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**Assessing the Role of Inward Foreign Direct Investment
in Chinese Economic Development, 1990-2007: Towards a Synthesis of Alternative Views**

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ABSTRACT

In the context of globalization, China has been widely regarded as the most successful country in the world in utilizing inward foreign direct investment (FDI) for economic development. The mainstream of the literature has produced a wide range of studies that are largely within the theoretical framework of neoclassical economics, and they tend to conclude that FDI has contributed significantly to Chinese economic development – through capital formation, export expansion, technology transfer, and the transformation of the economic structures and institutions. The objective of this paper is to assess the role of FDI in Chinese economic development with reference to the broader theoretical literature on FDI and late development, which encompasses structuralism and radical political economy along with neoclassical economics. From the perspectives of the broader literature, the analyses of the paper find that FDI in China has indeed promoted economic development in one respect (improving allocative efficiency), but has also had unfavourable effect in another respect (worsening productive efficiency), resulting in an overall impact that tends to be on the negative side. The mainstream story of China is thus judged to be partial, and the lessons to be drawn from the experience are arguably far more complex than have been hitherto perceived.

Key words: China, FDI, economic development

JEL classification: F21, N65, O19

1. Introduction

China has been amongst the world's largest recipient countries of foreign direct investment (FDI) since the early 1990s. In 2002, the first year after the country's accession to the World Trade Organization, it for one time surpassed the United States of America to become the largest FDI recipient. The amount of FDI which it receives continued to expand in the subsequent years, reaching a total of US dollar 84 billion in 2007, which was equivalent to 15% of the total flows to all developing economies in that year. The outbreak of the financial crisis in developed countries in 2008, and the world-scale recession that followed, did slow down FDI flows to China and the developing world as a whole. Nevertheless, as far as China is concerned, this slow-down has been temporary. FDI flows to China decreased by 12% in 2009, but then rebounded by a hefty 21% in 2010 and continued to increase steadily thereafter. By 2014, the flows to China amounted to US dollar 129 billion, which was equivalent to 19% of the total flows to all developing economies (data from United Nations Conference on Trade and Development, *World Investment Report*, various issues).

Assessing the role FDI has played in Chinese economic development is thus of enormous policy and intellectual importance. Indeed, international institutions such as the Organisation of Economic Co-operation and Development (OECD), the World Bank, the International Monetary Fund (IMF), etc. – which can be considered as representative of the mainstream establishments in the world political-economic orders – have been outspoken in portraying China as a 'model' for the rest of the developing world in utilizing FDI for economic development. And the mainstream of existing scholarly studies has been in support of this endeavour. Analytically, the studies mostly treat FDI as additional productive resources over and above the domestic stock. Whether in the form of additional savings, foreign exchange availability, technology transfer, or a catalyst for the formation of efficient institutions, FDI flows are taken to be of such nature. No wonder, the studies have mostly concluded that FDI flows have been conducive, even crucial, to Chinese economic development.

We believe these studies are partial in analytics and problematic in conclusions. Their analytics tends to centre on propositions framed according to neoclassical economics, while ignoring the contribution from alternative theoretical traditions. Yet, the literature on international investment

has never been clearly dominated by neoclassical economics. Equally influential is the structuralist tradition, which, based on theories of industrial organization, has developed various propositions arguing that FDI could suffocate late development by killing off local firms or distorting the structure of local industries. And there is the tradition of radical political economy. Based on Marxist theories of the labour process, the proposition of deskilling contends that FDI flows could put the recipient economy in a ‘low value-added, low compensation’ development trap. Based on Marxist or Post Keynesian macroeconomics, the proposition of the internationalization of capital contends that FDI flows could worsen the problem of global demand deficiency in the long term. These structuralist and radical propositions, whilst not necessarily being antithetical to neoclassical economics, do provide insightful alternative perspectives from which actual experiences can be analysed and assessed.

The objective of this paper is to attempt an assessment of the role of FDI in Chinese economic development. We analyse the experience by way of verifying the applicability of the propositions in the structuralist, radical, and neoclassical traditions. Our analysis focuses on developments up until 2007. The economic situation following the outbreak of the world-scale financial crisis in 2008 has thrown new lights on the implications of FDI flows to China, about which we will also offer a preliminary, brief discussion towards the end of the paper. The paper is organized in five sections. Following this introduction, section two briefly reviews relevant theoretical issues and the literature of applied studies on China’s experience. Section three examines the main features of FDI in China in light of the preceding literature surveys. Section four analyses the efficiency performance of foreign capital-invested enterprises at the sectoral and regional levels. Section five concludes the paper.

2. Theoretical Perspectives and Existing Studies

The literature on FDI and late development is vast. Broadly speaking, three established theoretical traditions, each of which being comprised of a range of analytical propositions, are discernible. The propositions are based on either theoretical arguments or generalized empirical observations, or both (for elaborate reviews on the theoretical traditions, see, e.g., Aitken and Harrison 1999, Lo 2012 ch.2, OECD 2002, Saggi 2002, Singh 2005, Smarzynska 2002, Tang *et al.* 2008, and UNCTAD 1999).

The first tradition, generally considered to be the mainstream for its association with major international agencies (especially the World Bank and other ‘Washington Institutions’), is largely based on neoclassical economics. Its views on the role of FDI in late development comprise the following main propositions: first, FDI represents the availability of additional financial resources, over and above domestic savings; second, FDI represents the availability of additional foreign exchange, over and above overseas borrowings and the export earnings of domestic firms; and, third, FDI could promote productivity growth in the recipient economy via technology transfer and structural/institutional change. The first proposition is standard neoclassical economics. The second proposition is derived from some ‘gap’ models (and hence not, strictly speaking, standard neoclassical), where the assumption is that there exist certain produced goods that are essential to economic development but are not readily available from domestic producers. And the third proposition is broadly associated with the notion of best practices as defined in the production function, and ultimately determined by competition in the world market. The productivity growth could arise from moving towards the production frontiers, or, as some theories of endogenous growth tend to emphasize, realizing static and/or dynamic increasing returns.

The second tradition, known as structuralist development economics in the literature, whilst not necessarily opposing the above propositions, tends to highlight two critical drawbacks of FDI. The first one can be summarized as ‘competition kills’. Especially where the carrier of FDI is transnational corporations (TNCs), which typically have technological and scale advantages over domestic firms, a main impact of FDI is likely to be the extension of the monopolistic power of these foreign firms into the domestic market. The second one can be summarized as ‘competition distorts’. Again, especially where the carrier of FDI is TNCs, which typically have acute competition among themselves in the world market, a main impact of FDI is likely to be the distortion of the economic structure of the recipient country – in the forms of excessive duplication of industrial projects, fragmentation of the structures of industries, and obstruction to the development of linked upstream capital-intensive industries. At one level, these two propositions are an application of established theories of industrial organization to this particular field. At a more substantive level, the application hinges on the view

that, in the world market, most dynamic (fast productivity-growing) industries are characterized by imperfect competition and the predominance of a small number of TNCs in each of them.

The third tradition, known as radical political economy, comprises a range of diverse views, of which two groups have been most influential. One group of views have coalesced around the thesis of the ‘new international division of labour’, which posits that deskilling is the likely outcome of the division of labour under modern capitalism (the ‘Taylorization’ of work) and that capital export from advanced countries tends to be motivated by the pursuit of cheap labour. The logical expectation, in these views, is that such capital tends to perpetuate the position of recipient developing countries in specializing in low value-added production and getting low labour compensation – a development trap that is difficult to escape. Meanwhile, another group of views centre on the idea of the ‘internationalization of (the contradictions of) capital’. It is posited that capital export from advanced countries is typically motivated by demand deficiency and/or falling profitability in the home market, and, by helping to create new centres of production in developing countries, it tends to result in global over-accumulation on an expanded scale. Consequently, by receiving such foreign capital as a means of integrating themselves into the world market, developing countries will often have to bear the brunt of severe fluctuations in the world economy – so much so that any developmental achievements they have made are constantly threatened to evaporate.

