1993, he finds that "the dispersion of both retail and agricultural prices rose rapidly between 1986 and 1989, after which it fell [until 1991 and 1992, respectively], and then rose again" (p. 1113). His findings on the monthly price data are that they "have gone through bouts of falling and rising dispersion" (p. 1114).²⁴

²² For the within-industry data, the overall change between 1977 and 2001, or between the high point of 1981 and 2001, is relatively small at approximately 10%, significantly smaller than in the case where only the three economic sectors primary, secondary, and tertiary sector are examined. Details on the U.S. data are provided in the appendix on U.S. data on cross-state specialization and price dispersion.

²³ The number of products, cities, and the time period covered are maximum numbers, i.e., not at every point of time are prices on all products in all locations (and, in the case of annual data, at the same quality specification) available. For example, going back to the original sources of the data, the number of consumer goods in the first dataset in the years 1986 and 1987 is only 132 (not 305). For further details and complications see the appendix on price data.

²⁴ In the literature, Sandra Poncet (2005b) examines the dispersion of monthly prices of each of seven agricultural products across 170 locations in China in the period 1987-97 and finds, like AY, that price dispersion exhibits a wave-like pattern over time. If distance and fixed effects are controlled for, in most years trading across provincial borders appears to imply extra price dispersion. Simon Fan and Xiangdong Wei (2005) examine the dispersion of monthly prices of 93 goods and services in 6 product categories across 36 cities in China from 1990 to 2003. In panel unit root tests and non-linear mean-reversion they find strong evidence of price convergence. In the aggregate,

Conceptual issues

AY writes: “Ceteris paribus, trade barriers, which segment markets, will increase the variation of prices across those markets” (p. 1112). However, a number of factors would suggest that trade barriers lead to a *decrease* in price dispersion. It is also possible that in some industries local trade barriers lead to high price dispersion, and in other industries to low price dispersion.

Trade barriers reduce price dispersion in the following scenarios. If price-setting authority rests with local enterprises, these may, in the newly closed market, adopt the rules they are familiar with from the planned economy, namely the (nationwide) *sectoral* average cost method, plus mark-up; the resulting profit is highest in provinces with lowest average costs, and lowest in provinces with highest average costs, but the resulting price would be very similar across provinces. If price-setting authority rests with local governments, these could try to keep prices somewhat in line with those in neighboring localities, for example in order to prevent “smuggling.” Or they could set prices at the historically given, customary and generally accepted level (as Audrey Donnithorne (1972, p. 616) suggests for the early 1970s when local self-sufficiency was a key economic policy). Local prices could also be determined through price guidelines issued by central line ministries in charge of particular industries; these guidelines could be locality-specific or nationwide uniform. None of these pricing methods necessarily implies that trade barriers come with a high degree of price dispersion across provinces.

Questioning AY’s data manipulations, and alternative manipulations

AY focuses on the (ln of the) standard deviation of (the ln of) prices of each product across provinces. However, differences in the inflation rate over time, as long as inflation affects all products equally, potentially confound his findings; a higher (lower) inflation rate implies a higher (lower) standard deviation. The coefficient of variation avoids this shortfall. His calculations are redone in the following using the coefficient of variation, dropping the double ln-manipulations, and trying to ensure absolute comparability of product coverage over time. The two agricultural procurement price series are dropped because AY’s findings using agricultural procurement price data are no or little different from those using retail or industrial materials prices, and because agricultural procurement price data are more difficult to interpret.²⁵

Figure 4 shows the results for retail prices. The findings match those of AY, with two differences. First, price dispersion as reported in Figure 4 does not rise continuously in 1987 and

price dispersion appears to increase with time; however, once the analysis is conducted by product category, prices converge in five out of the six categories. Xinpeng Xu and J.P. Voon (2003), using two sets of annual retail prices for 1985-93 and 1994-98 covering 13 and 28 sectors examine the comovements of price changes and find decreasing price integration across provinces between the two sub-periods 1985-89 and 1990-93, and then increasing price integration between 1990-93 and 1994-98. In all periods, sector-specific effects far outweigh province-specific effects three- to twenty-fold, and slightly more so in the short run than in the long run.

²⁵ The appendix on price data justifies and explains the slightly different calculations, gives an example of the impact of inflation on standard deviations, and elaborates on the complications that beset agricultural procurement price data.

1988 (contrary to AY's findings), but drops slightly in 1987, before rising in 1988; the difference in price dispersion to the 1986 base year is insignificant (less than two standard errors) in both years (as in AY). A second difference is that in all years except two (1989 and 1993), price dispersion is not significantly different from the base year 1986, whereas AY's analysis yields significant differences in 1989-93.

Figure 5 reports the results when a very few outliers are removed. If the price of a particular product in a particular location at a particular point of time is more than three standard deviations away from the mean of the prices of this particular product at this particular point of time across other locations, the observation is considered an outlier. Removing outliers obviously reduces price dispersion; only 1989 is still significant, and 1991-93 are now highly insignificant. There is no increase in price dispersion between 1986 and 1993. Removing outliers is justified when these observations are typos (as appears likely), or reflect measurement errors or changing quality specifications over time.²⁶ Otherwise, it is not.

Figure 6 reproduces AY's findings for "industrial materials" prices (which are prices of means of production, i.e., producer goods and materials). The patterns over time are identical to those obtained by AY. Removing outliers has no further consequences. The absolute size of the coefficient of the annual dummy variables appears very small throughout, even in the years with highest (and significant) price dispersion, when it increases the base-year coefficient of variation by just 0.04.

Alternative explanations

The key alternative explanation for the observed patterns of price dispersion over time is an institutional one. AY's price data cover retail goods, with annual prices, in 1986-93, and means of production, with monthly prices, in 3/90 through 5/99. Pricing regimes for individual products within the categories retail goods and means of production changed over time.²⁷

Starting in 1984/85, some means of production became subject to the dual-track price system with simultaneously a plan and a "market" price, increasing the opportunities for price differences across provinces; by 1988, two prices existed for approximately 40% of all product categories and 50-75% of sales volume. If prices of these products were previously centrally determined and set at a uniform nationwide price, the switch to market prices for some of the output opens up scope for new inter-provincial price dispersion. For example, a province with sufficient plan quota to meet all local needs enjoys the plan price; another province, with little plan quota, on the other hand, pays predominantly the market price. When market prices exceed plan prices, as was the rule through 1990, and if the marketized share increases over time, this implies increasing price dispersion, in extent depending on the regional distribution of quotas

²⁶ For further explanations on the removal of outliers see the appendix on price data. Perhaps the official collection of retail prices ended with the 1993 data for a good reason, namely the impossibility of obtaining price data for an identical product nationwide as the economy developed and product variety increased.

²⁷ Similarly for agricultural procurement, not discussed in the following because the data analysis has also been omitted. Details on price reform reported in the following are drawn from numerous pages in various issues of the *Price Yearbook*.

allocated by the central plan. The price dispersion for means of production is likely to feed through into retail prices. In China's shortage economy of the 1980s, producers of retail goods can easily sell all their output locally and may therefore have little incentives to establish nationwide distribution networks or to bother with a perhaps not particularly friendly state-run distribution network; traditionally, retail goods, i.e., consumer goods, are not part of the *central* plan, and inter-provincial trade in retail goods in the pre-reform period was presumably minimal. Figure 4 shows that retail price dispersion rises to a significant, high level in 1989.

Following the economy-wide, double-digit inflation rates in 1988 and 1989, procedures to control excessive market prices of both means of production and retail prices were implemented beginning in 1988/89. Products covered by the state mandatory or guidance (production) plan again became strictly subject to state-determined prices. In October 1988 the SC requested large and medium-sized cities to impose a reporting system for price changes in products the prices of which were originally market prices. Price departments were given the authority to prohibit or delay price increases. In 1989, the reporting system was extended across all China. The product categories and individual products within each category subject to price reporting (and thus price control) were predominantly a provincial-level matter; thus, the number of categories and products under price control differed from province to province, by central government design. For 13 product categories, price changes had to be reported by provinces to the SC. For "important" producer goods, if the center did not issue a uniform maximum price, then provincial price bureaus were to determine a local price (included in a SC list), taking into consideration local demand and supply. Some products for which the plan price had previously been abandoned again became subject to plan prices. At times, in 1989 and 1990, 50 different central government departments were setting prices in their economic or administrative sector.

In 1991, following the period of adjustment and consolidation with only 4.1 and 3.8% real GDP growth in 1989 and 1990, the number of product categories on which price changes had to be reported to the SC was reduced to 5. Most provinces began to dismantle their price reporting requirements. Central government departments also shifted price control authority over many products (for some of which prices had never been freed before) to localities or enterprises themselves. Figure 4 shows that the high price dispersion for retail goods of 1989 fell in 1990 and 1991 (to insignificant levels compared to 1986). Figure 6, for means of production, also shows the decline between 1990 (the starting year of this series) and 1991. This is in direct contrast to AY's argument that relaxation of central price controls allowed provinces to, by erecting trade barriers, manipulate prices, which then supposedly leads to an *increase* in price dispersion; the 1991 relaxation of central price controls led to a *decrease* in price dispersion.

By 1992, price liberalization became pervasive and the dual-track price system largely ceased to exist. The share of sales of means of production conducted at *centrally* determined plan or guidance prices, for example, fell from 46% in 1990 to 14% in 1993; the share of sales conducted at market prices rose from 36% to 81%.²⁸ Deng Xiaoping's Southern Tour in January 1992 started an investment boom causing renewed price pressure for both means of production and consumer goods. The ex-factory price index of industrial products reached 6.8% in 1992 and 24.0% in 1993 (before falling to 19.5%, 14.9%, and 2.95 in 1994-96). If imperfect markets do

²⁸ For details on the shares of retail sales, agricultural procurement, and sales of means of production at various pricing regimes over time see the appendix on price data.

not respond instantaneously, or if transportation facilities are scarce, or transportation costs high, or the distribution system limited and/or inflexible—with real-world, economy-wide evidence on the inflexibility of the transportation system—provincial price dispersion will increase following differential provincial expansion.²⁹ Figure 4 and Figure 6 show the increase in price dispersion in 1992 through 1994, before price dispersion drops off again.

