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The purpose of economic reform is to reduce distortions and enhance efficiency. However, when reforms are partial and incremental, individuals and local governments are often able to capture the rent inherent in the gradual transition process. Young (2000) warned that such rent-seeking behavior might lead to increasing market fragmentation. Empirical studies have shown the opposite in the product market. This article argues that as the rent from China's product market has been squeezed out due to deepening reforms, rent-seeking behavior may have shifted to the capital market. Further reforms are needed in the capital market to squeeze out these rent-seeking opportunities, just as those from the product and labor markets were squeezed out earlier. JEL Code: D33, D61, D63, O11, O53, P23.

Over the past 25 years, China's transformation from a centrally planned to an increasingly market-driven economy has led to substantial efficiency gains and rapid economic growth (Maddison 1998; Fan, Zhang and Robinson 2003). However, as Young (2000) argues, the reforms may not have been sufficiently complete to improve domestic market integration. This could happen, for example, if increased interregional competition as a result of fiscal decentralization led local governments to impose trade protection measures against each other.

Young's work has stimulated a series of studies to investigate trends in market integration. A recent survey by the China State Council Development Research Center (2003) indicates that China's domestic product markets have become more rather than less integrated. Measures of regional protection have also declined significantly over the past decade. Wei and Fan (2004) show that output prices have become more integrated. Huang, Rozelle, and Chang (2004) use evidence from the rice market to argue that China's commodity markets are becoming increasingly integrated as a result of the reforms. Based on a

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panel data set of 32 industries at the two-digit level of aggregation in 29 provinces, Bai and others (2004) find, after an initial decline, an increase in regional specialization of industrial production, suggesting diminishing impediments to regional trade flows. These findings appear to contradict Young's predictions about worsening market fragmentation.

Besides the final goods market, it is also possible that distortions occur in factor markets. De Brauw and others (2002) show that there has been a huge transfer of rural labor from the low-productivity farming sector to high-productivity nonfarm sectors over the past two decades, suggesting a shift toward a more integrated rural labor market. Using the population census data to examine labor flows across provinces, Poncet (2003) concludes that the inter-provincial border barriers to labor migration have declined from the 1980s to the 1990s. Zhang and others (2005) find that returns to education in nonpublic enterprises caught up with those in state-owned enterprises, indicating increasing labor mobility across sectors. Yet numerous studies suggest that there is still significant segmentation in the labor market (Meng 2000; Knight and Li 2005).

China has instituted several financial market reforms, such as the establishment of a stock market and regionalization of major banks. Yi (2003) argues that these reforms have made China's financial market more efficient. However, several empirical studies reach the opposite conclusion. Fan, Zhang, and Robinson (2003) find that the provincial marginal rates of return to capital in agriculture, urban industry, urban services, and rural enterprises have diverged since 1985. Boyreau-Debray and Wei (2003) use two methods to test the degree of capital market fragmentation based on provincial data for 1978–2000. The first approach is to examine the correlation of local savings and investment. In an integrated capital market the correlation should be low. The second approach, drawing from the risk-sharing literature, is to check the degree of consumption smoothing across time and space, which is an important indicator of capital mobility and asset market completeness. Both approaches show that the capital market has become more fragmented.¹

1. Recent rent-seeking activities in the banking and real estate sectors include those of Yang Xiuzhu, vice chief of the construction department of Zhejiang Province, who extracted bribes from property developers and disappeared (*Caijing* July 23, 2003); Shanghai real estate tycoon, Zhou Zhengyi, who was implicated in an array of illegal loans coupled with default on statutory compensations for relocatees whose homes were improperly demolished for redevelopment projects (*Shanghai Daily*, September 6, 2003); Chen Kai, a local government official of Fuzhou, Fujian Province, who borrowed an estimated \$50 million from six state banks and provided kickbacks of around 5 percent of the loans to the lending officers (*Washington Post*, December 17, 2003); former chairman of China Everbright Group, Zhu Xiaohua, who was sentenced to 15 years in jail in November 2002 for taking bribes worth 4 million yuan (*Caijing*, December 25, 2002); and Zhu Yaoming, a stock speculator who was arrested in July 2003 for loan fraud involving 2 billion yuan, which he borrowed from securities firms and banks to speculate on stocks in the Shanghai and Shenzhen stock exchanges (*Caijing*, December 25, 2003). Numerous Communist Party officials have also been ousted for accepting bribes involving property and real estate projects. They include the former mayor of Shanghai, Chen Liangyu; the former general secretary of Guizhou Province, Liu Fangren; former general secretary of Hebei Province, Cheng Weigao; former Minister of Land and Resources, Tian Fengshan; a former vice mayor of Shenzhen City; and a former mayor and a vice mayor of Shenyang City.

In summary, the empirical literature on trends in market fragmentation and its extent is inconclusive. Most studies focus on either product or factor markets and over a short period only. The objective of this article is to document the evolution of both product and factor markets using a more integrated framework over a longer period covering the entire course of economic transition and reforms. To assess the degree of factor market fragmentation, the economy is divided into four sectors: urban industry, urban services, agriculture, and rural enterprises (all nonfarm activities such as rural industry, construction, transportation, and commerce). The analysis is based on estimating production functions for each sector, using provincial time series data for 1978–2001. One side contribution of the analysis is the computation of a capital stock series by sector, using fixed investment data from the National Bureau of Statistics that are not yet fully available publicly. The estimated parameters from the regression equations are used to quantify the regional variation in the marginal products of capital and labor by sector. The results confirm that labor markets are becoming more integrated, but also show that capital markets have become more fragmented. As the reforms in the product markets have deepened, distortions seem to have shifted to the capital market. In this sense, Young's (2000) argument is still valid: in a partially reformed economy distortions may beget more distortions. However, the distortions may not necessarily stay in the same sector.