The preceding discussion on the second proposition of radical political economy reveals the complex financial and macroeconomic attributes of FDI flows, which are mostly assumed away in neoclassical economics. Conceptually, *contra* the neoclassical ‘prior-savings-finances-investment’ view, the Post Keynesian-Schumpeterian theory of endogenous finance posits that finance impacts the economy by creating credit ‘out of nothing’ (Dullien 2009, Kregel and Burlamaqui 2005). The relationship between savings and investment is thus more complex than the neoclassical view, and the availability of foreign savings via FDI flows cannot be judged as in itself indicating a contribution to the capital formation of recipient economies. Meanwhile, empirically, there is also an influential thesis from radical political economy concerning the nature of FDI flows in the era of globalization. It is argued that because of increasing financialization, and with it the increasing short-termism of investment behaviour and the increasing mobility of investment finance and earnings, the mainstream

view of FDI flows as a source of stable development finance is seriously in question (Kregel 1996, Singh 2005). This implies that the availability of additional foreign exchange via FDI flows cannot be judged as unquestionably a contribution to economic development.¹

It must be stressed that the propositions pertaining to the different theoretical traditions as outlined above, while carrying ideological contents in their own right, are of analytical insights. The intellectual contribution of these propositions, which entail asking different questions and/or offering different answers, could be evaluated from the standpoint of economic development. They should thus be treated as analytics rather than just doctrines of belief, and their validity or otherwise is ultimately an empirical issue. It is with reference to this broader literature that the strength and limitation of existing studies on FDI and Chinese economic development can be properly assessed.

Existing studies have mostly followed the mainstream tradition, in the sense that they see FDI as, unquestionably, embodying a net addition in financial and/or technological resources for recipient economies. This nature of the studies is clearly stated in the reports by major international institutions, including OECD (2002), World Bank (2006), and Tseng and Zebregs (2002) representing the IMF. Subsequent works from international institutions have continued to hold this view on the nature of FDI, although, increasingly, they have had to take it seriously the alternative, structuralist view that FDI potentially could also have negative impacts on economic development (Davies 2013, Li 2013).²

To substantiate this mainstream neoclassical view on the nature of FDI, in the literature, two bodies of research works have been produced. The first is simply to express various measurements of FDI as ratios to main indicators of economic aggregates, and thereby to ‘read out’ the contribution of FDI to economic development. It is found that the ratio of FDI inflows to China’s GDP, or capital formation, has been quite large in international comparison since the early 1990s. It is also found that, of China’s rapidly expanding total exports, the share accounted for by foreign capital-invested enterprises (FIEs) has risen sharply (see Davies 2013, Huang 2015, Li 2013; earlier works include Chen *et al.* 1995, Kaiser *et al.* 1996, Zhang and Song 2000, Sun 2003).

The second body of works is comprised of regression analyses of the relationship between various measurements of FDI and indicators of economic development. The core idea thereof is both to examine the indirect impact of FDI on observed development indicators (such as GDP growth),

which does not show out in the analyses of the first body of works, and to capture the impact on unobserved indicators such as total factor productivity (TFP) growth. Findings of these analyses vary, depending on the specification of the models used for estimation, but it is generally found that the indicated correlations are positive and significant. Perhaps the most optimistic finding is that, over the 1990s, FDI raised China's TFP growth by 2.5 percentage points. Together with the effect of raising GDP growth by 0.4 percentage points via its addition to capital formation, the contribution of FDI to China's economic growth over the 1990s is estimated to be near three percentage points per annum (Tseng and Zebregs 2002; see also the even more sanguine judgement by Whalley and Xin 2010, who state that without FDI inflows China's economic growth would have been unsustainable).

In the spirit of the analytics of the second body of research works, there have also been many studies that analyse the correlation between FDI and local economic growth – for individual regions or for cross-region comparison. The motivation is the easily observed fact that regions or provinces with a higher FDI intake have tended to exhibit faster economic growth. The analyses typically find that these two sides are positively and significantly correlated, and that FDI contributes to local economic growth via various kinds of direct or indirect impact including the addition to local capital formation, the crowding-in of domestic investment, and the enhancement or efficient utilization of the local stock of productive skill/knowledge. Inferences have thus been made that FDI does explain the diverse growth performance across regions, and that this holds important policy lessons for China as a whole (Berthélemy and Démurger 2000, Hong and Sun 2011, Madariaga and Poncet 2007, Mody and Wang 1997, Wei *et al.* 2001, Zhang and Felmingham 2002).

More recently, a practice that has become very popular among concerned scholars is to study the effects of FDI at the sector or firm level. The focus is on identifying the existence, or otherwise, of productivity spillovers from FDI to domestic firms. It is through these new studies that a complex picture has been revealed. Some studies find positive spillovers while some others find negative, depending on the cases studied and the regression models used. Perhaps more interesting are the attempts to identify the channels through which spillovers take effect. Some studies find that the impact of FDI on the output and productivity change of domestic firms varies (in degrees and between positive and negative measures) across industries, and between the short run and the long run (Hu and

Jefferson 2002, Ran *et al.* 2007, Xu and Sheng 2012, Jeon *et al.* 2013). Some others find that the existence or otherwise of spillovers depends on the absorptive capacity of the domestic firms (Girma *et al.* 2009, Qi *et al.* 2009). Still some others find that there are actually two-way spillovers between foreign and domestic firms (Wei *et al.* 2008). At any rate, there seems no consensus from these studies that FDI has clearly made a positive and significant contribution to Chinese economic development via productivity spillovers at the sector and firm levels.

A general point that arises from the preceding discussion concerns the importance of putting the analysis of the effects of FDI in context. Recent studies typically find that the correlation between FDI and economic development depends on the conditions in question. The conditions, often dubbed ‘threshold effects’ in the studies, refer to the absorptive capacity of the domestic agents, in various forms including the stock of human capital, the level of infrastructural development, the capacity in innovation, the geographical proximity to economically dynamic localities, etc. (Huang *et al.* 2012, Madariaga and Poncet 2007, Qi *et al.* 2009). Thus, adequate analyses of the effects of FDI require taking into account the relevant characteristics of Chinese economic development – in particular, the relative importance of allocative and productive efficiency, in relation to the prevailing directions of structural and institutional changes. This requirement is logically linked to the structuralist and radical traditions in the boarder theoretical literature. Both traditions place emphasis on a range of additional factors that are considered to be crucial in determining the impact of FDI. Overlooking these concerns will lead to the loss of insights that could have been generated for understanding the reality.³

3. FDI Flows and Chinese Economic Development: A First Look

Immediate aggregate indicators do not fare well with the view that FDI has been an important driving force behind Chinese economic growth. In the first place, the standard neoclassical ‘prior-saving-finances-investment’ view, even if it is accepted at the conceptual level, does not have the empirical backing. As is shown in Figure 1, FDI flows as a ratio to China’s GDP were almost negligible from 1979 to 1991. Massive increases have occurred from 1992, but the ratio still averaged to no more than 4% for the years until 2007. Put another way, FDI flows as a ratio to gross fixed capital formation

averaged to around 10% from 1992 to 2007. Given these magnitudes of the ratios, FDI flows could not account for a significant part of China's economic growth (all data henceforth are from *Zhongguo Tongji Nianjian* [China Statistical Yearbook], various issues, unless indicated otherwise).⁴

[Figure 1]

From the perspective of neoclassical economics, three points can be raised to posit that the above indicators could seriously understate the importance of FDI inflows for Chinese economic development. First, figures of FDI inflows do not reflect the full addition of FDI to capital formation, as there is also investment by foreign capital-invested enterprises (FIEs) using retained earnings. Second, the ratios of FDI inflows to GDP or capital formation do not capture the possible indirect investment crowding-in effect. Third, the ratios do not show the unobserved impact of FDI in raising the TFP of the economy.