The final increase in price dispersion in 1998/99 occurs in a period of low growth and deflation. Excess supply led to intense price competition among enterprises, with enterprises, in particular state-owned enterprises (SOEs), often selling below cost. The State Development and Planning Commission issued a prohibition to sell below cost. Sectoral associations issued “self-discipline” prices and, for some products, determined average costs, and, in cooperation with the Price Bureau, a lower, minimum acceptable price level below these average costs.³⁰ Not all provinces need to have been affected equally by these price wars, and local sectoral associations and local price bureaus may have established their own guidelines, which would imply rising price dispersion. Figure 6 documents the increasing price dispersion in 1998 and 1999.³¹

These institutional explanations match the observed patterns of price dispersion exceedingly well. AY, in contrast, has nothing to offer except two assertions. First, “*Ceteris paribus*, trade barriers, which segment markets, will increase the variation of prices across those markets” (p. 1112). He does not examine the *ceteris paribus* assumption. Second, “These bouts of falling and rising dispersion [of industrial materials prices in 1990-99] are consistent with trade wars that are periodically interrupted and suppressed by the central government, only to resume once again, when central attention focuses on other matters” (pp. 1114f.). He fails to provide *any* evidence of periodic central government interruption and suppression of trade wars.³² The section above, examining government regulations, argues there exists none.

AY (p. 1116) in a later section (discussed below) offers as alternative explanation for increasing price dispersion an increase in the variety of an individual product across provinces.

²⁹ As recently as 2003, when energy was short, the transportation system was unable to meet demand. Yifan Hu (2004) reports that in recent years approximately 60% of coal output is shipped by rail, accounting for approximately 45% of rail freight transportation (*yunliang*) and 33% of rail freight turnover (*zhouzhuangliang*). In the first ten months of 2003, national coal production was up 21.4% over the same period in the previous year, but rail transportation of coal in the months through September was up only 6.9%. He writes of many enterprises that cannot get the raw materials they need and cannot ship their products, of a railway system that can only meet 35% of demand, and of 50% price increases in the “last” six months in water transportation, where prices are not regulated. The article provides a multitude of specific examples and pieces of information on transportation bottlenecks.

³⁰ The period of price competition is documented in Carsten Holz (2003), pp. 270-3. In these instances, it would appear that enterprises (or their owners) are not motivated by profit (or revenue) maximization but by selling at all cost, even if that implies large losses. The motivation could be to survive whatever industry consolidation was to follow, or perhaps to generate enough cash flow to pay wages and avoid social unrest.

³¹ The appendix on price data discusses a likely bias in the coverage of the monthly price data and its consequences, which could include stronger than usual central interference in setting the prices covered by AY during periods of high inflation and deflation.

³² It appears that his only documentation of government action is the footnote referring to Chen Yongjun’s (1994) book, already discussed above. Beyond the discussion above, all the dates in this source except 1990 refer to years before the periodic trade wars noted by AY erupted. To point out one further inconsistency, if price dispersion changed if and only if trade barriers changed, the 1990 dip in measured price dispersion below the 1989 local maximum (for retail prices, here and in AY) is inconsistent with the fact that the SC only issued its one circular in late 1990 (which would indicate high trade barriers in 1990).

His alternative explanation for the bouts of converging and diverging prices during the 1990s is temporary economic shocks. (The two alternative explanations are not explored further by AY.)

The U.S. experience

Figure 7 reports quarterly price dispersion across 26 products in 48 U.S. cities in the period 1/75 through 4/92.³³ Following AY's logic, inter-state trade barriers in the U.S. rose sharply in 1976, fell drastically in 1978, then increased gradually through 1990, before they exploded in 1991 and 1992. The extent of trade barriers in 1992 exceeded that in 1975.

Quantitative Evidence 3: Variance Decomposition

AY's third test for increasing barriers to inter-provincial trade asks if the output convergence that he found in the first quantitative analysis could be due to a specific reason other than trade barriers. AY now focuses on primary and secondary sector only, and finds that the variance (across provinces) of the ln of the ratio of nominal primary sector output to nominal secondary sector output declined from 0.71 in 1978 to 0.53 in 1997, implying output convergence (similar to the findings in his first quantitative section). He then decomposes this variance into the three components (i) variance of the ln of the ratio of nominal sectoral labor productivity, (ii) variance of the ln of the ratio of sectoral labor allocations, and (iii) the covariance of the ln of the ratio of nominal sectoral labor productivity and the ln of the ratio of sectoral labor allocations, or

$$\text{var}\left(\ln \frac{P_P Q_P}{P_S Q_S} + \left(-\ln \frac{L_P}{L_S} + \ln \frac{L_P}{L_S}\right)\right) = \text{var}\left(\ln \frac{P_P Q_P / L_P}{P_S Q_S / L_S}\right) + \text{var}\left(\ln \frac{L_P}{L_S}\right) + 2 \text{cov}\left(\ln \frac{P_P Q_P / L_P}{P_S Q_S / L_S}, \ln \frac{L_P}{L_S}\right),$$

where P denotes price level, Q real output, L labor, and the subscripts p and s stand for primary and secondary sector. Table 1 reports his findings.³⁴ The variance of (the ln of) relative labor productivity increased between 1978 and 1995 from 0.12 to 0.15, and of (the ln of) relative labor allocations from 0.56 to 0.73, while the covariance fell from 0.01 to negative 0.17.

This means that "while China's provinces became more similar in terms of the composition of final output, they became increasingly *dissimilar* in terms of sectoral productivities and sectoral labor allocations ... If the convergence in the composition of output across China's provinces is driven by a convergence in the patterns of comparative advantage [rather than by trade barriers], then one should observe a growing similarity of labor allocations and productivities (i.e., the economies should be increasingly similar on all dimensions). Similarly, common specialization driven by the opening to the international market should be accompanied

³³ Chinese data are also city-level data and interpreted by Alwyn Young as provincial data. For the data see David Parsley and Shang-jin Wei (1996). The Bureau of Labor Statistics does not publish absolute price data on specific, *nationwide uniform products* because it cannot guarantee comparability of individual products across localities. For further details on the U.S. data see the appendix on the U.S. data on cross-state specialization and price dispersion.

³⁴ Because AY's data are not accessible to me, Table 1 not only reports AY's results, but also redoes the calculations using data from Chinese official sources (including Zhejiang, on which AY had no data). AY's Lotus files are available on his website, but neither I nor our department's computer technician were able to open it.

by a growing similarity of labor allocations. None of this is present in the data” (p. 1117).³⁵ I.e., the alternative explanation of output convergence—not trade barriers, but convergence of comparative advantages or common specialization induced by the opening to the international market—has additional implications that AY does not observe in the data. That would imply that this particular alternative explanation of the observed trends in variances is not valid.

Conceptual issues

AY writes: “The [reform period] Chinese data ... are compatible with a rise in trade barriers. [i] A growing diversity of nominal labor productivities could easily arise from growing interregional price disparities, which would increase both the variation of relative prices and, due to a decline in factor price equalization, the variation of real labor productivities. [ii] A rise in the variance of labor allocations could come from increasingly perverse labor allocations, as provinces poured resources into areas of comparative disadvantage, a view that would also not be incompatible with the growing negative correlation between productivities and factor allocations.” (p. 1118)

A short refutation of this argument is that (i) inter-provincial price dispersion, as seen in the previous section, has not *grown* through 1997 (retail prices for 1986-90, industrial materials prices for 1990-97). (ii) Trade barriers need not cause provinces to pour resources into areas of comparative disadvantage; they could cause provinces to pour resources into areas of comparative advantage where profits could be highest. If provinces were indeed found to pour resources into areas of comparative disadvantage (the evidence is lacking), this could be the result of central investment and development plans.³⁶

Alternative explanations

Because I question AY’s evidence below, there seems little point in trying to explain his evidence. AY himself offers one, though not further detailed, alternative explanation: if one views the Chinese economy in 1978 as highly distorted, then the findings are, “for an appropriately complex set of initial centrally planned distortions, perfectly compatible with a movement to the free market” (p. 1119).

Questioning AY’s data analysis, and alternative evidence

AY writes, as already quoted above, that while “China’s provinces became more similar in terms of the composition of final output, they became increasingly *dissimilar* in terms of sectoral productivities and sectoral labor allocations” (p. 1117). The bottom of Table 1 reports the data that AY’s *text* refers to—variances of ratios, rather than variances of the *natural logarithms* of

³⁵ Nor is the output convergence documented by AY for the U.S. accompanied by a growing similarity of labor allocations *and productivities*, only by a growing similarity of labor allocations. He does not further explore the fact that productivities converge in the U.S. as in China.

³⁶ A more detailed refutation is provided in the appendix on variance decomposition.

ratios. Between 1978 and 1997, the variance of the ratio of nominal primary sector output to secondary sector output fell from 0.24 to 0.15, a modest decline. The variance of relative labor productivity increased very slightly, and the variance of relative labor allocations, in extent depending on the labor data used, fell.³⁷ If the outlier Tibet is omitted (its 1997 value of relative labor allocation is twice that of the next-highest province), the variance of the ratio of labor allocations even fell *drastically*.³⁸

The data *confirm* AY's alternative explanation of output convergence through convergence of provincial comparative advantage or common specialization in the opening to the international market (if one accepts his assertion as to the implications of such a cause on the change in relative labor productivities and relative labor allocations). AY's claim that provinces "became increasingly *dissimilar* in terms of sectoral productivities and sectoral labor allocations" *lacks any foundation in the data*. China's provinces were *not* becoming dissimilar in terms of sectoral productivities and sectoral labor allocations. They were becoming dissimilar only in the variances of the *natural logarithms*, but that is not AY's argument. The pattern for China is exactly the one that AY accepts without questioning for the U.S. in his *text*: "Unlike China [a wrong statement], however, in the United States this convergence [in output structure] was associated with a large decline in the variance of labor allocations [not: variance of the *natural logarithm* of labor allocations]" (p. 1117).³⁹

But suppose his logical argument were based on behavior in terms of natural logarithms, for unexplained reasons and in contrast to his text. Then his findings are sensitive to the time period chosen. For the U.S. between 1977 and 1994, AY finds convergence in output, a near-constant variance of the ratio of labor productivity, a falling variance of the ratio of labor allocation, and near-zero covariance in 1994 (Table 1). He does not associate this pattern with trade barriers. Then, for the case of China, take, say, 1981 as starting year, and natural logarithms to match AY's manipulations. The findings are convergence in output, near-constant variance of the ratio of labor productivity, a possibly faint decline in the variance of the ratio of labor allocation (depending on the labor data chosen), and near-zero covariance in the final period (Table 1).