The article first reviews the history of market development in China in the second half of the twentieth century. It then presents data on changes in labor and capital productivity across sectors and regions in the Chinese economy over recent decades and explores trends in product market integration. Regional variations in the marginal products of capital and labor are quantified and serve as good indicators of factor market integration. The efficiency gains for economic growth are simulated with the current barriers to factor flows across regions and sectors removed. A supplemental appendix, available at <http://wber.oxfordjournals.org> provides additional details about the data.

I. MARKET DEVELOPMENT IN CHINA

This section briefly summarizes market development in China in the twentieth century.

Product Market

Market fragmentation has a long history in China. In the early 1950s, China adopted a “self-sufficient” agricultural and industrial policy at both national and provincial levels (Lin, Cai, and Li 1996). Provinces were encouraged to develop their own industries and ensure enough grain production. However, the underlying economic structure was often inconsistent with a region's comparative advantage. Therefore, local governments had to impose various protections on local products. The planning system led to

serious shortages in final goods, forcing the government to impose rationing on consumers as well.

Since the economic reforms of the late 1970s, China has decentralized its fiscal system to provide more incentives for local governments to develop their economies (Zhang 2006). Under the fierce competition that resulted from fiscal decentralization, interest groups in provinces and cities were eager to protect their local interests. Regional trade wars broke out in the 1980s and early 1990s (Young 2000). In responding to the crises of regional trade blockades, the National People's Congress passed the "Law on Unjust Competition" in 1993, and in 2001 the State Council issued order 303 "Stipulation of the State Council to Forbid Regional Blockade in Market Activities."

Labor Market

In the 1950s, the government established the *hukou* system of household registration, confining people to the village or city of their birth, to ensure enough agricultural labor to produce sufficient grain to support the industrial and urban sector. Rural and urban labor markets became totally segmented (Yang and Zhou 1999).

Since the 1980s, China has gradually reduced institutional barriers to migration (for more detail on China's labor market development, see Fleisher and Yang 2003 and World Bank 2005). In 1983, farmers were permitted to engage in transport and marketing of their products beyond local markets. In 1988, the central government permitted farmers to work in cities under the condition that they had to provide their own staples. Since the early 1990s, various measures have been introduced to further relax the *hukou* system and encourage greater rural to urban labor mobility. Some cities have adopted a selective migration policy, issuing permanent residency to migrants who paid a fee, invested in local business, or bought expensive houses in the city. In addition, urban reforms of housing, employment policies, and the social security system; the lifting of rationing; and expansion of urban nonstate sectors have made it easier for migrant workers to live in cities.

Despite progress in reducing institutional barriers to labor mobility, some obstacles still impede population movement across regions (Fleisher and Yang 2003). For instance, most rural migrants in cities are unable to obtain legal residence permits and are treated as second-class citizens. They have to pay much higher fees for healthcare and schools than legal residents. Discriminatory treatment of rural migrant workers in employment and social services is commonplace, particularly in the formal sector.

Capital Market

In the central planning era, banks were the dominant source of business financing (World Bank 2005). They provided loans primarily to formal state

enterprises within their locality. The central government exerted direct control over banks. Administrative rather than market forces determined capital movements. The major role of banks was to provide equity financing and to support national development strategies.

Since the late 1970s, China has conducted a series of banking sector reforms. In 1983, the four state-owned commercial banks (Bank of China, Agricultural Bank of China, Industrial and Commercial Bank of China, and Construction Bank of China) were reorganized to become more market oriented. In addition to direct vertical control within the bank, local governments were granted more horizontal controls over bank branches. As the economy developed rapidly, so did demand for credit. Local governments tightened their control over local bank branches by blocking saving deposits from moving elsewhere. Many local governments forced banks in their jurisdiction to extend credit to them, creating serious inflation in the early 1990s.

Since 1994 the central government has reasserted its control over the banks, ended local government control of bank branches, and set up regional banks to encourage capital mobility across provinces. However, loopholes remain in the system. In particular, local governments can use land to acquire loans to finance infrastructure (World Bank 2005). Once land is acquired from farmers for public purposes, local governments and developers can use this “state-owned” land as collateral for credit from the local branches of state banks. Land banking is a major driver of the rapid growth in infrastructure investment in China (Zhang 2006).

Even after the establishment of the Shanghai and Shenzhen Stock Exchanges in December 1990, banks have retained a dominate role in financial markets. In 2000, the banking system accounted for about two-thirds of financial transactions, while the bond and stock market accounted for only 5 percent of financial flows (World Bank 2005). There have been many abnormal phenomena in the development of the stock market (Lin 2004). Most listed companies are state-owned enterprises and in general perform worse than nonpublic enterprises (Chen 2003). Many listed companies performed well initially, but their performance deteriorated after the first year. The turnover rate has been much higher than in other countries. The scale of stock market activity is too small to contribute significantly to capital mobility across regions and sectors, something it should be able to do as it grows.

Despite the financial sector reforms, rural small businesses still find it harder to obtain credit than do urban-based, state-owned enterprises. The recent arrest and release of millionaire entrepreneur Sun Dawu highlights the problem. Because of the difficulties in raising funds from state-owned banks and credit cooperatives, Mr. Sun solicited deposits from his employees and local rural residents, which violated the state law (*Economist* 2004). Anecdotal evidence aside, more research is needed to quantify whether the capital market has become more integrated or more fragmented.