At first sight, the argument concerning retained earnings seems reasonable enough. Official data, for the first time released in April 2011 by the State Administration of Foreign Exchange, show that, by the end of year 2009, the stock of foreign direct investment in China amounted to US dollar 997 billion, which was 27% more than that had been previously recorded. This upward adjustment was mainly because of two additional factors: foreign investors' share of retained earnings of FIEs, and foreign company headquarters' lending to their subsidiaries in China. This statistical redefinition also results in the upward adjustment of the data of FDI inflows. As can be seen from Table 1, for the years 2005-2010, the amount of inflows according to the new definition was typically double that of the previously released data, the latter being official data from the Ministry of Commerce and used in Figure 1. Nevertheless, the upward adjusted amounts of FDI inflows still stand at a rather modest ratio of GDP. In the peak year of 2005, the amount was 5.5% of GDP at official exchange rate, or 2.3% of GDP measured by purchasing power parity. Meanwhile, the retained earnings of FIEs for foreign investors are in domestic currency but, legally, are permitted to be repatriated in the form of foreign exchange. It is thus possible for retained earnings of this kind to become short-term speculative flows instead of long-term productive investment, as is suggested by the theory of the financialization of FDI reviewed in the previous section. There is indeed evidence that a significant proportion of these retained earnings have become 'hot money' constantly in pursuit of short-term profits (Xu 2011).

How about the argument on the investment crowd-in effect of FDI inflows? There are studies which have found that FDI inflows have been positively and significantly correlated with domestic investment growth, and this has been interpreted as evidence of the existence of an investment crowding-in effect (see, e.g., Luo 2007, Tang *et al.* 2008, Wu *et al.* 2012). There are also studies that come out with opposite findings. Braunstein and Epstein (2002), for instance, finds that FDI flows to China have tended to crowd-out domestic investment at the provincial level. But most importantly, virtually all of these are disaggregate studies, and it is well-known that FDI has tended to flow to locations that are with sufficient prior investment in infrastructure and other related facilities (see, e.g., Berthélemy and Démurger 2000, Huang *et al.* 2012). It is thus likely that the relationship between FDI inflows and domestic investment is two-way rather than one-way causation, notwithstanding the findings of some existing studies that have sought to test the causality in a purely statistical sense.

There remains the third argument, regarding the possible contribution of FDI to TFP growth. This is the focus of the existing literature. Some studies emphasize the availability of additional foreign exchange following FDI flows. And foreign exchange is deemed important because it could be used to finance technology imports, not least in the embodied form of machinery and/or industrial inputs. Other studies emphasize the contribution of FDI to TFP growth by improving the efficiency of FDI-receiving firms, industries and regions. And the mechanisms through which this contribution takes effect include technology transfer, and the promotion of economic institutional and structural changes (OECD 2002, World Bank 2006). These studies have been reviewed in the previous section. It is particularly of note that the emphasis on technology transfer and efficiency promotion has been incorporated into the body of studies on productivity spillovers mostly at the micro level. We shall look at the evidence at the regional and sectoral levels in the next section.⁵

Consider the issue of foreign exchange. It is true that FDI represents the availability of additional foreign exchange at the time of the flows. Yet, FDI is not the same as international aids; FDI needs pay off, or to be repaid over the long term. Without the necessary data of profit repatriation and re-investment by FIEs, it is not possible as yet to ascertain the magnitude of the contribution of FDI to China's long-term economic growth in this regard. Regardless the existence or otherwise of

repatriation, because retained earnings are in Chinese Yuan but can be converted into foreign currencies at any time, they cannot be considered as a contribution to foreign exchange availability for China. It is thus possible to present, as an approximation, the total contribution of foreign exchange availability by FDI inflows in the form of Table 2.

In Table 2, the total contribution of FDI to foreign exchange availability (T) is the sum of three items: investment earnings that flow out of China (F) which are a negative contribution, new FDI inflows (I_f), and foreign trade surplus of FIEs (B). By the column T , we see that ever since 1992, FDI has been making positive contribution to foreign exchange availability in China. However, in most of the years before 1990 when China ran a deficit in trade balance (see Table 3 below), FDI contributed negatively to China's foreign exchange availability. RC denotes the change in official reserves. The difference, $RC-T$, indicates what the change in official reserves would have been in the absence of the contribution of FDI. We see that in years 1992-1993 and 1998-2000, FDI made positive contribution to the availability of foreign exchange for China and, meanwhile, the official reserves would have decreased in the absence of FDI. In those years when foreign exchange was a scarce resource, FDI was indeed helpful by increasing China's availability of foreign exchange (when $T > 0$). The trend changed in recent years. FDI still contributes substantially to the increase in China's official reserves, but the reserves would increase anyhow even without the contribution of FDI. Given the evidence of the huge social costs and risks brought about by 'excessive' accumulation of foreign exchange reserves in developing countries, especially in China (see, e.g., Frankel 2005, Rodrik 2006, and Zheng and Yi 2007), it is difficult to conclude that FDI has significantly contributed to Chinese economic development via contribution to foreign exchange availability.

[Table 2]

Some existing studies have highlighted the contribution of FDI to export earnings as of central importance. It is found that FDI inflows have been strongly correlated with export expansion – although the direction of causation appears to be two-way instead of one-way (Liu *et al.* 2002). It is also found that FIEs have become a main impetus behind the expansion of China's total exports, with exports carried out by non-FIEs tending to stagnate (Whalley and Xin 2010) – although there remains the question as to in what measure have FIEs been in competition with domestic firms for China's

exportable goods. Even if the questions concerning causation and the competition for exportable goods are put aside, it is an exaggeration to infer from existing data that FIEs have largely contributed to the expansion of export earnings. True, FIEs have accounted for a rapidly expanding share of China's total exports, exceeding 40% from 1996 and 50% from 2001. Yet, as can be seen from Table 3, it is also true that FIEs have accounted for an even larger share of total imports. For 13 years from 1985 to 1997, FIEs ran a sizeable trade deficit every year, in contrast to China's overall trade surplus for most years after 1989. And, although FIEs have enjoyed trade surplus every year from 1998, such surplus had until 2005 accounted for a minor part of the national total. Parts of the imports by FIEs are production equipment which they bring along with investment. The possible contribution to TFP growth in this regard then comes down to two forms: technology transfer to FDI-receiving firms which use the imported equipment, and the potential for FIEs to become important net exporters in the long term – the latter possibility, as noted, did not really materialize until recent years.

[Table 3]

Now, consider possible contribution of FDI to TFP growth by means of improving the efficiency of the economy. Mainstream theories postulate that this could take effect in various forms: technology transfer to FDI-receiving firms, spill-over effects on other firms of the same industries and/or linked industries, the promotion of structural change of the economy in the direction of following its 'endowed' comparative advantage, the promotion of institutional change in the direction of following principles of the market, etc. Whether or not these theoretical views are valid, and whether or not some or all of such benefits are present, the net effect is likely to show up mainly in the performance of the entire sector of FIEs relative to the rest of Chinese industry.

Figure 2 shows the productivity performance of FIEs relative to Chinese industrial enterprises as a whole. Note first the relative labour productivity series, which exhibits a trend of secular decline from 1993 to 2007. On the face of it, this trend is consistent with both the neoclassical thesis of structural change towards China's endowment-determined comparative advantage – that is, taking advantage of the existing 'cheap labour' (labour abundance) in China – as well as the radical thesis of deskilling. In other words, it is quite possible that the trend embodies improving allocative efficiency and/or worsening productive efficiency. It is thus necessary to turn to look at the indicator of overall

efficiency performance, represented by the evolution of the relative TFP series. Again, the relative TFP series exhibits basically the same trend of secular decline, amid the massive expansion of FDI inflows and of the sector of FIEs over the period 1993-2007. This suggests that the productive efficiency loss has dominated the allocative efficiency gains, which is hardly supportive to a positive assessment of the contribution of FIEs to China's economic development.