The only difference in the findings is that the variation of labor allocation in China does not fall by as much as in the U.S. There are good reasons why it doesn't. The household registration system, still strongly in force in the period covered by AY, prevents inter-provincial flows of urban labor and hampers intra- and inter-provincial flows from rural to urban areas. Much of the flow out of agriculture may simply depend on the availability of *rural* industrial jobs, which in turn, during the period examined by AY, depended much on local government entrepreneurial initiatives.

The findings are also sensitive with respect to the choice of sectors to examine. Switching to another combination of sectors, for example, the secondary vs. tertiary sector, and choosing the

³⁷ The labor data are problematic in several respects, and explained in detail in an appendix on the labor data.

³⁸ For charts of the relative nominal labor productivities and of the relative labor allocations of all provinces in 1978 vs. 1997 see the appendix on variance decomposition. A lesser outlier of Jilin in terms of relative nominal labor productivities makes no substantial difference to the results.

³⁹ For the U.S., he ignores that the variance of relative labor productivities stayed constant over time—as it did in China.

period 1987-99, the U.S. pattern (in the case of the primary vs. secondary sector), in \ln , can be almost perfectly reproduced for China with a decrease in the variance of the nominal output ratio from 0.18 to 0.09, a slight increase in the variance of relative labor productivities from 0.04 to 0.06, a decrease in relative labor allocations from 0.16 to 0.11, and the covariance with negative 0.01 and negative 0.04 near-zero in the two years.⁴⁰

A further examination, as in the first section, of inter-industry variances with two industries at a time would yield no further insights because, according to AY's logic, the output divergence observed for the within-industry case in the first section is already a sign of *decreasing* trade barriers. There is, thus, no need to consider alternative explanations.

The U.S. experience

Selecting a different period for the U.S. than AY did, namely the years 1980 to 1989, the U.S. pattern over time, in \ln , matches that of China (Figure 8). The variance of the \ln of the nominal output ratios fell (from 0.82 to 0.67), as in China. The variance of the \ln of the labor productivity ratios slightly increased (from 0.26 to 0.34), as in China. The variance of the \ln of the labor ratio increased (from 0.92 to 1.00), as in China. The covariance of the \ln of the labor productivity ratios and the \ln of the labor ratio decreased (from -0.02 to -0.04) and was negative in the final period, as in China. Not only did inter-state trade barriers in this period increase, but the variances are all higher than in China, suggesting that trade barriers in the U.S. are more substantial than in China.⁴¹

Quantitative Evidence 4: Agriculture and the Weather

In a final step, AY wishes to show a movement of factor allocations away from patterns of exogenously given comparative advantage. He focuses on agriculture. In charts, he shows that in 1978 labor intensity, measured as the \ln of primary sector employment per hectare (ha) of sown land, was positively correlated with the yield, measured as the \ln of grain output in tons per ha of land sown with grain. AY regards this as a "natural" positive association (p. 1120). By 1997, however, that relationship had disappeared, and AY suggests trade barriers as reason. Figure 9 reproduces the positive correlation for 1985 (the first year of AY's subsequent regression analysis), here in non-logarithmic values, as well as the absence of a correlation in 1997.

⁴⁰ For time series charts of the variances and covariances of primary-secondary sector ratios and secondary-tertiary sector ratios see the appendix on variance decomposition. AY only mentions in passing "relative output of primary to secondary industry, two predominantly tradable sectors" (pp. 1116f.). I do not understand in how far tradability for *both* sectors is needed. At any rate, only about 20-40% of all grain produced in China is actually traded and much of this trade could occur very locally (see Carsten Holz, 2006, Appendix 13); i.e., AY's predominantly tradable primary sector possibly involves very little trade. In as far as much of the labor flow between secondary and tertiary sector is likely to happen in urban areas, the household registration system is less likely to obstruct such flows.

⁴¹ The values for the U.S. in 1977 and 1994 in Figure 8 are different from those of AY reported in Table 1. My sources (see notes to the figure) are identical to those of AY except for employment where AY uses the BEA's "state personal income 1968-95" data whereas I use the BEA's "income and employment tables by SIC industry, 1958-2001," with "total full-time and part-time employment by industry." (I do not have access to AY's data; see note 34.)

Figure 10, also reproducing AY's findings, shows that low-yield provinces in 1978 (here 1985) experienced an increase in labor intensity in the following years, and vice-versa for initially high-yield provinces. AY argues that the 1978 (or 1985) yield reflects the technology available to a particular province, which in turn determines labor input. Labor intensity in the period 1985-97, thus, moved *against* the comparative advantage (technology, original yield).

To further show that provinces have moved against their comparative advantages, AY switches to regressions and a weather-focused measure of comparative advantage (rather than the 1978 yield). He regresses the annual provincial yield of 1985 through 1997 on input variables (irrigation, fertilizer, power, labor), year and province dummies, and three measures of rainfall: precipitation, precipitation squared, and the coefficient of variation of monthly rainfall. In a second step, the three rainfall variables are combined using the coefficients from the first regression, and then for each province averaged over the 13-year period in order to obtain one time-invariant measure of provincial "weather." This is a province-specific measure of comparative advantage.

Regressing the various inputs, in particular labor, on this weather variable interacted with time (and including year and province dummies), the weather-time comparative advantage variable has a negative impact on all four inputs. This suggests that "over time provinces with better weather withdrew factors of production from agriculture" (p. 1124). Regressing the yield on the various factor inputs and weather interacted with time yields a negative coefficient of labor as well as of comparative advantage; i.e., "provinces with good weather [comparative advantage] experienced declining yields" (p. 1126).⁴² The first three columns of Table 2 reproduce the key findings of AY.

Conceptual issues

AY in interpreting the charts argues that the causality in Figure 9 in 1978 (or 1985) runs not from labor intensity to grain yield, but in reverse. Provinces endowed with a superior technology "will have more productive land, raising the marginal product of labor on that land and drawing labor into the sector" (pp. 1121f.). But "with *barriers to trade* [emphasis added], the tendency for factors to flow into more productive sectors can be weakened and, possibly, reversed. In a free market economy, provinces with better agricultural yields would experience a decline in the price of grain, which would reverse the flow of factors of production into that sector. In China, with the enduring national and local controls over the price of grain, price mechanisms such as this are unlikely to be at play. Nevertheless ... in provinces with productive land, farm labor, faced with limited internal demand, migrates into industrial activity. Evidence in favor of a reversal of the link between yields and factor intensities is given in [here, Figure 10] which shows that the provinces with the most productive agricultural sectors in 1978 [here, 1985] were

⁴² "Provinces with good weather experienced a relatively lower increase in yields" would be a more accurate statement. AY also reports results for the regressions of inputs on year dummies, weather, and weather interacted with time, i.e., omitting provincial dummies and including weather itself. The significance results largely disappear; the coefficients are the same but the replacement of provincial dummies by the provincial comparative advantage (weather) leads to a poorer fit.

the ones that, relative to the mean change, experienced the greatest declines in the labor intensity of agricultural production.”⁴³ (p. 1122)

Implicit in the second-to-last sentence of this statement, and crucial to the argument, is the assumption that the imposition of (or increase in) inter-provincial trade barriers leads to *lower* prices (or lower labor intensity in the absence of a free market, as argued by AY) in provinces with *better* technology (higher initial grain yields). He offers no reason why this should be the case. The argument is plausible if it is made in terms of excess supply or demand: if local production of grain is insufficient to meet local demand after the imposition of trade barriers, the price (labor intensity) is likely to rise; if local production of grain exceeds local demand after the imposition of trade barriers, the price is likely to fall. Key to the analysis of local price (labor intensity) behavior is the degree of positive or negative excess supply after the imposition of trade barriers, i.e., in a closed provincial economy. But yield is not a measure of a province’s excess supply (excess supply within a closed provincial economy). Yield is not even *correlated* with the degree of aggregate household excess demand for grain, neither in 1985 nor in 1997.⁴⁴

With yield being neither a measure for nor a proxy of excess supply, yield has no implications for how prices (labor intensity) behave in response to the imposition of trade barriers. If nothing else happened between 1985 and 1997 except that trade barriers increased, then the scattergram of technology (original yield) and change in labor intensity (Figure 10) should look random. This it does not. AY lacks both an explanation of the observed pattern and a test of a change in the degree of trade barriers.

The same holds for AY’s regression of labor (and other factor inputs) on comparative advantage (“weather,” interacted with time). The estimation results imply that, controlling for a general time trend, provinces with a high comparative advantage (better weather) reduce primary sector employment per area of sown land. Implicit in the trade-barrier-as-cause argument again is the assumption that better weather also means provincial excess supply of farm products, so that as trade barriers go up, labor leaves the fields in those provinces which have a comparative advantage. But neither does AY provide an argument that better weather means excess provincial supply nor is weather correlated with aggregate household excess demand for grain.⁴⁵

The estimation results of *yield* regressed on factor inputs and weather interacted with time imply that provinces with a comparative advantage (better weather) make ever less use of it in terms of producing yield. But increasing trade barriers cannot account for this finding. First, why

⁴³ In this passage AY accepts the existence of *national* and local controls over the price of grain, but interprets agricultural procurement price fluctuations in his second section as evidence of trade barriers.

⁴⁴ Aggregate household excess demand for grain is measured as aggregate provincial household grain consumption divided by provincial grain production (with details in the appendix on regression analysis). In 1985, the correlation coefficient is -0.0792, and in 1997 -0.0845 (after correcting two typos in AY’s grain output data); neither is different from zero at the 10% significance level. The same holds if grain output per capita is used as a measure of excess supply/demand (with correlation coefficients of 0.3115 and 0.0048, neither significant).