II. CHANGES IN FACTOR PRODUCTIVITY

Driven largely by institutional reforms, the Chinese economy has experienced a dramatic transformation over recent decades.² The share of agricultural GDP in total GDP declined from more than half in 1952 to less than 20 percent in 2001, while the share of the rural nonfarm sector increased from almost zero to more than a quarter. Coupled with these structural changes was a massive shift of labor from the lower productivity agricultural sector to the higher productivity nonfarm sector.

Growth in labor and capital productivity by region and sector highlights the dramatic changes in factor markets and economic structure over the period 1978–2001 (tables 1 and 2). Labor and capital productivities are calculated as the ratios of GDP to labor and capital; they are therefore measures of average not marginal productivity.

There are large regional variations in labor productivity, and they have widened over time. The northeast region had the highest labor productivity in 1978, but by 2001 it had fallen well behind the eastern region. The regional gap between the west and the rest of China has worsened over time. Compared with labor productivity, the regional disparities in capital productivity are much smaller, and they have narrowed over time.

Labor productivity grew fastest in the rural nonfarm sector and slowest in the agricultural sector (see table 2). Labor productivity began at a relatively low level in agriculture, and the gap with other sectors is now much wider. The transfer of rural labor from farm to nonfarm activities will undoubtedly have enhanced overall economic growth and labor productivity. The rural nonfarm sector also experienced the most rapid growth in capital productivity and by 2001 had achieved the highest level of all sectors. These disparities highlight capital market imperfections and the hunger for credit and capital that remains within rural areas for nonfarm activities. Broadening access to credit and investing more in the rural nonfarm sector would enhance economic efficiency and growth.

A comparison of the labor productivity of the industrial and service sectors relative to agriculture for China and several other Asian countries helps to put China's economic transformation in a broader international perspective (table 3). The differences are stark. The labor productivity ratio of industry to agriculture is much higher in China than in other Asian countries. Moreover, while the ratios for other countries have generally remained stable or fallen, the ratio for China has risen substantially over the past 20 years. The same is true for the labor productivity ratio between services and agriculture. These extremely high ratios for China as well their increasing trends are symptomatic of

2. Lin (1992) provides a good reference for rural reforms; Groves and others (1994) cover the reforms of state-owned enterprises; Lau, Qian, and Roland (2000) explain the rationale behind the successful price reforms.

TABLE 1. Labor and Capital Productivity by Region

Productivity	China	East	Central	Western	Northeast
<i>Labor productivity</i>					
1978	868	1,073	707	619	1,672
1984	1,260	1,655	1,046	853	2,072
1990	1,841	2,578	1,471	1,201	2,912
1995	3,356	5,429	2,567	1,842	4,409
2001	5,949	9,694	4,468	3,223	8,063
Growth rate (%)	8.7	10.0	8.3	7.4	7.1
<i>Capital productivity</i>					
1978	36	41	38	25	45
1984	42	45	43	32	47
1990	41	42	42	36	43
1995	53	56	55	43	51
2001	52	52	54	47	57
Growth rate (%)	1.6	1.0	1.5	2.7	1.1

Note: The unit of labor productivity is 1978 yuan; the unit of capital productivity is 1978 yuan per 100 yuan capital stock. East includes the municipalities of Beijing, Shanghai, and Tianjin, and the provinces of Fujian, Guangdong, Hainan, Hebei, Jiangsu, Shandong, and Zhejiang. Central includes Anhui, Henan, Hubei, Hunan, Jiangxi, and Shanxi Provinces. West includes the autonomous regions of Nei Mongol, Ningxia, Tibet, and Xinjiang, and the provinces of Gansu, Guangxi, Guizhou, Ningxia, Qinghai, Shanxi, Sichuan, and Yunnan. Northeast includes Heilongjiang, Jilin, and Liaoning Provinces.

Source: Calculated by the authors based on the data for 28 provinces, which are slightly different from those based on national data. For details on the data see supplemental appendix S.1, available at <http://wber.oxfordjournals.org>.

major distortions in China's factor markets. There appears to be considerable potential for further economic growth simply by reallocating labor and capital among sectors.

III. TRENDS IN PRODUCT MARKET INTEGRATION

This section updates Young's (2000) analysis of the trends in product market integration. As in Young, the analysis uses the following sum of the squared deviations of the sectoral output shares of China's provinces from the group average to the degree of product market integration:

$$\text{Unweighted measure : } \sum_i \sum_j (S_{ij} - \bar{S}_j)^2 \quad (1)$$

$$\text{Weighed measure : } \sum_i \sum_j N^* w_i (S_{ij} - \bar{S}_j)^2 \quad (2)$$

where S_{ij} denotes the share of sector j in province i 's output; \bar{S}_j is the group average S_{ij} across provinces; w_i denotes the province's share of total GDP of N

TABLE 2. Labor and Capital Productivity by Sector

Productivity	China	Agriculture	Urban industry	Urban services	Rural nonfarm
<i>Labor productivity</i>					
1978	868	346	3,245	1,949	623
1984	1,260	509	3,783	2,883	856
1990	1,841	585	5,713	4,615	1,510
1995	3,356	761	8,597	6,275	4,917
2001	5,949	987	23,074	9,573	8,193
Growth rate (%)	8.7	4.7	8.9	7.2	11.9
<i>Capital productivity</i>					
1978	36	52	46	19	22
1984	42	74	45	26	30
1990	41	78	38	30	59
1995	53	74	45	33	121
2001	52	57	51	25	192
Growth rate (%)	1.6	0.4	0.5	1.1	9.8

Note: The unit of labor productivity is 1978 yuan; the unit of capital productivity is 1978 yuan per 100 yuan capital stock.