[Figure 2]

If its relative efficiency has been actually falling, why has the sector of FIEs expanded rapidly in terms of its share in Chinese industry? To answer this question requires investigation into the decision-making of FDI flows, but it is likely that the answer lies in the respect of labour compensation. As is well-known, because of the effectively unlimited supply of immigrant workers, wage rates in most of China's labour-intensive, export-oriented FIEs remained basically unchanged at low levels up until recent years. Figure 2 shows that the average wage rate of FIEs, relative to all Chinese industrial enterprises, followed a trend of decline. And the relative average wage rate curve is below the relative labour productivity and relative TFP curves in many of the years. Given this condition, it might have still been profitable for FIEs despite their deteriorating trends of relative labour productivity and TFP. But the trends themselves imply that, for Chinese industry as a whole, the development associated with the expansion of the sector of FIEs cannot be judged as efficient.⁶

4. The Effects of Foreign Capital-Invested Enterprises: Sectoral-Regional Analyses

The discussion in the preceding section concerns the role of FDI inflows, and the entire sector of FIEs, in Chinese economic development. It will be of insight to carry forward the discussion by analysing the economic performance – relative to national average – of industrial sectors and provinces that are with an above-average level of presence of FIEs. For, the indicator of the industrial value-added share of FIEs in a particular sector or province in a year shows the accumulated penetration of FDI inflows in that sector/province from the beginning up until that year. The analysis of the relationship between this indicator and the relative performance of the sector/province in question will thus in a way help to verify the mainstream hypothesis of FDI improving efficiency, via

technology transfer/spillover and institutional/structural change, as well as the structuralist hypothesis of FDI worsening efficiency via distorting/killing domestic industries and the radical hypothesis of deskilling. This section is thus devoted to sectoral-provincial analysis, with a view of taking on the existing literature for comparison purpose.

Table 4 presents the relevant data of the 35 sectors of Chinese industry, for the year 1991 and 2007. The reason for selecting 1991 as the beginning point is that this was the year immediately prior to the massive expansion of FDI inflows, as has been shown in Figure 1. And 2007 is the last year before the global financial crisis and economic recession struck. The reason for selecting the latest year before the 2008 world crisis, as mentioned, is that the indicator of the industrial value-added share of FIEs reflects the cumulative effects of FDI flows and FIEs operations in each of the particular sectors over the previous years. Looking at the data of sectors that are with an above-average level of industrial value-added share of FIEs, three points are of note from the table.

[Table 4]

The first point concerns the sectoral distribution of FIEs in relation to the production characteristics of industries. Theoretically, both the mainstream theory of comparative advantage and the radical theory of the ‘new international division of labour’ would expect the market-oriented FIEs to tend to concentrate in China’s labour-intensive industries. This is basically true in reality. As is customary in the literature of trade analysis, industries that are with relative labour productivity lower than the value of 0.9 are usually classified as labour intensive. On this count, of the 18 industrial sectors that are with an above-average level of penetration of FIEs in 2007, a majority of 11 sectors could be classified as labour intensive both in that year and in 1991.

The second point concerns the impact of FDI on the labour productivity of Chinese industry. The mainstream theory would expect the FIEs-dominated sectors to tend to have slower-than-average growth in labour productivity, reflecting their adoption of production techniques that are with a higher-than-average labour intensity. Again, this is basically true in reality. Of the 18 industrial sectors in question, 14 sectors experienced a negative growth in relative labour productivity between 1991 and 2007. This performance is consistent with the expectation of improving allocative efficiency. Yet, the performance is also consistent with the radical thesis of deskilling, which argues

that FIEs – and, by extension, FIEs-dominated sectors – would tend to retard the economy-wide trend of improving labour productivity.

The third point concerns the total impact of FDI on the efficiency of Chinese industry, which is reflected in the relative TFP performance of FIEs-dominated sectors. Note that, because the indicator is TFP relative to Chinese industry as a whole, it excludes the effect of economy-wide factors and highlights the effect of sector-specific factors including the above-average level of presence of FIEs. And the indicator could in principle capture the impact of technology transfer, horizontal or intra-sector spillover, the enhancement of market institutions in these sectors, etc. The results in Table 4 are quite in contrast to the mainstream of the literature: of the 18 FIEs-dominated industrial sectors, 14 sectors had a negative growth in relative TFP between 1991 and 2007. It appears that, insomuch as there does exist the positive impact of FDI on the efficiency of Chinese industry as postulated by neoclassical economics, this has hitherto been dominated by the negative impact as postulated by the structuralist and radical theories.

Table 5 presents the relevant industrial data of the 30 province-level regions of China, again for the year 1991 and 2007. It is of note the high degree of spatial concentration of FIEs in China: there are only eight regions – Guangdong, Shanghai, Fujian, Tianjin, Hainan, Jiangsu, Beijing, and Jilin – that are with an above-average level of industrial value-added share of FIEs in 2007. In this circumstance, the performance of the eight regions in question is somewhat different from the result of sectoral analysis. Judging from the criterion of relative labour productivity, only one (Jilin) of the industries of the eight regions could be classified as labour-intensive in 1991. By 2007, two (Guangdong and Fujian) out of the eight became labour-intensive. Given the exceptionally high value-added share of FIEs in the two regions, it might still be possible to say that FIEs have to some extent followed the principle of endowment-determined comparative advantage with respect to spatial distribution. Meanwhile, the same is also basically true concerning the impact of FIEs on allocative efficiency: four (Guangdong, Shanghai, Fujian, and Beijing) out of the eight regions exhibited a negative growth in relative labour productivity between 1991 and 2007. And it is precisely these four regions, together with Jiangsu province, that have also experienced a negative growth of relative TFP

from 1991 to 2007. Thus, it seems clear that the analysis of regional data has produced a result that is broadly similar to that from the analysis of sectoral data.

[Table 5]

The sectoral-regional analyses associated with Table 4 and Table 5 appear to indicate that FDI does have the kind of impact as suggested by neoclassical economics, but it is not true that the impact results in a positive and strong contribution to the overall efficiency of Chinese industry. The analytical findings are consistent with the view that FDI flows, and FIEs operations, have helped to improve the allocative efficiency of the industrial sectors and regions. Yet, the findings are also consistent with the alternative views that FIEs operations could result in retarding labour productivity growth as well as distorting the industrial structure of the sectors/regions in question. The negative growth in relative TFP for most of the FIEs-dominated sectors and regions suggests that this negative impact has hitherto dominated the positive impact in the Chinese experience.

To bring our sectoral-regional analyses of the role of FDI in Chinese economic development to a close, it will be useful to make further use of the data in Tables 4 and Table 5 for carrying out statistical tests. For, the analyses above only look at the FIEs-dominated sectors/regions instead of the full set of data. This might be somewhat too narrow a focus with respect to the general picture of FIEs in the Chinese economy. Meanwhile, in another respect, the analyses might also be too general: in accounting for the performance of efficiency of the sectors/regions, the analyses do not single out the above-average level of presence of FIEs from other sector- or region-specific factors. These two shortcomings could be mitigated by using the full set of data for statistical tests. Specifically, it could be hypothesized that the level of industrial total factor productivity (A) of a sector, or of a province, is determined by the total scale of that sector/province as represented by its total value-added (V) and the value-added share of FIEs in that sector/province (V_f/V), that is,

$$\ln A = a + b \ln V + c(V_f/V)$$

In two respects, the analyses of applying the above formulation can be useful. First, using V as an explanatory variable of A implies that the analyses take into account the growth paths of the sectors/provinces – that is, the existence or otherwise of economies of scale or agglomeration. Second, in the cross-regional comparison, the analysis can help to verify the effects brought about by FDI of

inter-sectoral technological spillover as well as structural and institutional changes. This is because such spillovers and changes are likely to take effect mainly within the boundary of a province. Finally, it should be recalled that the variable V_f/V captures the accumulated penetration of FIEs in a particular sector/province. Doing a cross-sectional analysis on the one-year data of 2007 would thus provide information for inferring the accumulated impact of FDI on Chinese industry.