⁴⁵ In 1985, the correlation coefficient is 0.0829, and in 1997 0.2792 using AY’s original measure of weather, or 0.0703 and 0.2702 using a corrected weather measure, or -0.2148 and -0.2165 using a comprehensive weather measure (all explained below in the text); none is statistically significantly different from zero (apart from the fact that the first four have the wrong sign for AY’s argument). The same holds if grain output per capita is used as a measure of excess supply/demand (with correlation coefficients of 0.2062 and -0.1615 using the corrected weather variable, and 0.1577 and 0.1200 using the comprehensive weather variable).

would an increase in trade barriers cause provinces with excess supply to reduce *yield*, i.e., to waste resources? If anything, an increase in trade barriers should cause provinces with excess supply to reduce the *sown area of grain* (and to use the land for the production of agricultural products in which there is excess demand), without necessary effect on grain *yield*. But suppose a province has excess supply in *all* agricultural products, so that the only way for farmers to respond to trade barriers is to reduce yield, possibly across the board, and including grain. Then, second, the point remains, as above, that a high weather value does not imply (nor is correlated with) provincial excess supply of grain. In other words, an increase in trade barriers may cause a change in the degree of provincial excess supply and therefore a change in yield. But weather can't substitute for provincial excess supply in this causal chain: it neither (logically) stands for, nor proxies, provincial excess supply. AY's has no valid test of his hypothesis.

Alternative explanations

What do AY's findings on the impact of comparative advantage on factor inputs and yield mean when taken literally? Factor inputs and yield, controlling for year and province, exhibit a positive time trend (except for labor). This increase is reduced depending on the comparative advantage of the province. The "better" the typical weather of a province for producing yield, the stronger the softening effect. This implies a relative catching up of the provinces with an originally comparative disadvantage. This is plausible if, for example, improvements in seed technology favor those provinces with a comparative (weather) disadvantage; seed innovations may well take the form of making seeds more resistant to inhospitable climate conditions. It is also plausible if central government policies on agriculture favor the provinces with the lowest values of comparative advantage (or initially lowest yield).

Second, Figure 10 suggests that the initial provincial level of comparative advantage measured as grain yield is negatively correlated with the change in primary sector employment per ha of sown land; a similar result is obtained in the regression analysis (with comparative advantage measured as weather). A closer examination of Figure 10 shows that five Western provinces, namely Shaanxi, Ningxia, Gansu, Qinghai, and Xinjiang, create the negative correlation. If these five provinces, which accounted for 5.86% of China's grain output in 1985, are omitted, the slope turns slightly positive. Assuming AY's logic of the impact of trade barriers on factor allocation were correct (contrary to what is argued above), this suggests no factor movements against comparative advantages except in these five provinces; that, in turn, suggests no trade barriers except in these five provinces.

What is special about these five provinces? All five are backward provinces, furthest from the more industrialized areas of China, with some of the most limited highway access, and with perhaps the least entrepreneurial spirit in China. Given the distance from China's grain basket provinces (identified in the notes to Figure 10), transportation and distribution costs may also mean that farmers in these provinces operate at largely subsistence level. In the near-absence of labor movement within agriculture across provinces (due to tradition/ clan systems/ culture), and perhaps in these five provinces the highest barriers to exit from agriculture anywhere in China

(due to the lack of rural non-agricultural employment opportunities), rural population growth in these provinces may simply translate into rural labor growth.⁴⁶

A third alternative explanation is provided by AY himself: “Chinese agricultural production during the reform period has become less dependent on the weather, the simple manifestation of technological progress that has undermined historical sources of comparative advantage in agriculture” (p. 1126). His subsequent last refuge for trade barriers is that for the 15 provinces for which the data are available for all years, labor intensity and yield were positively correlated in 1952, 1957, 1965, 1978, and (somewhat weaker) 1988, reflecting a “completely sensible relation between labor inputs and land yields” (p. 1126). But in 1997 there was no correlation.

As argued above, trade barriers cannot logically explain the de-linking of yield and labor intensity. Furthermore, the bivariate analysis may well be too simplistic. For example, between 1985 and 1997, labor intensity in Inner Mongolia fell by 26.61%, while grain yield increased 64.13%. Inner Mongolia has the fourth-lowest comparative advantage value (weather as measured by AY) among all provinces. AY’s earlier argument would suggest that this heavily disadvantaged province would move labor into agriculture, instead it shows the largest fall in labor intensity among all provinces while still increasing yields at a near-record level (third-highest increase among all provinces). A similar case is Heilongjiang, with a low comparative advantage value, a slight reduction in labor intensity (-1.10%), and the highest increase in yield among all provinces (99.57%). Both provinces are characterized by a massive shift out of wheat into corn and soybean production. Perhaps provincial self-sufficiency forced these provinces into producing wheat for food prior to the reform period. In the reform period, the development of national grain markets, i.e., access to inter-provincial trade, then allowed them to specialize in feed production. Such developments, and perhaps similarly for other provinces, could well explain the 1997 absence of a correlation in AY’s last refuge argument. Free to specialize, provinces specialize on those types of grain for which their localities are most suited, and the type of grain then determines labor, irrigation, fertilizer, and machinery requirements.⁴⁷

Questioning the accuracy of AY’s evidence

AY’s regression analysis suffers from a number of econometric issues. Some of the variables are also problematic, such as using *total primary sector* employment per sown area as the variable to relate to grain yield, rather than only employment in the production of grain, a limitation imposed by the data. Some of these issues are addressed in the following. All are discussed in detail in an appendix on regression analysis.

⁴⁶ All five provinces have some of the very lowest “weather” (comparative advantage) values, except Shaanxi, which has a medium value; these cases, thus, also affect the regressions. Dropping these five observations in Figure 9 yields a slightly positively sloped 1997 trendline.

⁴⁷ Yet a further alternative explanation is presented in the appendix on regression analysis. In the literature, Albert Park and Yang Du (2003) question the accuracy of the agricultural labor data as well as the combination of primary sector employment with grain production. They switch to a different dataset with crop-specific labor data and net value added as a measure of output, and, controlling for comparative advantages (the weather*time variable), find a positive and significant impact of labor on soybean yield value and an insignificant impact on wheat and corn yield value. Weather times time has a negative and significant impact on labor inputs only for wheat.

Alternative evidence

Table 2 reconstructs AY's core regression results, correcting four errors in his data and switching to more meaningful measures of irrigation and agricultural machinery.⁴⁸ (Both types of adjustments, together and independently, slightly improve/strengthen AY's key findings.) The first regression reported in Table 2 serves to identify the contribution of precipitation, precipitation squared, and the coefficient of variation of precipitation to yield; for each province, the sum of the three coefficients multiplied with the variable values yields an aggregate value, which, once averaged across 1985-97, then constitutes the provincial comparative advantage value "weather." AY's key findings of the negative impact of comparative advantage on labor and yield over time are in the second and third data columns (AY's regressions 5 and 8).⁴⁹

AY's source of provincial data on precipitation, the *Statistical Yearbook*, in adjacent tables reports monthly temperatures and duration of sunshine. These appear as relevant for a measure of weather (or comparative advantage) as precipitation, perhaps even more so because typically more than half of all fields are irrigated, making precipitation less relevant; furthermore, irrigation water may come from rivers fed by rainfall in distant provinces.⁵⁰ The fourth regression, therefore, repeats the first but makes use of all available climate information to derive new weather values. The following two regressions then repeat AY's core regressions, but now with the new, comprehensive weather values based on the fourth column.⁵¹ AY's findings in the case of labor are reversed: provincial labor intensity moves along rather than against the comparative advantage (weather). AY's findings for yield are partially reversed: labor intensity now has no impact on yield, rather than a negative impact, but the yield still moves against the comparative advantage, although the size of the effect now is greatly reduced.⁵²

With AY arguing for a causality from grain yield to labor intensity, a natural consequence is to allow for such a causality in the regressions. The 3SLS results are reported in the last two columns of Table 2. In the labor regression, the higher the yield, the higher labor intensity, as AY expects with free markets. Labor intensity moves along rather than against the comparative advantage over time (AY's supposed evidence for trade barriers disappears). In the yield regression, labor intensity has a negative impact on yield (as in AY's findings), but the comparative advantage is not associated in any way with how yield changes over time. Overall, provinces are clearly not moving in labor or yield against their comparative advantage.

⁴⁸ The details are reported in the appendix on regression analysis.

⁴⁹ For the regressions, I adopt AY's practice of using the ln of variable values because the consequence of doing so, in regression analysis, has a clear and useful meaning (of coefficients measuring percentage changes).

⁵⁰ AY offers no explanation why he ignores the temperature and sunshine data.

⁵¹ Spearman's coefficient of rank-order correlation between the two measures of weather (based on precipitation, first column, vs. based on temperature, precipitation, and sunshine, fourth column) at 0.1345 is significantly different from zero only at a 24% significance level. I.e., using a standard 5 or 10% significance level, the two weather measures are not correlated.

⁵² A one standard deviation increase in the value of weather (0.055) is associated with about 0.2% per year slower growth in yield compared to 0.6% per year slower growth in AY's case (third column, with a standard deviation of AY's more limited measure of weather of 0.022), and compared to a mean provincial trend growth of yield of 2.5% per year.

The control variables in the 3SLS regressions all come with plausible results. (i) The more fruit output relative to grain output, the higher labor intensity, measured here, as by AY, by primary sector employment per ha of sown land (fruit production requires about five times more labor per land area than grain). (ii) The higher labor productivity in the primary sector (primary sector value added per primary sector laborer) relative to labor productivity across the provincial economy (provincial GDP per laborer), the lower labor intensity. (iii) The larger the share of SOEs in investment, i.e., the less reform-minded the province, the higher (primary sector) labor intensity. (iv) The larger the share of rural workers that is in agriculture, i.e., the fewer non-agricultural jobs in the countryside, the higher the labor intensity. (v) The higher the share of rice in grain sown, the higher the yield (rice has an approximately 50 percent higher yield per land area than wheat). (vi) The higher the benefits (net financial results per laborer) of growing fruit in comparison to the benefits of growing grain, the higher the yield; one reason could be that as farmers switch from grain to fruit production, the land on which grain is sown needs to be worked more intensively to meet the government's grain production/quota targets.⁵³

AY assumes that yield and factor inputs follow a deterministic trend, which is not likely if seed technology or improvements in machinery are random, or if new job opportunities in the non-agricultural sector open up randomly. An alternative is to take first differences of yield and factor inputs, i.e., of irrigation, fertilizer, power, and labor (all in ln as in AY's regressions), and to rerun the core regressions, those with labor and yield as dependent variables. Comparative advantage (weather) never matters for the annual change in labor or yield (Table 3); nor does weather interacted with time (if included despite the fact that first differences were already taken).⁵⁴

Finally, one may want to take into consideration that province-specific factors can change over time. All such province-specific, time-dependent factors, if they are correlated with AY's measure of comparative advantage, end up being captured by the coefficient of his weather variable (one provincial value independent of time) interacted with time. His comparative advantage variable interacted with time, thus, captures not only climate (exogenous) advantages. A wide range of other factors is plausibly correlated, even if only weakly, with AY's weather values; they range from province-specific government agricultural policies over time (possibly mandated by the center) to improvements in specific seed technology (for one type of grain produced in a limited set of provinces), changes in province-specific rural attitudes towards migration, and provincial rules on land tenure.