Source: Calculated by the authors based on provincial data. For details on the data see supplemental appendix S.1, available at <http://wber.oxfordjournals.org>.

provinces and $\bar{S}_j = \sum w_i S_{ij}$. In the absence of trade, a region would return to an autarky type of Robinson economy, with a production structure diversified to cope with daily needs for food, clothes, shelter, and so on. Therefore, without trade, the likelihood of having a specialized production structure is much smaller than with trade integration. It is expected that the more barriers there are to interregional trade, the more similar the composition of output across provinces and the smaller the value of the measures.

Graphing the unweighted and weighted measures of the composition of output shares for 1978–2001 shows similar results—the composition of output converges up to the early 1990s and diverges thereafter (figure 1). Product market development follows a U-shaped curve. An initial decline is followed by an upward trend that leads to a higher overall degree of regional specialization in 2001 than in 1978. The convergence between 1978 and the early 1990s replicates Young's (2000) finding that China's product market became more fragmented. However, the upward trend of the measures since the early 1990s indicates that product markets have become more integrated. The evolving pattern of regional integration reported here for a four-sector disaggregation of GDP also echoes the findings of Bai and others (2004) based on a 36-industry breakdown. The turningpoint coincides with the time when the central government took serious measures to remove interregional trade barriers. The initial market reforms may have brought about more distortions in the short run, but with deepening reform, the barriers in the product markets were broken down over time.

Figure 2 presents the standard deviation of the logarithmic provincial GDPs per capita of farming, urban industry, urban service, and rural nonfarm

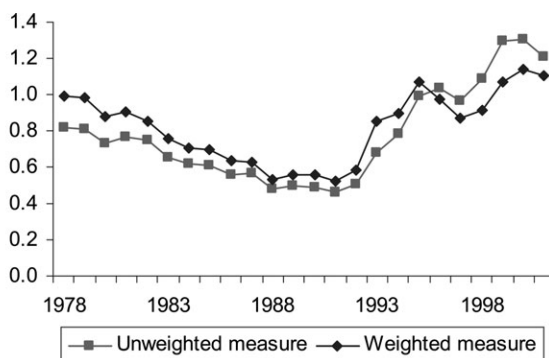
TABLE 3. Trends in the Labor Productivity of the Industry and Service Sectors as a Ratio of Agricultural Labor Productivity, China and Other Selected Asian Countries, Various Years

Country/year	Industry/agriculture	Services/agriculture
<i>China</i>		
1978	7.0	4.9
1988	4.6	3.8
1995	5.4	3.2
2001	7.5	4.0
<i>Philippines</i>		
1989	4.4	2.1
1995	4.5	2.1
2002	4.2	1.8
<i>Korea, Rep.</i>		
1987	2.5	2.6
1995	2.4	1.9
2002	3.1	1.7
<i>Japan</i>		
1990	3.2	3.0
1995	3.1	3.4
2001	3.3	3.4
<i>Indonesia</i>		
1993	7.2	3.6
1998	7.0	2.8
2002	6.5	3.0
<i>Malaysia</i>		
1987	2.7	1.5
1995	2.1	1.8
2001	2.5	1.9
<i>Taiwan, China</i>		
1981	2.4	3.9
1988	2.6	3.9
1995	2.9	4.7
2002	3.0	4.5
<i>United States</i>		
1987	1.5	1.6
1995	1.8	1.7
2001	1.4	1.3

Source: World Bank, various years, *World Development Indicators*.

activities. The variations in output per capita of urban industry and urban services are steady up to 1990 and then increase rapidly. The standard deviation of output per capita of farming increases by 81 percent from 1978 to 1994 and levels off thereafter, while the spatial distribution of rural nonfarm activity becomes increasingly uneven over the whole sample period. However, as Young (2000, p. 1111) notes: "The imposition of trade barriers has clear

FIGURE 1. Convergence in the Composition of Output



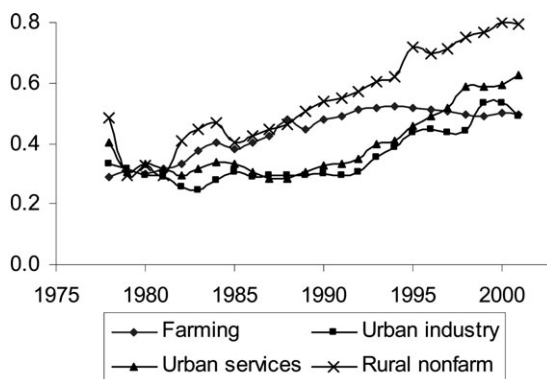
Note: The measures are the weighted and unweighted sum of squared deviations of the sectoral output shares of China's provinces from the national average. *Source:* Authors' analysis based on data described in supplemental appendix S.1, available at <http://wber.oxfordjournals.org>

implications for the interregional variation in output shares; it has no prediction regarding the variation in absolute output levels." Nonetheless, the variations of output per capita in the four sectors offer useful information on the evolution of spatial distribution of economic activities.