[Table 6]

Table 6 shows the results of the cross-sectoral and cross-regional regression analyses. It can be seen that, in both cases, the estimated value of the coefficient of V is statistically significantly positive. Yet, conceptually, the existence or otherwise of economies of scale or agglomeration in industrial development is determined by a multiple of factors that are mainly exogenous to FDI. The above analytical result thus suggests that, to the extent that FDI has contributed to the productivity improvement of Chinese industry, this is likely to be a process of two-way instead of uni-directional causation. Meanwhile, it can be seen further from Table 6 that the estimated value of the coefficient of V_f/V is statistically significantly negative in the case of cross-sectoral analysis and statistically insignificant in the case of cross-regional analysis. This result is consistent with the inference above from Figure 2 that the contribution to Chinese industrial development by the expansion of FIEs, and their increasing penetration level, has tended to be insignificant or even negative. This is the case even if one takes into account the indirect impact of inter-sectoral technological spillover and overall structural and institutional changes, as is evident in the result of cross-regional analysis.

5. Conclusions

The mainstream of existing studies on the role of FDI in Chinese economic development has mostly followed the analytics of neoclassical economics. They tend to see FDI as embodying a net addition in financial, technological and/or institutional resources for recipient economies. Their assessment of the role of FDI in China has tended to be strongly positive. Yet, this theoretical view might be too narrowly focused, and the judgement from the applied analyses might be problematic. A range of alternative theories rather see the nature of FDI as more than the availability of new resources, and

argue that FDI flows could bring about negative impact on economic development. The body of studies on productivity spillovers, which focuses on micro-level analyses and does not *a priori* take the neoclassical view that FDI can only positively affect economic development, represents a deviation from the mainstream. Their analytical findings reveal that, in the Chinese case, there have been indeed both positive and negative effects brought about by FDI.

The objective of this paper is to study the subject matter in the light of the broader theoretical literature on FDI and late development, focusing on both the aggregate and sectoral levels. Its main analytical finding is that FDI in China has indeed promoted economic development in one respect (improving allocative efficiency), but has had unfavourable effect in another respect (worsening productive efficiency), resulting in an overall impact that tends to be on the negative side. These findings are broadly consistent with the micro-level analyses of the studies on productivity spillovers. The mainstream story of China is thus judged to be partial, and the lessons to be drawn from the experience are arguably far more complex than have been hitherto perceived.

Before closing the paper, it will be useful to briefly discuss the new lights cast by the world economic situation post-2008 on the implications of FDI flows to China. There are two important, inter-related points in this connection. The first is empirical, concerning the role of China in the so-called ‘global imbalances’. The symptom is that, since the early years of the new century, China has registered a massive current-account surplus – amid the United States registering a massive current-account deficit. Commentators, including top officials of the US government, have thus held China responsible for causing (via the alleged ‘global savings glut’) the financial crisis and prolonging the world recession. Whether or not this accusation has any validity is a matter of debate. From the perspective of this paper, it is of note the role of FDI in the generation of China’s external surplus. Recall from our analyses in Section Three: it is precisely since the early years of the new century that the trade surplus of FIEs has accounted for a rapidly increasing share of China’s total trade surplus, from 23% in 2002 (the first year of China’s WTO accession) to 58% in 2008.

The second point of note is intellectual. Recall the literature review in Section Two, where it was indicated that of the three theoretical traditions only radical political economy envisages – in the proposition of the internationalization of capital – the possibility of FDI worsening global demand

deficiency over the long term. The ‘global imbalances’, or at least China’s sizeable external surplus following the massive inflows of FDI post WTO-accession, might be a vindication of this proposition. Whether or not this is the case, the international friction caused by the expansion of China’s external surplus implies that the availability of increased export earnings – a central proposition of the mainstream view on FDI – is not necessarily always beneficial. The further phenomenon of the alleged ‘global savings glut’, or at least China’s situation of savings persistently and substantially exceeding investment post WTO-accession, also turns on the head of the orthodox proposition that the availability of additional, foreign savings brought about by FDI inflows is an unquestionable blessing. All these add further complexities to the policy lessons from the Chinese experience of utilizing FDI for economic development, and warn against simple-minded policy recommendations (typical of the mainstream of existing studies) of attracting as much FDI inflows as possible.

Footnotes

1. This paper focuses on issues of allocative and productive efficiency in China's nexus of FDI and economic development. Due to limitation of space, we shall not carry out applied analyses at the financial and macroeconomic levels. The review in this paragraph and the comment towards the end of the paper only serve to highlight the importance of the financial and macroeconomic issues. As far as we know, the existing literature has not provided any study on these issues.
2. These cited works all adhere to the neoclassical propositions that FDI represent the availability of additional financial resources and foreign exchange, as well as a driving force for efficiency improvement. Outside the mainstream, scholars such as Dullien (2005) and Sun (2003) recognise early on that, theoretically, FDI could also bring about negative effects *à la* the structuralist propositions – although their actual analyses of the Chinese experiences still mainly confine to testing the three neoclassical propositions, and they tend to conclude that these propositions are broadly valid in the Chinese experience.
3. The emphasis here, with respect to the importance of putting the analyses of the effects of FDI in context, is a general statement. It needs concrete contents in relation to the specific analyses of existing studies. Due to limitation of space, it is not possible in this paper to attempt to summarise the main characteristics of Chinese economic transformation over the period under study. What we can do is to highlight the following three points that are deemed directly relevant to the subject matter of the paper. First, it is an established stylised fact that China's economic growth since the mid-1990s has followed an investment-led, or capital-deepening path. There is evidence that this path embodies strong properties of productive efficiency, in the form of dynamic increasing returns, and large-scale capital-intensive industries have benefitted most from this growth path (Lo and Li 2011). Productivity growth has thus been very fast: measured by the real growth of per-worker GDP, the average annual rate was 9.69% in the period 1990-2007. Second, before its entry to the World Trade Organisation (and the enforcement of the principle of non-discrimination) in late 2001, China's policy-institutional regime governing the utilization of FDI exhibited a spatially diverse but progressively converging pattern. The Special Economic Zones set up in the

early reform years (four in 1979-1980, one more in 1985) enjoyed a far more liberal regime than the rest of the coastal regions. The same was true for the coastal regions as a whole vis-à-vis the inland and western provinces. Thus, at least before 2001, the spatial distribution of FDI and its impact on local economic development were not entirely the outcome of competitive market activities. This is a tricky issue that has rarely been taken into account by the analyses in existing studies. Third, in the sectoral-regional analyses below in section four, we use indicators of relative productivity as measurements of performance. This is meant to highlight the effects of sector- or region-specific factors including the impact of FDI. We also use, as explanatory factors, indicators that capture the accumulated penetration of FDI in the sectors or regions in question. This way, the above two points can be, to some extent, taken into account in our analyses.