⁵³ The reported results differ in no significant way if the three control variables irrigation, fertilizer, and small tractors are omitted from the labor regression (as AY does). I have included them because I think them, a priori, relevant. The reported 3SLS results in terms of the effects of comparative advantage over time on yield as well as on labor hold for all variations of the 3SLS regressions that I have explored, as does the effect of yield on labor. The effects of labor on yield loses significance in one scenario. The appendix on regression analysis reports the results of some variations of the 3SLS regressions, going both for a more elaborate as well as for a minimalist setup.

⁵⁴ Including irrigation, fertilizer, and small tractors in the labor regressions does not change the results. In the labor regression only, if year is included (and weather interacted with time is not), year is significantly negative; alternatively, if weather interacted with time is included but year is not, weather interacted with time is significantly negative (but not so for yield, where weather interacted with time, or, separately, year, remain insignificant throughout these variations). In the regression reported in the table I include both simultaneously, year and weather interacted with time, so that weather interacted with time cannot capture general time effects but only comparative advantage effects.

To take province-specific, time-dependent but not necessarily comparative-advantage factors into account, yield is first regressed on AY's usual control variables (irrigation, fertilizer, small tractors, and labor), provincial characteristics (provincial dummies) and provincial characteristics *interacted with time*. The coefficients of the latter capture the average annual provincial growth rate in yield *after* controlling for factor inputs and time-independent provincial characteristics. In a second step, the obtained 29 provincial growth rates (coefficients) are regressed on a constant and the measure of comparative advantage (the comprehensive weather variable covering 9 climate variables). Comparative advantage has *no significant* impact on provincial growth rates (at or anywhere near the 10% significance level). Replacing the constant by 3 regional dummies (East, Center, West) makes no difference. In other words, once provinces are allowed to exhibit province-specific growth patterns outside the common trend (year) and AY's imposed straightjacket of relative comparative advantage (the relative values across provinces embedded in the weather variable that is interacted with time), comparative advantage plays no longer any role in explaining provincial changes in yield over time. Proceeding similarly for labor, with or without the three control variables (irrigation, fertilizer, and small tractors) in the first step regression, weather has a *positive and significant* impact on provincial changes in labor over time.⁵⁵

The U.S. experience

Figure 11 reports 1978 and 2002 labor intensity and yield for the U.S., where the yield measure covers those grains which in the agricultural census are uniformly measured in bushels (grain details are in the notes to the figure). For these grains, rather complete data are available in both years. Focusing on the core states, those with labor intensity below 0.1, the year 1978 comes with positive slope and the year 2002 with a negative slope. I.e., following AY's logic, the introduction between 1978 and 2002 of severe trade barriers between U.S. states led to a strong factor movement against comparative advantages.⁵⁶

Conclusions

AY concludes: "The central proposition of this paper is, seemingly, unbelievable. One is asked to accept that twenty years of economic reform in the People's Republic ... have resulted in a fragmented internal market with fiefdoms controlled by local officials whose economic and political ties to protected industry resemble those of the Latin American economies of past decades." (p. 1128) This paper suggests that not only "seemingly," but, in effect, the central proposition of AY's paper is unbelievable. Undoubtedly, China at some points of time during the reform period experienced some specific cases of local protectionism, but that does not necessarily mean widespread local protectionism with substantial impact.

⁵⁵ The significance levels, identical in the two variations of the dependent variable (the provincial time coefficients obtained in the regression of labor on provincial dummies, provincial dummies interacted with time, and in one variation including the three control variables), are 1% with intercept and 5% with 3 regional dummies.

⁵⁶ Further details on the data and the results if a labor intensity of 0.3 is used as a cut-off point and/or if all grains are included (and trying to convert the different measurements) are reported in the appendix on regression analysis.

None of AY's evidence for trade barriers holds up to scrutiny. AY's economic rationale for trade barriers to increase in the reform period requires no or few trade barriers, or no or few *local* trade barriers in the pre-reform economy. The literature suggests that none of these possible assumptions for the pre-reform economy are correct. Alternative economic rationales and documentary evidence on economic policy suggest a decrease in trade barriers over time, or the largely absence of trade barriers all along. Across AY's four quantitative arguments, the causal link between trade barriers and evidence is weak or non-existent, alternative explanations for the evidence appear at least as (if not more) plausible than the trade barrier explanation, the quantitative evidence is at times inappropriate to address the argument, and alternative evidence suggests a different conclusion.⁵⁷

Going through the quantitative analyses, the perhaps strongest counter-argument to AY's output convergence argument is that when one examines the economic sector on which his economic rationale focuses, namely the industrial sector, the finding is one of output divergence; if AY's trade barrier argument were plausible, this would imply *decreasing* trade barriers. In the case of prices, no increase in price dispersion can be found (which, in AY's logic, means no increase in trade barriers), and the observed cyclical patterns over time match institutional developments in the economy well; his claim for 1990-99 of "trade wars that are periodically interrupted and suppressed by the central government" lacks evidence of such government action. The variance decomposition exercise yields exactly what AY expects to find for the case of no trade barriers once the data are examined that AY refers to in his argument. The final regression analysis, once technically improved, shows that provinces have not moved against their comparative advantages, which in AY's logic means no trade barriers.

If the reader were to still take AY's evidence as sign of increasing local trade barriers, s/he will also have to accept that over the past 25 years fierce trade wars have been raging across the U.S. Individual patterns raise challenging research questions, such as how the enormous reduction in trade barriers between 1980 and 1981, in just one year, came about, and was then reversed through a drastic increase in trade barriers in just a few years after 1981 (Figure 2). Where Chinese economists, the Chinese central government, and China researchers abroad quickly noticed the problem of barriers to inter-provincial trade, a rich research and policy agenda has utterly escaped the attention of those interested in the U.S. economy.

The reader who nevertheless continues to believe in increasing local trade barriers in China and in the U.S. will also have to somehow reconcile the sometimes contradictory year-specific conclusions on increase or decrease in trade barriers that follow from the first two quantitative analyses by AY, where year-specific conclusions are readily available. The summary increase in trade barriers over time in the third and fourth quantitative analyses of AY would also have to somehow be reconciled with the trade wars which are periodically interrupted and suppressed by the central government in AY's second quantitative analysis.

⁵⁷ AY in the final sentence of his abstract (only) moves away from trade barriers to a broader argument of provincial fragmentation: "Thus, the reform process led to the fragmentation of the domestic market and the distortion of regional production away from patterns of comparative advantage" (p. 1091, abstract). But even the fragmentation argument fell apart in the analysis here: AY's point of provinces moving away from their comparative advantages (whether explained by trade barriers, as AY does, or not) also turned out to be unsustainable.

The title of AY's paper, "The Razor's Edge: Distortions and Incremental Reform in the People's Republic of China," refers to the Katha-Upanishad with "Sages say the path [to salvation] is narrow and difficult to tread, narrow as the edge of a razor." This paper suggests that China's economic reforms have not strayed from the safe path, at least as concerns avoiding the swamp of trade barriers. The path seems sufficiently wide—perhaps the size of a major highway— that some puddles in some stretches appear to have been largely irrelevant.

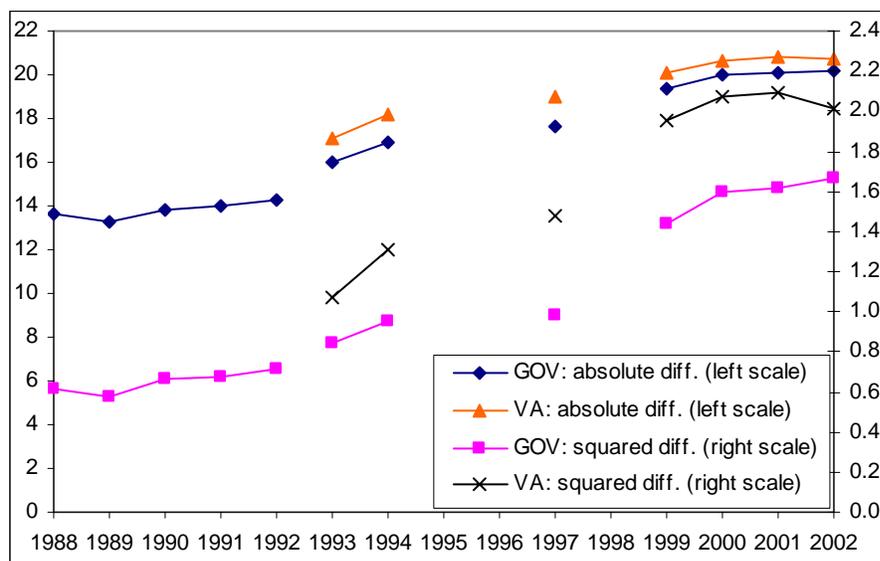
This does not mean that China has (or had) no inter-provincial trade barriers whatsoever. Nor does it mean that China's economy is not distorted, or that the abolition of one distortion does not lead to one or more new distortions. It means that AY's arguments for trade barriers and/or evidence do not hold, and that in as far as the trade barrier case is meant to be an example of how the removal of old distortions leads to (significant) new distortions, AY does not have an example. If central government policies are anything to go by, local protectionism was worthy of some attention in 1990 or just before 1990, but has otherwise always been a minor issue. With local protectionism a phenomenon of all economies, one may wonder if China does (did) not simply differ in degree, if even that.