IV. VARIATIONS IN MARGINAL PRODUCTS OF CAPITAL AND LABOR

Following the analysis above of recent trends in product market integration, this section turns to an analysis of possible fragmentation in factor markets. Resource allocation is most efficient when the marginal product of each input is equalized across sectors and regions. Thus intersectoral and interregional

FIGURE 2. Standard Deviation of ln GDP Per Capita



Source: Authors' analysis based on data described in supplemental appendix S.1, available at <http://wber.oxfordjournals.org>.

variations in the marginal product of each factor can show the degree of factor market distortions and hence opportunities for achieving greater economic efficiency through improved factor allocation.³

Assume that real value added (GDP) by sector follows a well-behaved, neo-classical production function:

$$Y_{it} = f_{it}(X_{i1t}, \dots, X_{ijt}, \dots, X_{imt}, T) \quad (3)$$

where X_{ijt} is input j for sector i in year t . A thornier question is what functional form of the production function to use. Considering both econometric estimation and theoretical consistency, the following Cobb-Douglas functional form can be specified:⁴

$$\ln(Y_{it}) = A_{it} + \sum_j b_{ij} \ln(X_{ijt})$$

where $A_{it} = a_{i0} + a_{it}t + a_{it}t^2$

$$\text{or } A_{it} = c_{i0} + \sum c_{it}D_t. \quad (4)$$

D_t is a set of year dummy variables, and c_{it} is the corresponding coefficient. The parameters in equation (4) corresponding to labor and capital are their elasticities. The estimated function for agriculture includes arable land as a separate input in addition to capital and labor. Because arable land area does not change much and is location specific, provincial dummy variables cannot be used to control for potential heteroscedasticity. As a compromise, dummy variables for the eastern, central, and western regions are added to the production functions. To capture technological change over time, the time trend and its square are included in one specification. In a second specification, the fixed effects of year dummy variables are added.

To estimate production functions for each of the four sectors, data are used for 28 provinces for 24 years (1978–2001), providing a panel of 672 observations. Tibet is excluded mainly because of lack of data. For data consistency, Chongqing and Hainan Provinces are included in Guangdong and Sichuan Provinces, although they were separated in 1987 and 1997. A detailed

3. Desai and Martin (1983) estimated the efficiency loss due to resource misallocation in industry in the former Soviet Union using a similar method. Syrquin (1988) conducted a similar exercise.

4. It is well known that the Cobb-Douglas form has caveats. It assumes constant returns to scale and strong separability among inputs. To test the robustness of the results on the first caveat, Zhang and Tan (2004) present an alternative specification using a varying coefficient model, and the basic findings are the same. Several flexible functional forms have been put forward to address the separability problem. However, their limitations have been increasingly recognized in the empirical literature (Chambers 1988). For example, the multicollinearity problem inherent among the interactive terms and the fewer restrictions on the underlying production technology often lead to results that do not make much economic sense.

description of the data used is provided in the supplemental appendix (available at <http://wber.oxfordjournals.org/>).

The results of the estimated production functions for the four sectors under two different specifications are presented in table 4.⁵ Because agricultural output is measured as value added, intermediate inputs such as fertilizer are excluded from output measures by definition. Including fertilizer and other intermediate inputs is more appropriate in estimating a production function for gross output. The results under the two different specifications are similar. The adjusted R^2 s are high for all the regressions, indicating a good fit. The year dummy variables in the first specifications are jointly significant in all four regressions. Most coefficients for the time trend variables in the second specification are statistically significant.

The regression results for agriculture indicate that land still plays an important role in Chinese agricultural production. Among the regressions for all the sectors labor elasticity is larger than capital elasticity, indicating that China's comparative advantage lies in labor-intensive production.

Differences in estimated elasticities for the same input across sectors reflect differences in production technology, but on their own do not provide any indication of how efficiently resources are allocated. To obtain such insights, it is necessary to calculate the marginal productivities of each factor. The marginal product of each factor is equal to the product of the estimated elasticity and the corresponding partial factor productivity:

$$\frac{\partial Y_{it}}{\partial X_{ijt}} = b_{ij} \frac{Y_{it}}{X_{ijt}}. \quad (5)$$

Figure 3 presents the marginal product of labor and capital by sector. The marginal product of labor is much higher in urban areas than in the farming and rural nonfarm sector, indicating huge potential gains from rural to urban labor migrations. In 1990, the marginal product of labor in urban industry was about 19 times that of agriculture and the marginal product of labor of urban services was about 13 times that of agriculture. The results are comparable to the findings in Yang and Zhou (1999) that the ratios of the marginal product of labor in the state sector to the agricultural sector was about 15 and 16 between 1988 and 1992. The ratio of the marginal product of labor in the rural nonfarm sector to the farming sector in 1990 was 3.6 in 1990, similar to the 3.7 in 1992 reported by Wang (1997). In 1993, the Company Law was passed to encourage privatization of town and village enterprises. As a result, their share in gross industrial output value jumped from 20 to 25 percent while

5. The calculations of variations in marginal products of factors are rather robust to various specifications in large part because marginal products are determined mainly by factor productivity across sectors rather than by the estimated elasticities. For simplicity, the inequality measures based on several alternative specifications are not reported here but are available on request.