4. FDI data are from Ministry of Commerce, not Balance of Payment (BoP) records. The difference between the two series is that, from year 2005, the BoP series include two additional items: first, foreign investors' share of retained earnings of FIEs, and, second, foreign company headquarters' lending to their subsidiaries in China (we discuss the importance of these below). Consistent BoP data before 2005 are not available. Meanwhile, the FDI-to-GDP ratios in Figure 1 are calculated by converting FDI data from US dollar to Chinese Yuan at the official exchange rate. Using purchasing power parity (PPP) measures of GDP will substantially adjust down the ratios, and will strengthen our argument that FDI flows cannot be considered as very important in accounting for the growth of capital formation. According to the World Bank estimates of Chinese GDP at PPP, the ratios varied from the lowest level of 0.35% in 1990 to the peak level of 2.10% in 1994. The ratio so measured was 1.04% in 2010. Note that, unlike GDP, there does not exist PPP estimates of China's gross fixed capital formation.
5. TFP is a controversial concept both theoretically and in applied analysis (Felipe and McCombie 2010, Temple 2010). In the context of applied analysis of Chinese economic development at the disaggregate levels (firm, sector, and region), there are considerations that could undermine the usefulness of the concept. One consideration concerns data. Labour input is typically measured in the number of employees, instead of number of working hours. This implies that firms with a comparatively faster pace of increasing (or slower pace of decreasing) work intensity, defined in

terms of working hours per year, will tend to exhibit faster TFP growth. Capital input is typically proxied by the official data of the net value of fixed assets, without taking care of the fact that, as a legacy of the pre-reform system, the rate of depreciation has been set exceedingly low. This implies that firms that are comparatively new will tend to exhibit faster TFP growth. Both of these measurement problems of data will tend to favour FIEs, vis-à-vis other firms, in the estimation of TFP growth. All these notwithstanding, we continue to use the concept in this paper as a tactic of engaging with the existing literature: if it is found that FIEs have been actually outperformed by the rest of Chinese industry, on the basis of an analytics that is already in favour of FIEs, further doubt will be cast on the mainstream claim over their comparative efficiency. On top of this, for want of more appropriate analytics, we believe the sectoral-regional analyses of TFP performance might still be of value for understanding Chinese economic development.

6. It might be useful also to briefly discuss the contribution of FDI inflows to employment creation, which has been widely viewed as a significant benefit to China. FDI does create jobs, especially because FIEs tend to concentrate in labour-intensive sectors. But there are two qualifications. First, job creation needs to be seen in conjunction with labour compensation, especially in the light of the secular trend of falling relative wage rates of FIEs indicated in Figure 2. The widespread phenomena of labour shortage in labour-intensive, export-oriented industries in coastal China since 2005, and the waves of labour unrest in these industries since 2009, indicate the limit to the labour absorption capacity of FIEs based on the wage rates they offer. Second, the presumption that a labour-intensive path of economic growth – which FIEs have helped to promote (see section four) – must create more jobs than a capital-intensive one, does not have a sufficient theoretical basis. In line with the famous Feldman-Mahalanobis-Domar model, a capital-deepening growth path can be characterized by faster productivity growth and capital accumulation – and thus possibly a stronger capacity to create jobs. As indicated in Footnote 3, there is good evidence that Chinese economic growth since the early 1990s has followed a capital-deepening path, and has registered fast productivity growth and capital accumulation. Issues of labour employment, and the role of FDI thereof, should be explicitly analysed in this context.

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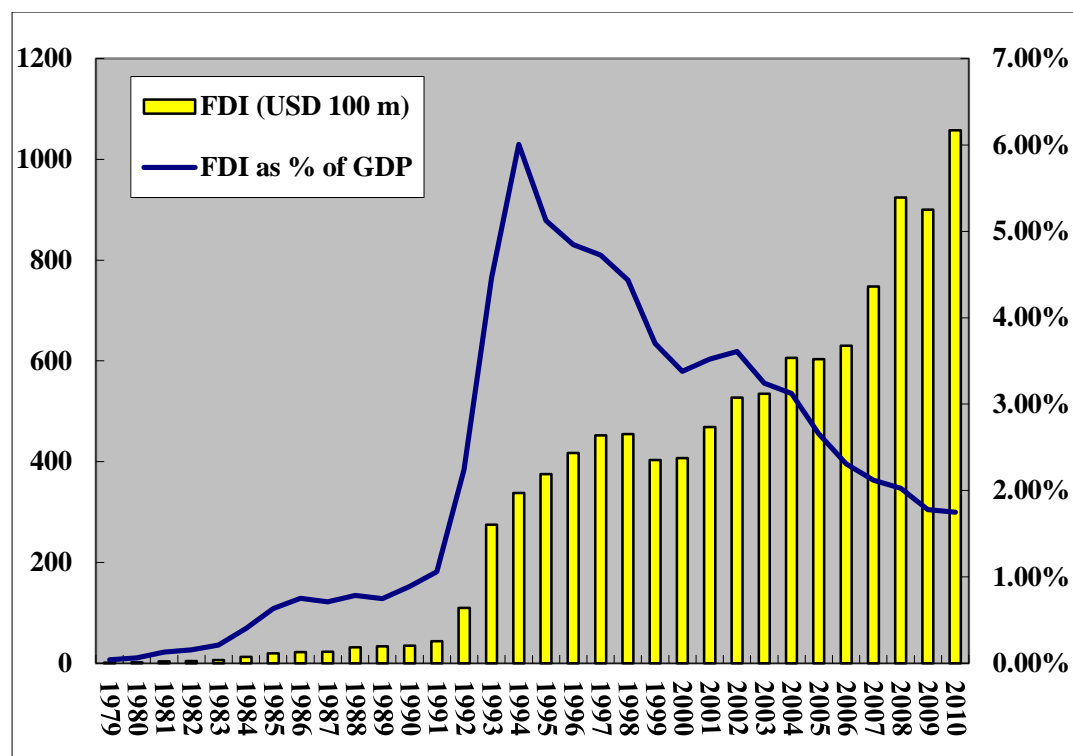
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Figure 1. The scale of FDI flows to China



Sources: 1979-82 figures of FDI flows from Chen *et al.* (1995); all others from *Zhongguo Tongji Nianjian* [China Statistical Yearbook] 2015.

Notes: FDI data are measured by the Ministry of Commerce definition, not from Balance of Payment records. In calculating the FDI/GDP ratios, FDI figures are converted into Chinese currency at the year-average official exchange rates.

Table 1. FDI inflows as ratio to GDP (%)

	FDI (Ministry of Commerce definition)		FDI (Balance of Payment definition)	
	as % of GDP (exchange rate)	as % of GDP (PPP)	as % of GDP (exchange rate)	as % of GDP (PPP)
2005	2.66%	1.12%	5.45%	2.29%
2006	2.31%	1.00%	4.86%	2.11%
2007	2.12%	1.01%	4.86%	2.30%
2008	2.03%	1.11%	4.13%	2.27%
2009	1.78%	0.97%	2.89%	1.58%
2010	1.75%	1.02%	3.42%	1.99%

Sources: FDI (Ministry of Commerce definition) and GDP (measured at market exchange rate) data from *China Statistical Yearbook*, various issues; FDI (Balance of Payment definition) data from State Administration of Foreign Exchange website; GDP (measured at purchasing power parity) data from World Bank *World Development Indicators*.

Table 2. Contribution of FDI inflows to foreign exchange availability (US\$ 100m)

	Investment Earnings (F)	Net FDI inflows (I_f)	Balance of foreign trade of FIEs (B)	Total contribution of FDI to foreign exchange availability ($T = F + I_f + B$)	Change in Official reserve (RC)	RC-T
1985	0	17	-18	-1	-25	-24
1986	0	19	-21	-2	-14	-12
1987	0	23	-22	1	47	46
1988	0	32	-34	-2	23	25
1989	0	34	-39	-5	-5	0
1990	0	35	-45	-11	116	126
1991	0	44	-46	-2	141	143
1992	0	112	-38	73	-23	-96
1993	-2	275	-166	107	18	-89
1994	-4	338	-182	152	304	152
1995	-100	358	-161	98	220	122
1996	-117	402	-141	144	314	170
1997	-167	442	-28	247	349	101
1998	-220	438	42	259	51	-209
1999	-223	388	27	192	97	-95
2000	-265	384	22	141	109	-32
2001	-277	442	74	239	466	227
2002	-223	493	69	339	742	404
2003	-228	471	84	327	1168	842
2004	-227	549	141	464	2067	1603
2005	-532	1172	567	1207	2526	1319
2006	-577	1241	913	1577	2853	1276
2007	-727	1601	1356	2230	4609	2379
2008	-812	1751	1707	2646	4783	2137
2009	-993	1142	1267	1416	3821	2405
2010	-1128	1851	1238	1961	4696	2735

Sources: F , I_f and RC are from BoP Tables of the State Administration of Foreign Exchange website; the other data are from *Zhongguo Tongji Nianjian* [China Statistical Yearbook], various issues.