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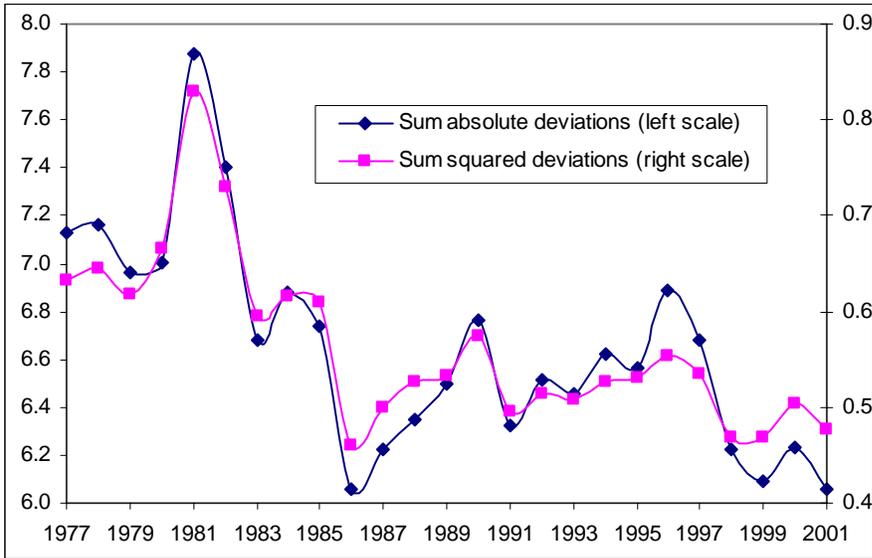
GOV: gross output value in current prices; VA: value added in current prices.

The data cover the directly reporting industrial enterprises (on other industrial enterprises no sectoral data are available); this group of enterprises was re-defined in 1998. The sectoral classification differs between three periods: 1988-1992 (36 sectors, covering virtually all of industry, presumably except the arms and ammunition industry), 1993-1997 (39 sectors, of which 37 sectors were used, because for one very minor sector no 1997 data are available, and for another very minor sector no 1994 data are available), and 1999-2002 (25 major sectors only, out of a total of 37 in the *Statistical Yearbook* (which excludes arms and ammunition), a source which does not have sectoral data by province). For changes in the sectoral classification over time also see Carsten Holz (2003, Chapter 2). The number of provinces in the first two periods, 1988-1992, and 1993-1997 is 30 (separate Chongqing data are first available for 1997 and were folded back into Sichuan); the number of provinces in 1999-2001 is 31 (separate Chongqing data are now available for all years).

In the calculation of deviations, the average share of a particular sector in provincial total output is the arithmetic mean across provinces. Using the one nationwide value to obtain the average share of a particular sector in nationwide total output yields identical time trends.

Source: *Industrial Yearbook*, numerous issues.

Figure 1. Divergence in the Composition of Output Across Industrial Sectors in China

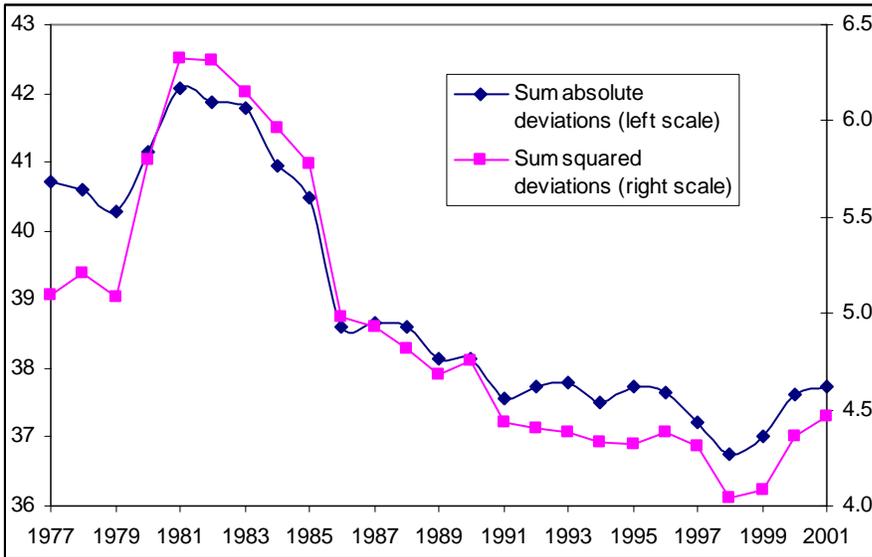


The data are gross state product data, approximately corresponding to the national concept of GDP.

The calculation procedures match those of Alwyn Young (2000), and use mean state shares (using nationwide shares yields the same time pattern).

Source: <http://www.bea.gov/bean/regional/gsp/> (accessed 22 May 2004). See notes on webpage for definitional issues. An appendix on U.S. data on cross-state specialization and price dispersion provides more details.

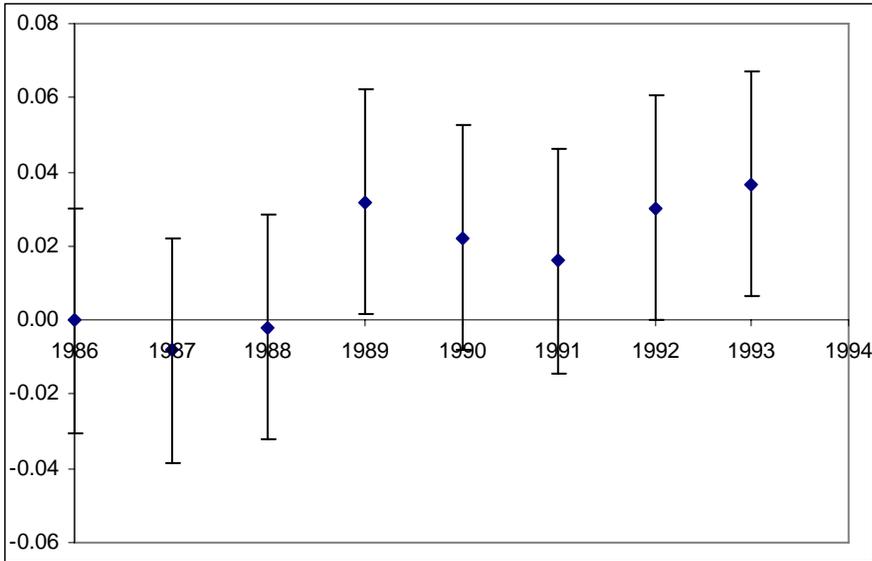
Figure 2. Convergence in the Composition of Value Added Across U.S. States



For details on the data and their manipulation see Figure 2 (and the appendix on U.S. data on cross-state specialization and price dispersion). The deviations in this figure are across 25 subsectors of industry (and the 51 states).

Source: <http://www.bea.gov/bean/regional/gsp/>. See notes on webpage for definitional issues.

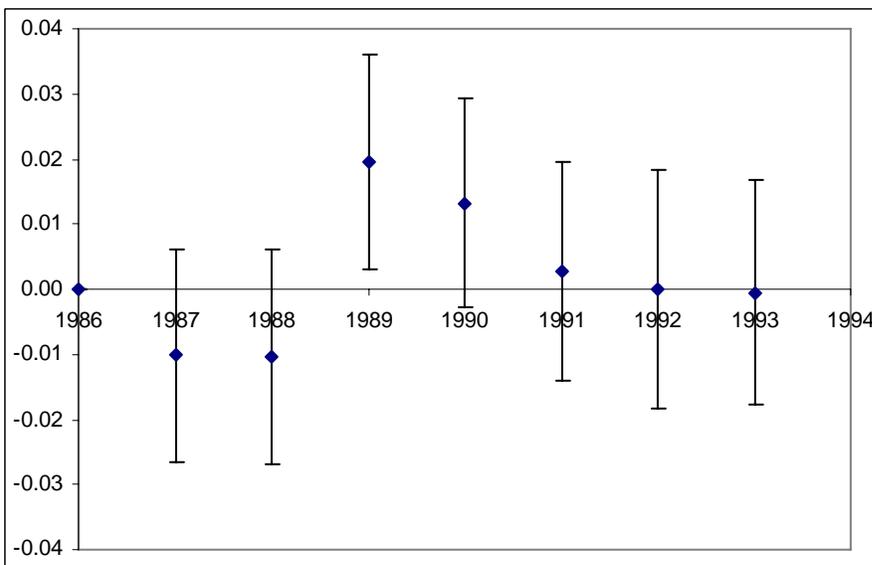
Figure 3. Convergence in the Composition of Industrial Value Added Across U.S. States



Each observation in the chart is the coefficient of the corresponding time (year) dummy in a regression of the coefficient of variation (of prices of a particular product across 29 large and medium-sized cities) for each of 41 products against a complete set of product dummies and time dummies for all periods except the first (1986). The coefficient represents the difference in price dispersion compared to 1986. The vertical bars reflect ± 2 standard errors. Products with fewer than five price observations (across cities) at a particular point of time were excluded in that particular period (to match Alwyn Young's procedure). For a further discussion of the data and their coverage see the appendix on price data.

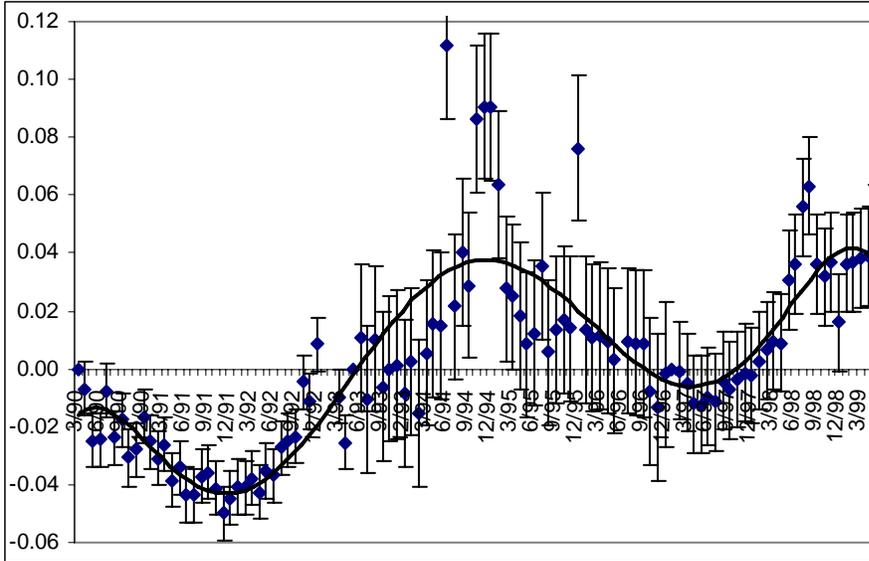
Sources: Alwyn Young (data posted online at <http://gsbwww.uchicago.edu/fac/alwyn.young/research/>) and his original source, the *Price Statistical Yearbook 1988 through 1994*.