TABLE 4. Estimated Production Functions by Sector, China

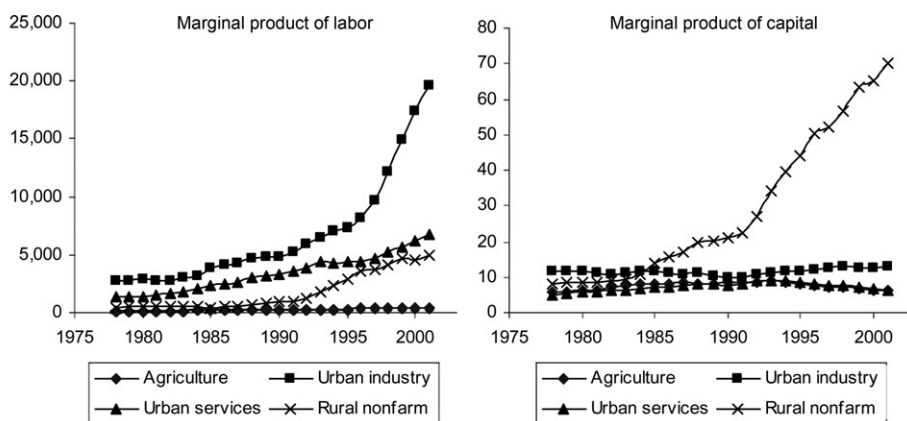
	Specification I				Specification II			
	Agriculture	Urban industry	Urban service	Rural nonfarm	Agriculture	Urban industry	Urban service	Rural nonfarm
Labor	0.430* (0.026)	0.852* (0.037)	0.708* (0.036)	0.601* (0.026)	0.428* (0.026)	0.819* (0.037)	0.694* (0.036)	0.565* (0.026)
Capital	0.111* (0.018)	0.256* (0.036)	0.263* (0.029)	0.364* (0.031)	0.114* (0.018)	0.287* (0.038)	0.273* (0.029)	0.406* (0.032)
Land	0.386* (0.031)				0.386* (0.031)			
Eastern region	0.081* (0.039)	0.376* (0.039)	0.373* (0.051)	-0.325* (0.056)	0.079* (0.039)	0.373* (0.040)	0.363* (0.051)	-0.330* (0.058)
Central region	-0.203* (0.033)	-0.152* (0.040)	0.107* (0.051)	-0.391* (0.055)	-0.203* (0.032)	-0.156* (0.040)	0.105* (0.043)	-0.378* (0.058)
Western region	-0.521* (0.035)	0.044 (0.047)	0.018 (0.048)	-0.818* (0.057)	-0.522* (0.035)	0.030 (0.047)	0.010 (0.048)	-0.791* (0.059)
Year dummy variable	Yes*	Yes*	Yes*	Yes*				
T					0.071* (0.005)	0.110 (0.659)	0.088* (0.007)	0.037* (0.009)
T ² /100					0.112* (0.020)	0.245* (0.026)	-0.171* (0.029)	0.323* (0.037)
Adjusted R ²	0.951	0.928	0.917	0.958	0.951	0.928	0.917	0.954

*Significant at the 10 percent level.

Note: Figures in parenthesis are standard errors.

Source: Authors' analysis based on data described in supplemental appendix S.1, available at <http://wber.oxfordjournals.org>.

FIGURE 3. Marginal Products of Labor and Capital



Source: Authors' analysis based on data described in supplemental appendix S.1, available at <http://wber.oxfordjournals.org>.

that of state enterprises dropped from 43 to 34 per cent from 1993 to 1995 (China National Bureau of Statistics, *China Statistical Yearbook*, p. 401, 1996). The large difference in marginal product of labor suggests potential gains in aggregate output from labor mobility across sectors.

The graph of the marginal product of capital by sector shows that the nonfarm sector has grown much faster than other sectors and by 2001 has the highest value among the four sectors (see figure 3). The marginal product of capital is lowest in the farming and urban service sectors.

Overall, the differences in marginal product of factors across sectors are quite large. A generalized entropy (GE) inequality measure was used to quantify the degree of variation in the marginal products of inputs across the 4 sectors and 28 provinces.⁶ Because each province has four sectors, there are

6. Other measures are also used, and the results are similar. Following Shorrocks (1980), the GE measure in the marginal product of capital (k) can be written as:

$$GE(c) = \begin{cases} \sum_{i,j} w_{ij} \left\{ \left(\frac{M_{ijk}}{\mu} \right)^c - 1 \right\} & c \neq 0, 1 \\ \sum_{i,j} w_{ij} \left(\frac{M_{ijk}}{\mu} \right) \log \left(\frac{M_{ijk}}{\mu} \right) & c = 1 \\ \sum_{i,j} w_{ij} \log \left(\frac{\mu}{M_{ijk}} \right) & c = 0 \end{cases}$$

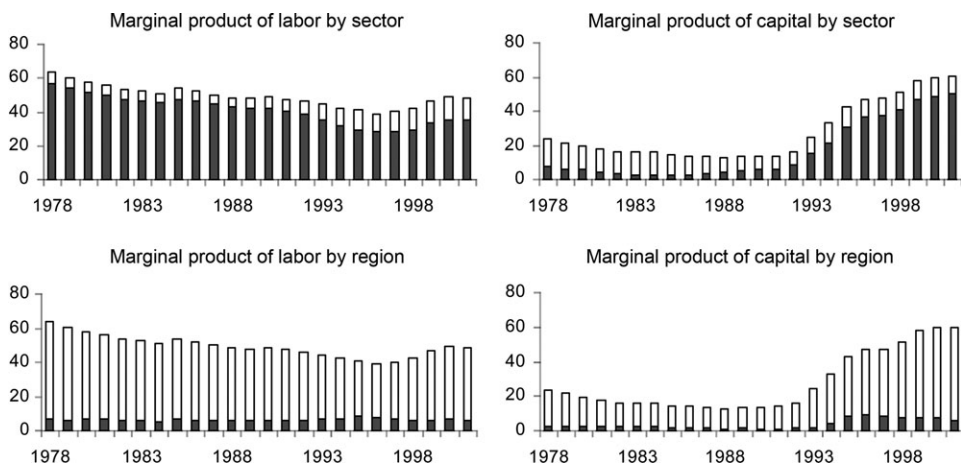
where M_{ijk} denotes the marginal product of factor k for sector j in province i , μ is the arithmetic sample mean, and w_{ij} is the share of GDP of sector j for province i in total GDP. $GE(0)$ is the mean logarithmic deviation, $GE(1)$ is the Theil index, and $GE(2)$ equals half the square of the coefficient of variation. In principle, the GE measures are sensitive to various parts of the distribution depending on the selected value of c . The simplest form of this equation was used in which $c = 0$. When $c = 0$, it is the mean logarithm deviation and more sensitive to the bottom part of the distribution. The results are similar for $c = 1$ and $c = 2$. The reason for using GE is its appealing property of decomposing overall inequality into between- and within-group subcomponents.