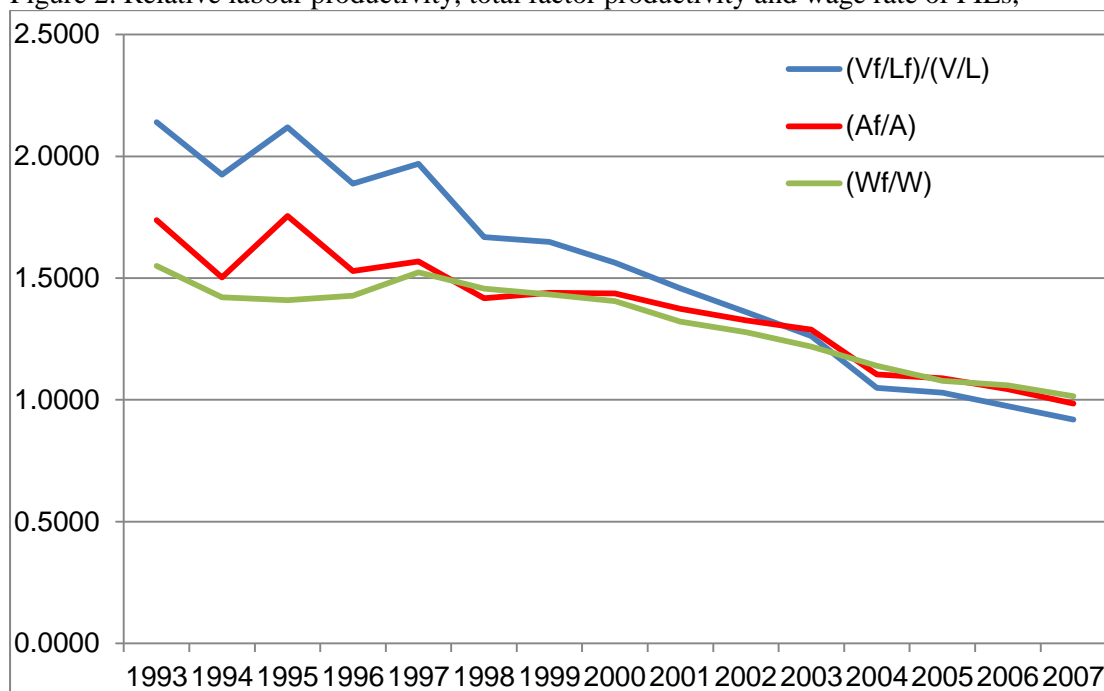
Note: The figures in some of the years do not exactly add up due to rounding.

Table 3. Exports and imports of foreign capital-invested enterprises (FIEs)

	Exports		Imports		Balance (US\$ 100m)	Balance of China's Total foreign trade (US\$ 100m)
	Amount (US\$ 100m)	as % of total	Amount (US\$ 100m)	as % of total		
1985	3	1.10%	21	4.97%	-18	-149
1986	5	1.62%	26	6.06%	-21	-120
1987	12	3.04%	34	7.87%	-22	-38
1988	25	5.26%	59	10.67%	-34	-78
1989	49	9.35%	88	14.88%	-39	-66
1990	78	12.59%	123	23.09%	-45	87
1991	123	17.12%	169	26.56%	-46	81
1992	174	20.44%	211	26.23%	-38	44
1993	252	27.51%	418	40.24%	-166	-122
1994	347	28.68%	529	45.78%	-182	54
1995	469	31.51%	629	47.66%	-161	167
1996	615	40.72%	756	54.46%	-141	122
1997	749	40.98%	777	54.59%	-28	404
1998	810	44.07%	767	54.70%	42	435
1999	886	45.47%	859	51.83%	27	292
2000	1194	47.93%	1173	52.10%	22	241
2001	1332	50.06%	1259	51.67%	74	225
2002	1693	52.00%	1624	55.00%	69	304
2003	2403	54.84%	2319	56.17%	84	255
2004	3386	57.07%	3244	57.81%	141	321
2005	4442	58.30%	3875	58.71%	567	1020
2006	5638	58.19%	4725	59.70%	913	1775
2007	6954	57.10%	5598	58.56%	1356	2618
2008	7906	55.26%	6200	54.74%	1707	2981
2009	6721	55.93%	5454	54.22%	1267	1957
2010	8622	54.65%	7384	52.88%	1238	1815

Sources: *Zhongguo Tongji Nianjian* [China Statistical Yearbook] and *Zhongguo Tongji Zhaoyao* [China Statistical Abstract], various issues; Wang Luolin (ed.) (1997) *Report on Foreign Direct Investment in China*, Beijing, Economic Science Press.

Figure 2. Relative labour productivity, total factor productivity and wage rate of FIEs,



Sources: *Zhongguo Tongji Nianjian 2008* [China Statistical Yearbook 2008].

Notes: V = industrial value added (current prices, 100 million yuan); L = labour employment (year average, 10,000 persons); K = Value of fixed-assets net of depreciation (year average, 100 million yuan); V/L = labour productivity (yuan per worker); $A = V/[(L^{0.6})(K^{0.4})]$ = total factor productivity; W = average wage rate. Figures with no subscript refer to all industrial enterprises; those with subscript “f” refer to FIEs. The category “all industrial enterprises” refers to “township-and-above independently accounting industrial enterprises” before 1998, and “all state-owned industrial enterprises and above-scale non-state-owned industrial enterprises” from 1998. The same definitions apply to Tables 4, 5 and 6 below.

Note that the wage rate (W and W_f) data cover all “formal employees” (*chengzhen zhigong*) of both industrial and non-industrial firms. Compared to the V, K, and L data, the coverage of the wage rate data is thus narrower in one respect (it does not cover “informal employees”) but wider in another respect (it covers employees of both industrial and non-industrial firms). These two set of data are thus not strictly comparable. Putting the relative efficiency (labour productivity and TFP) data and the relative wage data together in this same graph is no more than trying to indicate the trends of development.