Figure 4. Price Dispersion of Annual Retail Prices of Selected Consumer Goods



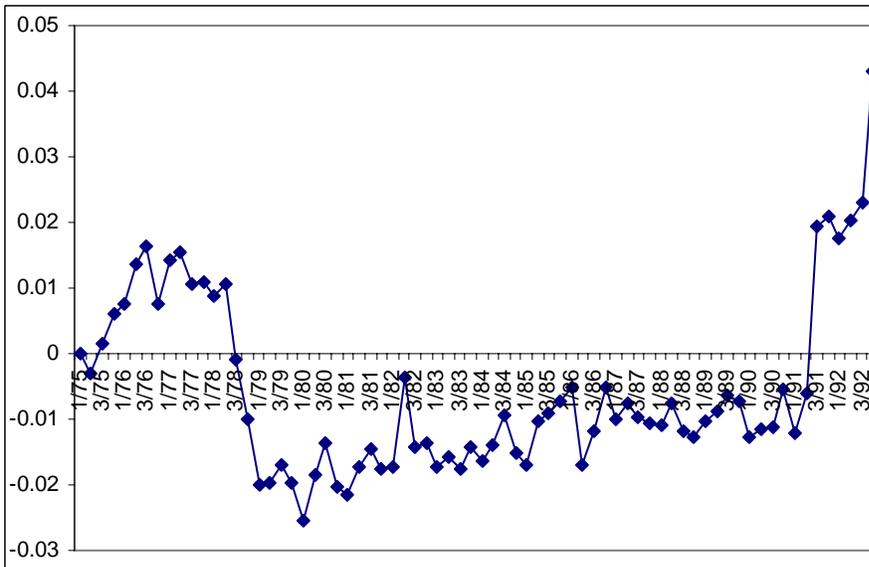
For notes and sources see Figure 4, and for details on the removal of outliers the appendix on price data.

Figure 5. Price Dispersion of Annual Retail Prices of Selected Consumer Goods Without Outliers



The chart covers three distinct periods, 3/90 – 4/93, 5/93 – 12/96 (with an increase in the number of localities covered from 24 to 35), and 1/97 – 5/99 (with a major redefinition of product specifications). See notes to Figure 4 on how to interpret the chart, and the appendix on price data for further details. Sources: Alwyn Young (data posted online at <http://gsbwww.uchicago.edu/fac/alwyn.young/research/>) and some issues of his original source, the *China Price* magazine.

Figure 6. Price Dispersion of Monthly Industrial Materials Prices



The data are quarterly price data for 26 non-perishable goods in 48 U.S. cities (nationwide) in the period 1/75 through 4/92. For detailed explanations see David Parsley and Shang-Jin Wei (1996). See the appendix on U.S. data on cross-state specialization and price dispersion for further details. Source: <http://mba.vanderbilt.edu/david.parsley/Research.htm>, accessed on 26 June 2004.

Figure 7. Price Dispersion Across U.S. Cities

Table 1. Variance Decomposition, Primary Vs. Secondary Sector

	Variance of			Covariance of
	$\ln \frac{P_P Q_P}{P_S Q_S}$	$\ln \frac{P_P Q_P / L_P}{P_S Q_S / L_S}$	$\ln \frac{L_P}{L_S}$	$\ln \frac{P_P Q_P / L_P}{P_S Q_S / L_S}, \ln \frac{L_P}{L_S}$
Alwyn Young^a				
a. China (28 provinces)				
1978	0.71	0.12	0.56	0.01
1997	0.53	0.15	0.73	-0.17
b. U.S. (50 states & D.C.)				
1977	1.18	0.31	0.63	0.12
1994	0.72	0.32	0.37	0.01
Calculations here^b				
1978	0.66	0.12	0.52	0.01
without Tibet	0.64	0.12	0.49	0.01
1981	0.75	0.15	0.71	-0.03
without Tibet	0.75	0.15	0.65	-0.03
1997(1) ^c	0.53	0.15	0.69	-0.16
without Tibet	0.48	0.14	0.59	-0.12
1997(2) ^c	0.53	0.13	0.75	-0.18
without Tibet	0.48	0.12	0.65	-0.14
	Variance of			Covariance of
	$\frac{P_P Q_P}{P_S Q_S}$	$\frac{P_P Q_P / L_P}{P_S Q_S / L_S}$	$\frac{L_P}{L_S}$	$\frac{P_P Q_P / L_P}{P_S Q_S / L_S}, \frac{L_P}{L_S}$
Calculations here^d				
1978	0.24	0.00	9.74	-0.02
without Tibet	0.21	0.00	7.53	-0.02
1997(1) ^c	0.15	0.01	6.97	-0.10
without Tibet	0.11	0.01	2.56	-0.06
1997(2) ^c	0.15	0.01	8.48	-0.11
without Tibet	0.11	0.01	3.28	-0.07

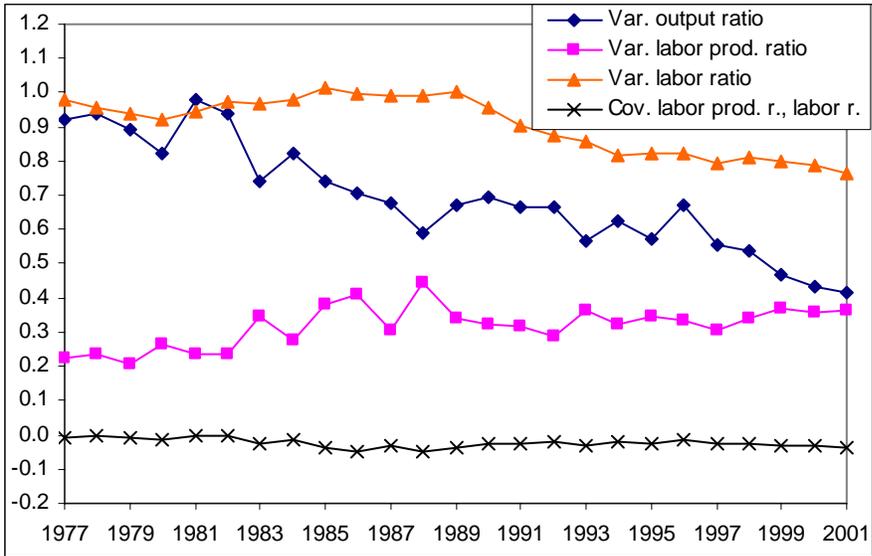
a: See AY's Table IV (p. 1116). AY presumably adds Chongqing (in the years when separate data are published) back into Sichuan, and says he excludes Tianjian and Zhejiang (which would make a total of 27 province). He also reports 1952, 1965, 1978, and 1997 data for 14 Chinese provinces (and finds a somewhat similar pattern between 1952 and 1965 as in the U.S.), but because the overall arguments of his paper (distortions begetting distortions, or trade barriers) concern only the reform period, earlier years are not examined here and these data not copied.

b: In the calculations here, Chongqing is added back into Sichuan in the most recent years when separate data are available. Tianjin is excluded throughout because of a lack of labor data in 1978-84. In contrast to AY's calculations, Zhejiang is included here (since the data are available), and Guangdong and Hainan are treated as two separate provinces throughout (again, the data are available), which makes for a total of 29 provinces.

c: Employment data for 1997 are from *Fifty Years* (1), and from the *Statistical Yearbook* (2).

d: See note (b). AY did not do these calculations, based on non-logarithmic values.

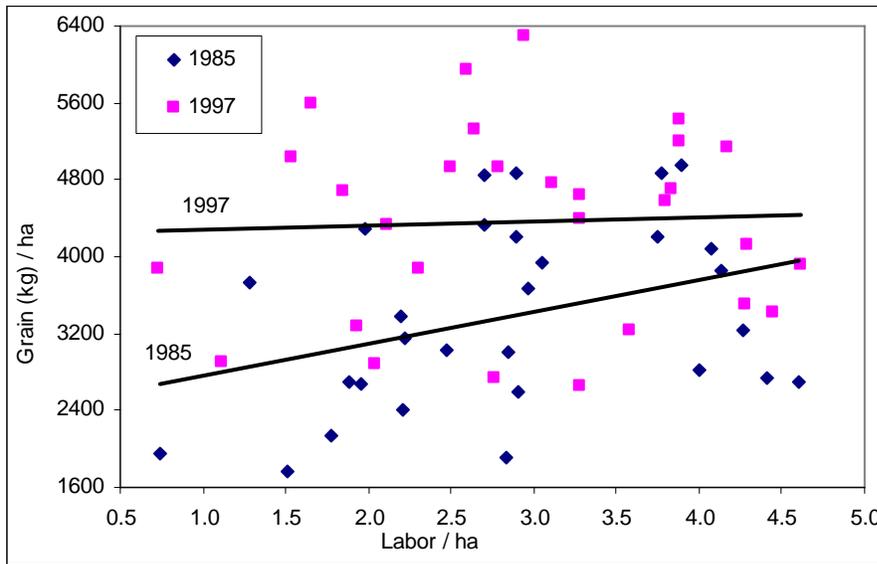
Sources (province-specific page numbers): Sectoral value added: 1978, 1990: *GDP 1952-95*; 1997, 2002: *GDP 1996-2002*. Employment: 1978, 1990, 1997(1): *Fifty Years*; 1997(2), 2002: *Statistical Yearbook*. Individual, missing data in the years prior to 1996 are supplemented from *Seventeen Years*.



Output of the primary sector is gross state product in agriculture, forestry, and fishing, of the secondary sector gross state product in mining, construction, and manufacturing. Employment of the primary sector is farm employment, and of the secondary sector mining, construction, and manufacturing employment (in the private sector). The District of Columbia is omitted due to zero employment in agriculture; Delaware is omitted in 1999-01 due to lacking employment data. Lacking employment data for Idaho and Minnesota in 1998 were bridged by using the average value of 1997 and 1999. Starting and final year in this figure are determined by the availability of employment data. (Employment data are also available for 2001-4, but the industry classification changed.)