2,688 observations in all. Figure 4 graphs the variations in the marginal products of labor and capital.

The marginal product of labor has shown some convergence over the reform period, except in the last five years of the analysis (which may be the result of changes in the way the labor surveys were conducted during those years; see supplemental appendix). Variation in the marginal product of capital, in contrast, was steady between 1978 and the early 1990s before rising substantially. The divergence in the marginal product of capital during the 1990s indicates greater fragmentation of capital markets. This finding is consistent with that of Boyrau-Debray and Wei (2003). These results suggest that as competition intensified in product and labor markets, distortions may have shifted to banking, real estate, and infrastructure projects. In this sense, the findings support Young's (2000) argument that partial reforms may lead to more distortions in the rest of the economy.

The GE family of inequality measures can be decomposed into the sum of within- and between-group components for any given partitioning of the population into mutually exclusive and exhaustive groups. Figure 4 graphs the between- and within-group (region and sector) components of the variation in the marginal products of capital and labor. The ratio of the between-group component to overall inequality is called the polarization index (Kanbur and Zhang 1999; Zhang and Kanbur 2001). Intersectoral variations in the marginal products of labor and capital contribute far more to overall inequality than interregional variation. In particular, the sectoral polarization index on the marginal product of capital has increased. This provides further evidence that

FIGURE 4. Variations in Marginal Product of Labor and Capital



Note: The blank bars show the within-sector or -region variation, while the solid bars show the between-component variation. *Source:* Authors' analysis based on data described in supplemental appendix S.1, available at <http://wber.oxfordjournals.org>.

as the reform process has deepened in the product market, the capital market has become more distorted.

These results indicate that there is room to improve China's overall economic efficiency simply by reallocating factors among sectors and regions. Reversing the entrenched urban-biased investment policies and undertaking in-depth reforms within the financial sector would not only have the greatest impact on economic efficiency but would also promote greater equity as most poor people live and work in rural areas.

V. POLICY SIMULATIONS

How large are the potential gains from improving factor market performance? To answer this question, estimated production functions from the first specification in table 4 are used to calculate the potential increases in national GDP resulting from simulated factor reallocations.⁷ Supplemental appendix S.2 reports the underlying models and baseline information. As a first step, the models are calibrated to obtain the constant terms in the production functions of the four sectors based on the estimated elasticities on labor, capital, and GDP information for 2001. Doing that means that the production functions will predict the actual results for 2001. Next, the calibrated models are used in the four sectors to conduct policy simulations.

Considering the low level of labor productivity in the agricultural sector, the first experiment is to move additional labor out of that sector. With 2001 as a baseline, three scenarios are evaluated: moving 1, 5, and 10 percent of the agricultural labor force out of agriculture and distributing it equally among the other three sectors (table 5). Reallocating even 1 percent of the agricultural labor force could increase national GDP by 0.9 percent. Reallocating 5 percent or 10 percent increases national GDP by 4.4 percent or 8.8 percent. The results are supported by an independent early study by Yang and Zhou (1999), who find gains in aggregate output of 0.7 percent, 3.1 percent, and 5.8 percent based on the same three hypothetical percentage transfers of labor using 1992 as a baseline.

The second experiment simulates a change in the current urban-biased policies by shifting capital from cities to rural areas while keeping total capital constant. Reallocating 1 percent, 5 percent, and 10 percent of urban capital to rural areas leads to gains in national GDP of 0.5 percent, 2.1 percent, and 3.9 percent.

7. Policy simulations point out only the potential gains from reform. However, questions remain on the mapping from simulations to actual reforms. In addition, there are no standard errors. Therefore the precision cannot be assessed. It is likely that the simulations results depend on the underlying functional forms as well as the accuracy of the data. We are reassured in that simulations based on a varying coefficient model have led to similar findings (Zhang and Tan 2004). In 5, we also check the robustness of the results by undertaking similar simulations with a baseline of higher labor productivity in the agriculture sector.

TABLE 5. Impact of Alternative Policy Simulations on China's GDP

Experiment	Results		
Move $x\%$ of the agricultural labor force out of farming	1%	5%	10%
Change in GDP (%)	0.89 (0.89)	4.42 (4.22)	8.77 (8.78)
Reallocate $x\%$ investment from cities to rural areas	1%	5%	10%
Change in GDP (%)	0.46 (0.41)	2.13 (1.90)	3.90 (3.45)
Add x billion yuan of investment in rural areas	10	50	100
Change in GDP over 2001 (%)	0.03 (0.03)	0.15 (0.14)	0.29 (0.27)
Change in GDP over 2001 (billion yuan)	3.66	18.26	32.31
Add x billion yuan of investment in urban areas	10	50	100
Change in GDP over 2001 (%)	0.01 (0.01)	0.04 (0.04)	0.07 (0.08)
Change in GDP over 2001 (billion yuan)	0.92 (1.03)	4.58 (5.16)	9.16 (10.30)
The ratio of returns to investment in rural areas to urban areas	3.99 (3.60)	3.98 (3.59)	3.97 (3.58)

Note: The figures in the parentheses are the simulation results based on adjusted national GDP data.