Table 4. Relative productivity performance of industry by sectors, 2007

	V_f/V	$(V_s/L_s)/(V/L)$			A_s/A		
	2007	1991	2007	change	1991	2007	change
National Total	27.45%	1.0000	1.0000	0.0000	1.0000	1.0000	0.0000
Communication equipment, computers and other electronic equipment	76.48%	1.4146	0.9069	-0.5077	1.4198	1.0797	-0.3401
Culture, educational and sports articles	60.88%	0.8044	0.3127	-0.4917	1.1859	0.5994	-0.5865
Measuring instruments and cultural and office machines	56.25%	0.8308	0.7317	-0.0991	1.0663	1.0667	0.0004
Leather, fur, feather and related products	50.63%	0.6784	0.3876	-0.2908	0.9685	0.8074	-0.1611
Transport equipment	48.16%	1.0247	1.1485	0.1238	1.1364	1.2121	0.0756
Apparel, footwear and hats	47.45%	0.6788	0.3679	-0.3108	1.0891	0.7226	-0.3665
Furniture	43.20%	0.5219	0.4766	-0.0453	0.7880	0.7295	-0.0586
Artwork and other manufactures	40.52%	0.6326	0.4508	-0.1818	1.0338	0.7816	-0.2522
Plastic products	39.97%	0.8734	0.6418	-0.2317	0.9738	0.8389	-0.1350
Electrical machines and equipment	36.06%	1.1382	0.9068	-0.2314	1.3429	1.2376	-0.1053
Beverage manufacturing	35.84%	1.5361	1.2546	-0.2816	1.4182	1.2557	-0.1625
Rubber products	35.05%	1.2450	0.7373	-0.5077	1.5347	0.8326	-0.7020
Paper and paper products	33.54%	0.7896	0.8480	0.0584	0.8893	0.7920	-0.0973
Metal products	33.26%	0.7432	0.7406	-0.0026	1.0337	1.0269	-0.0068
Printing and recording media	31.51%	0.7493	0.6432	-0.1061	0.9538	0.7351	-0.2188
Chemical fibres	31.36%	2.7812	1.2022	-1.5790	1.8023	0.9510	-0.8513
Food manufacturing and processing	29.64%	0.9331	1.0945	0.1613	0.9659	1.2832	0.3173
Raw chemicals and chemical products	29.11%	1.2647	1.2987	0.0341	1.1425	1.1461	0.0036
Medicines	27.30%	1.8511	1.1202	-0.7309	1.8491	1.1501	-0.6990
General and special-purpose machines	26.66%	0.7678	0.8122	0.0444	0.9393	1.0541	0.1148
Textile	24.12%	0.7065	0.5279	-0.1786	0.8426	0.7094	-0.1332
Non-metallic mineral products	18.66%	0.6355	0.7276	0.0921	0.7646	0.8013	0.0367
Timber, wood, bamboo, rattan, palm, and straw products	18.06%	0.5698	0.6528	0.0830	0.6913	0.9067	0.2154
Water production and distribution	16.56%	1.1948	0.5953	-0.5995	0.7016	0.3815	-0.3201
Petroleum processing, coking, and nuclear fuel processing	15.10%	3.0565	2.5839	-0.4726	1.8418	1.7263	-0.1155
Non-ferrous metals Smelting and Pressing	14.73%	1.4039	1.9278	0.5239	1.1555	1.6956	0.5401
Ferrous metals smelting and pressing	11.89%	1.5618	1.9907	0.4288	1.2109	1.4717	0.2608
Electric power and heat power production and distribution	9.67%	2.1328	2.3117	0.1789	1.0753	1.0245	-0.0507
Petroleum and natural gas extraction	8.50%	4.1111	4.7868	0.6758	1.8657	2.8065	0.9409
Non-metal ores mining and processing	8.26%	0.5172	0.7465	0.2293	0.7163	0.9831	0.2668
Non-ferrous metal ores mining and processing	3.80%	0.7105	1.1883	0.4778	0.7235	1.4894	0.7659
Ferrous metal ores mining and processing	2.75%	0.6723	1.2717	0.5994	0.7375	1.4633	0.7258
Coal mining and washing	1.54%	0.3870	0.6814	0.2944	0.4043	0.7944	0.3901
Other ores mining and processing	0.92%	0.5237	0.8462	0.3225	0.8539	1.1682	0.3143
Tobacco	0.15%	13.7209	10.5525	-3.1683	9.7445	7.7289	-2.0157

Sources: *Zhongguo Tongji Nianjian* [China Statistical Yearbook] and *Zhongguo Gongye Jingji Tongji Nianjian* [Statistical Yearbook of China's Industrial Economy], various issues.

Note: V = industrial value added; L = labour employment; K = Value of fixed-assets net of depreciation; V/L = labour productivity; $A = V/[(L^{0.6})(K^{0.4})]$ = total factor productivity. Figures with no subscript refer to all enterprises; those with subscript "f" and "s" refer to FIEs and the sector in question, respectively.

Table 5. Relative productivity performance of industry by provinces, 2007

	V _f /V	(V _s /L _s)/(V/L)			A _s /A		
	2007	1991	2007	Change	1991	2007	change
National total	27.45%	1.0000	1.0000	0.0000	1.0000	1.0000	0.0000
Guangdong	58.54%	1.5763	0.7258	-0.8504	1.4167	0.8961	-0.5206
Shanghai	57.25%	1.6980	1.3103	-0.3878	1.5365	1.1302	-0.4063
Fujian	51.96%	1.0716	0.6741	-0.3975	1.1361	0.8268	-0.3093
Tianjin	44.60%	1.1450	1.6451	0.5001	1.1243	1.4343	0.3101
Hainan	41.84%	1.0310	1.5257	0.4947	0.8665	1.0504	0.1839
Jiangsu	40.67%	0.9380	1.0101	0.0721	1.0532	1.0298	-0.0234
Beijing	37.06%	1.5597	1.2184	-0.3414	1.4185	0.9577	-0.4608
Jilin	28.39%	0.7739	1.2799	0.5060	0.7767	1.1159	0.3392
Zhejiang	26.33%	0.9925	0.6441	-0.3484	1.1835	0.7330	-0.4505
Hubei	22.66%	0.8719	1.0956	0.2236	0.9063	0.9029	-0.0033
Liaoning	21.97%	0.9189	1.1063	0.1874	0.8854	1.0253	0.1399
Guangxi	20.38%	1.0552	1.0272	-0.0281	1.0519	0.9561	-0.0958
Shandong	19.29%	1.0918	1.1972	0.1054	1.0078	1.2234	0.2157
Hebei	17.46%	0.8237	1.0702	0.2465	0.7947	1.0293	0.2346
Jiangxi	15.37%	0.6600	0.8712	0.2112	0.7794	0.9365	0.1572
Anhui	14.73%	0.6977	0.9675	0.2698	0.7779	0.9644	0.1865
Sichuan-Chongqing	11.72%	0.7837	0.9943	0.2107	0.8544	0.9941	0.1397
Tibet	9.25%	0.8363	0.7814	-0.0549	0.6440	0.5226	-0.1214
Inner Mongolia	7.64%	0.7248	1.8278	1.1030	0.7098	1.3231	0.6133
Hunan	7.61%	0.8360	0.9823	0.1463	0.9354	1.0297	0.0944
Shaanxi	7.59%	0.8288	1.2918	0.4630	0.8516	1.1951	0.3435
Ningxia	7.35%	0.8246	0.9847	0.1601	0.7422	0.8215	0.0793
Shanxi	6.40%	0.7589	0.8744	0.1155	0.7326	0.7949	0.0623
Heilongjiang	6.17%	1.0738	1.3437	0.2699	1.0256	1.1994	0.1738
Henan	5.75%	0.8247	1.2964	0.4717	0.8161	1.3400	0.5239
Yunnan	5.53%	1.7007	1.2841	-0.4167	1.5445	1.0960	-0.4485
Qinghai	3.03%	0.5010	1.4819	0.9809	0.5087	0.9230	0.4143
Guizhou	2.57%	1.0422	0.8993	-0.1428	1.0138	0.7830	-0.2308
Gansu	2.40%	0.9872	0.9294	-0.0578	0.9276	0.7976	-0.1301
Xinjiang	1.48%	1.1251	1.7470	0.6219	0.8983	1.2340	0.3357

Sources: *Zhongguo Tongji Nianjian* [China Statistical Yearbook] and *Zhongguo Gongye Jingji Tongji Nianjian* [Statistical Yearbook of China's Industrial Economy], various issues.

Note: V = industrial value added; L = labour employment; K = Value of fixed-assets net of depreciation; V/L = labour productivity; A = $V/[(L^{0.6})(K^{0.4})]$ = total factor productivity. Figures with no subscript refer to all enterprises; those with subscript "f" and "s" refer to FIEs and the sector in question, respectively.

Table 6. Determinants of industrial total factor productivity of sectors and provinces, 2007

	$\ln A = a + b \ln V + c(V_f/V)$			
	a	b	c	R^2
Sectors	1.2449	0.0994 (1.9007)*	-1.1865 (-2.8849)***	0.2489
Provinces	0.9322	0.0892 (3.239)***	-0.1624 (-0.779)	0.2755

Sources: *Zhongguo Tongji Nianjian* [China Statistical Yearbook], various issues.

Note: V = industrial value added; $A = V/[(L^{0.6})(K^{0.4})]$ = total factor productivity. Figures with no subscript refer to all industrial enterprises of the sector or province; those with subscript “f” refer to FIEs. ***, ** and * are significant at 1%, 5% and 10% confidence levels, respectively.