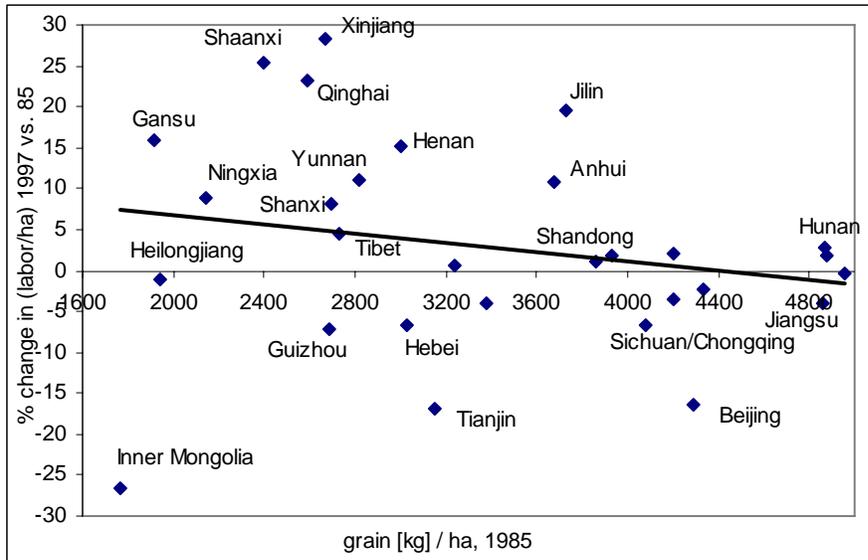
Sources: Output data: <http://www.bea.gov/bea/regional/gsp/> (accessed 22 May 2004); employment data: <http://www.bea.doc.gov/bea/regional/spi/default.cfm> (accessed 16 Dec. 2005).

Figure 8. Variance/Covariance of the LN of Primary Vs. Secondary Sector Ratios, U.S. States



Source: AY's dataset (or, similarly, data from *Statistical Yearbook 1985* and *1998*). Alwyn Young's grain output values for Guangdong/Hainan and Sichuan/Chongqing in 1997 and his primary sector employment value for Shandong in 1997 were corrected using the *Statistical Yearbook 1998* (from 32.693m tons to 21.116m, from 34.613m tons to 46.190m, and from 24.879m to 25.105m).

Figure 9. Factor Intensity and Productivity, 1985 and 1997



If the five Western provinces of Shaanxi, Ningxia, Gansu, Qinghai, and Xinjiang, which accounted for 5.86% of China's grain output in 1985, are omitted, the slope turns slightly positive. If Heilongjiang is omitted, the slope turns slightly more positive; when Inner Mongolia, in addition, is omitted, the slope turns back slightly negative. The five top grain producers in China, Jiangsu, Shandong, Henan, Hunan, and Sichuan/Chongqing accounted for 40.45% of total grain output in 1985.

Source and additional note: see Figure 9.

Figure 10. Initial Productivity and Change in Factor Intensity, 1985 and 1997

Table 2. Productivity, Factor Allocations, and the Weather

	AY'-1 Yield	AY'-5 Labor	AY'-8 Yield	1' Yield	5' Labor	8' Yield	3SLS Labor Yield	
Year	.003 (1.1)	.006** (3.4)	.019** (4.7)	.005* (2.0)	-.032** (-6.3)	.015** (2.4)	-.025** (-3.2)	.011* (1.8)
Irrigation	.352** (7.6)		.271** (6.6)	.312** (6.6)		.307** (7.13)	-.101* (-1.8)	.257** (5.9)
Fertilizer	.202** (6.5)		.163** (5.0)	.190** (5.7)		.230** (7.2)	-.098* (-2.3)	.178** (5.5)
Small tractors	.044** (2.6)		.024 (1.4)	.043** (2.6)		.050** (2.9)	.015 (1.1)	.049** (2.9)
Labor	-.122* (-2.12)		-.166** (-2.9)	-.118* (-2.1)		-0.079 (-1.3)		-.417** (-4.3)
Precipitation	.022** (3.1)			.016* (2.1)				
Precip. squared	-.001** (-3.4)			-.001** (-2.7)				
Coeff. of var. of prec.	-.035* (-1.9)			-.029 (-1.5)				
Temperature				0.039* (2.0)				
Temp. squared				-0.002* (-2.3)				
CV of temp.				0.034** (2.9)				
Sunshine				0.002* (1.7)				
Sun. squared				-9.10 ⁻⁶ * (-2.1)				
CV of sunsh.				-0.092* (-2.3)				
Weather(AY)* time		-.157** (-4.1)	-.253** (-5.3)					
Weather*time					.095** (6.3)	-.043* (-2.4)	.064** (4.2)	-.005 (-.3)
Yield							.398* (2.1)	
Fruit-grain- output							.062** (3.4)	
Relative productivity							-.252** (-5.4)	
SOE share in investment							.061* (2.0)	
Agr. share in rural labor							.892** (10.0)	
Rice-grain- sown								.129** (4.5)
Fruit-grain- benefit								.052** (3.7)
Prov. dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R ²	.954	.978	.954	.958	.979	.951	.985	.951
Observations	375	377	377	372	377	377	364	

* / ** : significant at 10% / 1% level. T-statistics are in parentheses.

The observations are annual observations on 29 provinces (Guangdong combined with Hainan, and Sichuan combined with Chongqing) for the years 1985-97. The data are from AY (or from the *Statistical Yearbook* series) except for four corrections of presumably typos, and the switch to a more meaningful series of agricultural farm machinery in form of small tractors rather than ‘power,’ and a more meaningful measure of irrigation (all explained in the appendix on regression analysis). The numbers in the head row refer to the equations in AY’s Table V.

Yield: $\ln(\text{grain output (10 tons)} / \text{grain sown area (ha)})$. (The choice of “10” units follows the practice of AY.)

Irrigation: $\ln(\text{irrigated area} / \text{cultivated area})$.

Fertilizer: $\ln(\text{chemical fertilizer (10 tons)} / \text{total sown area (ha)})$.

Small tractors: $\ln(\text{power of small tractors and hand-led tractors (kw)} / \text{total sown area (ha)})$.

Labor: $\ln(\text{employment in primary sector (10 persons)} / \text{total sown area (ha)})$.

Temperature: average (for each year) monthly temperature (Celsius).

Precipitation: average (for each year) monthly rainfall (cm).

Sunshine: average (for each year) monthly duration of sunshine (hours).

Weather(AY): (province-specific) mean (of 1985-97) value of precipitation variables multiplied by coefficients in column “AY’-1.”

Weather: (province-specific) mean (of 1985-97) value of 9 climate variables multiplied by coefficients in column (1’).

Fruit-grain-output: $\ln(\text{fruit output (tons)} / \text{grain output (tons)})$.

Relative productivity: $\ln(\text{value added per laborer in primary sector} / \text{(provincial) GDP per laborer})$.

SOE share in investment: $\ln(\text{investment expenditures by state-owned units} / \text{total investment expenditures})$.

Agr. share in rural labor: $\ln(\text{agricultural laborers} / \text{rural labor force})$.

Rice-grain-sown: $\ln(\text{sown area of rice} / \text{sown area of grain})$. Since Qinghai province has no data on rice, inclusion of this variable implies the exclusion of Qinghai.

Fruit-grain-benefit: $\ln(\text{net benefit [in yuan RMB] per laborer of growing fruit} / \text{of growing grain})$; national variable, i.e., not province-specific (For details see the appendix on regression analysis.)

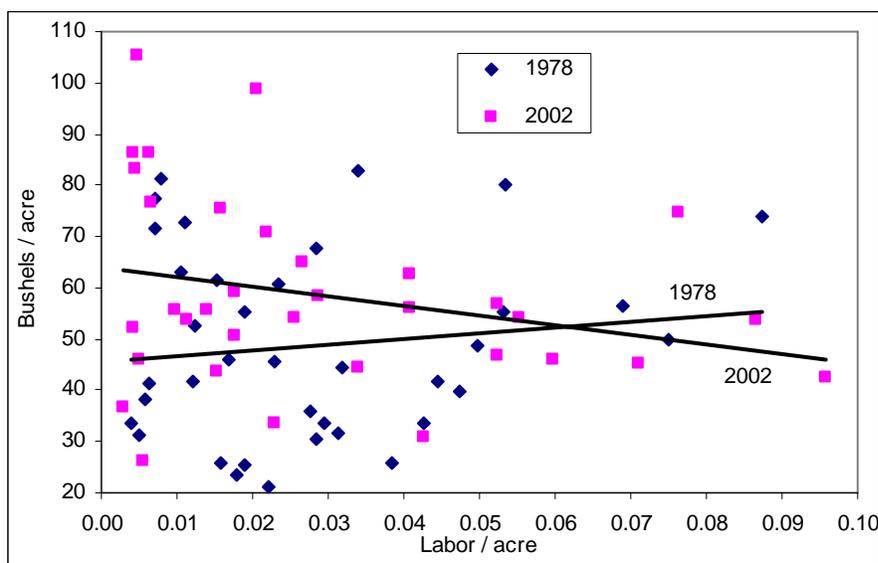
Sources: AY; *Statistical Yearbook* (issues of 1986-1998); *Fifty Years*; *Seventeen Years*; *Rural Yearbook*.

Table 3. Productivity, Factor Allocations, and the Weather: First Differences

	First differences			
	dLabor	dLabor	dYield	dYield
dIrrigation			.142 (.8)	.157 (.9)
dFertilizer			.151** (3.1)	.152** (3.1)
dSmall tractors			-.035 (-.6)	-.033 (-.5)
dLabor			-.057 (-.5)	-.061 (-.5)
Weather	-.141 (-1.6)	-.049 (-.2)	-.239 (-1.1)	-.534 (-1.1)
Year		-.001 (-1.0)		-.002 (-.7)
Weather *time		-.012 (-.5)		.040 (0.7)
R ²	.007	.036	.034	.035
Observations	348	348	348	348

* / ** : significant at 10% / 1% level. T-statistics are in parentheses.

Variables are defined as in Table 2 (see notes to Table 2); “d” denotes first differences.



A cut-off point of a labor intensity of 0.1 is applied. Only those grains are included which in the agricultural census are measured in bushels (corn for grain, wheat for grain, oats for grain, barley for grain, sorghum for grain, soybeans for beans). In 1978, grains measured in bushels accounted for 100% of grain output (all items) in about two-thirds of all states—with across many states data on several grains “not available”—but in 2002 all states had diversified away from grains measured in bushels. In part this could be an artifact in that in 1978 no state had any entry for “corn for silage or greenchop,” a non-bushel item, and this output was possibly included in “corn.” For further notes and sources as well as additional data see the appendix on regression analysis.

Figure 11. Factor Intensity and Productivity, Grains Measured in Bushels (U.S. States)