Source: Authors' analysis based on data described in supplemental appendix S.1, available at <http://wber.oxfordjournals.org>.

The third experiment assumes that the government allocates all the additional investment in rural areas and distributes it equally between the agricultural and rural nonfarm sectors. The investment is converted into capital stock using a discount rate of 4 percent and a national fixed asset price index.⁸ An additional 10 billion yuan of investment in rural areas yields a 0.03 percent increase in national GDP, equivalent to 2.9 billion 2001 yuan. Considering that the farm and rural nonfarm sectors are labor intensive, this scenario would likely also boost the incomes of many of the poorest people in China. When investment increases to 50 billion yuan, national GDP rises by 0.15 percent (14.3 billion yuan) and when it increases to 100 billion yuan GDP rises by 0.29 percent (28.4 billion yuan). Because the capital does not vanish immediately, the long-term impact is much higher. Assuming a 4 percent discount rate, the annual internal rate of returns to the investment in rural areas is more than 20 percent.

The next experiment considers a counterfactual scenario in which all the additional investment is distributed evenly in the two urban sectors. Under the three scenarios of investment of 10, 50, and 100 billion yuan, national GDP increases by 0.92, 4.58, and 9.16 billion yuan, respectively. As shown in the last row of the table, the rate of returns to rural investment is almost four times of that to urban investment.

8. For the period 1991–2001, the national fixed asset price index is available from the *China Statistical Yearbook*. However, it was not published prior to 1991. Therefore, the national GDP deflator is used a proxy for the period, 1978–91. For the whole period the calculated capital price index is 3.53, compared with the published GDP deflator of 3.33.

The National Statistical Bureau adjusted national GDP figures based on the first economic census in 2004. To check the robustness of the results, the constant terms in the four production functions were recalibrated as shown in supplemental appendix S.2 using the adjusted 2001 GDP data by sector, and the same set of simulations was undertaken. The basic results are similar to those based on original GDP figures (see table 5).

The policy simulation highlights the potential economic gains from reallocating factors from low- to high-productivity sectors. Removing barriers to labor movement, reversing the urban bias in government investment policies, and deepening reforms would significantly enhance overall economic growth. In addition, these policy changes could bring about favorable distributional effects by reducing regional and sectoral inequalities. Since large inequalities are a potential source of social conflict and instability, the far-reaching social impact of these policies could be equally important.

VI. CONCLUSIONS AND POLICY IMPLICATIONS

The aim of China's reforms is to reduce economic distortions and improve efficiency. This article has examined the changing patterns of distortions during the reform process, how past policies have contributed to these distortions, and the estimated cost to the economy through lower output and greater regional and sectoral disparity. The empirical findings indicate that product markets in China have become more integrated after a short period of increasing fragmentation in the early reform period. Labor markets also have become increasingly integrated due to a large shift in the labor force from the agricultural sector to nonfarm sectors and relaxed constraints on migration. However, intersectoral differences in the marginal product of capital have grown during the reform period.

Local governments, which have been collecting rents in a partially reformed system, are the interim winners from reform. In the short run, distortions might beget more distortions, as Young (2000) has shown. However, in response to the increasing fragmentation in product markets, the government has undertaken measures to remove local protections. Consequently, there are fewer and fewer rents to be collected in the product and labor markets over time, and the distortions have been increasingly squeezed into the financial and land markets (including infrastructure and real estate). For local governments, these are the two last bastions for rent collection, as well as breeding grounds for corruption. Looking only at the product market suggests that the market might have become distorted in the short run. However, as the government responded to the problems with deepening reforms, the market became integrated. When all the sectors are considered, however, the results seem to support Young's argument that as some distortions in a partially reformed economy are removed, new distortions may be added. The key is whether the government can continue to add new reforms to squeeze out the distortions in

the capital market as those in the product and labor markets were squeezed out before them.

The continuing large differences in labor and capital productivity across sectors suggests that China still has great potential for further efficiency gains through continued structural change. To realize this potential, however, restrictions on factor movement, in particular, intersectoral capital movement, need to be removed. Efficient capital markets that can funnel new investment to sectors with higher returns still need to be developed. The higher capital returns in the rural nonfarm sector suggest that more aggressive government policies should be sought to increase investment there or at least not hinder its movement. Such policies will not only improve overall economic performance, but will also narrow the development and inequality gaps between the rural and urban sectors. Similarly, the government should encourage labor movement from agriculture to rural enterprises, urban industry, and service sectors since labor productivity in these sectors continues to be much higher than in the agriculture sector.

While empirical estimates and policy simulations can provide rough order of magnitude estimates of structural problems, policy recommendations on gradual elimination of these distortions need to take into account complex issues of political feasibility, sequencing, implementation problems, downside risks of policy measures, nature of vested interests and how to overcome them, the need to minimize negative side effects, and the effects on equity, regional disparity, and rural-urban inequality. More research is needed to understand the political economy dimensions that have at times seriously constrained the pace of reform. Nonetheless, simulations of alternative policy proposals and their estimated effects could act as useful inputs to policymaking.

VII. SUPPLEMENTARY MATERIAL

Supplementary material is available at: <http://www.wber.oxfordjournals.org/>

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