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Sourafel Girma, Yundan Gong and Holger Görg

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GEP Leverhulme Centre for Research on Globalisation and Economic Policy

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Can you teach old dragons new tricks?
FDI and innovation activity in Chinese State-owned enterprises

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Abstract

We investigate whether inward FDI, either at the firm or industry level, has any impact on product innovation by Chinese State owned enterprises (SOEs). We use a comprehensive firm level panel data set of some 30,000 SOEs covering the period 1999 to 2003. Our results show that foreign capital participation is associated with higher innovative activity. Inward FDI in the sector has a negative effect on innovative activity in SOEs. However, there is a positive effect of FDI on SOEs that export, invest in human capital or R&D, or have prior innovation experience. We also find that SOEs with *internal* R&D activity and human capital development are successful innovators. Hence, our results suggest that rather than relying on sector level inward FDI to improve domestic innovative activity, it is important to get the firm-level fundamentals right.

JEL classification: F23, O31

Keywords: Innovation, FDI, state owned enterprises, spillovers, competition, China

Outline

1. *Introduction*
2. *An overview of FDI in China*
3. *Empirical approach*
4. *Database description and variable construction*
5. *Discussion of the results*
6. *Conclusions*

Non-Technical Summary

China has undergone dramatic economic changes since it started its economic reforms in 1979. Indeed, it has now emerged as a rapidly growing manufacturing base and exporting nation; an issue that has stirred much recent debate in the popular press as well as among academics. The process of opening up the Chinese economy has received a further boost since its accession to the World Trade Organisation (WTO) in 2001. Economic reforms have had particular implications for Chinese State-owned enterprises (SOEs). From being the by far dominant form of enterprise in pre-reform China their importance has declined rapidly over the last two decades. Hence, reforming SOEs in order to make them efficient to compete successfully on domestic and international markets is of utmost importance for sustained growth of the Chinese economy in particular in the light of the necessary adjustment of domestic policy to WTO rules.

One way of improving efficiency and competitiveness in a firm is through innovative activity and this is what we focus on in this paper. In particular, we concern ourselves with product innovation. Specifically, our research question is to examine the role of firm level characteristics as well as inward foreign direct investment (FDI) for SOEs innovative activity.

FDI can impact on SOEs' activities in two ways. Firstly, directly at the level of the firm through injections of foreign capital, e.g., through acquisitions or joint ventures. In this case, our working assumption is that foreign capital participation at the firm level may bring with it transfer of knowledge from the foreign parent company which should stimulate innovation activity. Alternatively, even without knowledge transfer a capital inflow may reduce financial constraints and hence improve innovation. Secondly, FDI at the level of the industry can impact on SOEs innovation activity through potential competitive effects or spillovers. Competition from foreign multinationals can either stimulate domestic innovative activity or the effect can turn out to be negative, similar to the ideas discussed in the recent literature. Furthermore, knowledge spillovers can have positive effects on innovative activity of SOEs.

To investigate these issues we use a rich panel data set of some 30,000 state-owned enterprises (SOEs) in manufacturing industries for the period 1999 to 2003. Our data, hence, allow us to have a first look at the post-WTO response of SOEs to multinational activities in China. We estimate an empirical model of SOEs product innovation activity where we take explicit account of endogeneity of regressors and allow for heterogeneous FDI effects. Our results show that that foreign capital participation in an SOE is associated with higher innovative activity. Inward FDI in the sector has a negative effect on innovative activity in SOEs. However, there is a positive effect of FDI on SOEs that export, invest in human capital or R&D, or have prior innovation experience. We also find that SOEs with internal R&D activity and human capital development are successful innovators.

We can interpret our findings in terms of the ideas developed in the recent literature on the role of competition for innovation. Poorly performing SOEs may be "laggards" and hence their innovative activity is discouraged due to increasing competition through FDI. By contrast, Chinese SOEs with higher level of absorptive capacity may be "neck-on-neck" with foreign multinationals and, hence, their innovative activities are stimulated. This points to the conclusion rather than just rely on unconditional FDI spillovers to improve domestic innovative activity, policy makers should focus more on getting the firm-level fundamentals right.

I. Introduction

China has undergone dramatic economic changes since it started its economic reforms in 1979. Indeed, it has now emerged as a rapidly growing manufacturing base and exporting nation; an issue that has stirred much recent debate in the popular press as well as among academics. The process of opening up the Chinese economy has received a further boost since its accession to the World Trade Organisation (WTO) in 2001.

Economic reforms have had particular implications for Chinese State-owned enterprises (SOEs). From being the by far dominant form of enterprise in pre-reform China their importance has declined rapidly over the last two decades. For example, as Bajona and Chu (2004) show, the share of output produced by SOEs decreased from 78 percent in 1978 to 28 percent in 1999. Also, the SOE sector was shown to have been making net losses since the late 1990s. Still, the welfare of tens of millions of urban workers, the efficiency of the domestic banking sector and the generation of adequate state revenues all depend to a large extent on the success of SOEs. Given this development, a number of economists argue that without state subsidies, protection and easy access to bank credits, the majority of SOEs would be on the verge of collapse (e.g. Lin et al. 1998). Hence, reforming SOEs in order to make them efficient to compete successfully on domestic and international markets is of utmost importance for sustained growth of the Chinese economy in particular in the light of the necessary adjustment of domestic policy to WTO rules.

One way of improving efficiency and competitiveness in a firm is through innovative activity.[1] Innovation allows firms to develop new processes to produce existing goods more efficiently or indeed develop new products (or differentiate existing ones) that allows it to expand sales and improve market performance. These two innovation activities

[1] Of course, alternative responses at the firm level may be to reduce costs at given levels of output and technology ("downsizing"), or to shut down completely. We do not consider these issues here but focus on innovative activity in SOEs.

are generally referred to as process and product innovation. We concern ourselves with the latter of these, product innovation. Specifically, our research question is to examine the role of firm level characteristics as well as inward foreign direct investment (FDI) for SOEs innovative activity.[2]

FDI can impact on SOEs' activities in two ways. Firstly, directly at the level of the firm through injections of foreign capital, e.g., through acquisitions or joint ventures. In this case, our working assumption is that foreign capital participation at the firm level may bring with it transfer of knowledge from the foreign parent company which should stimulate innovation activity. Alternatively, even without knowledge transfer a capital inflow may reduce financial constraints and hence improve innovation. Secondly, FDI at the level of the industry can impact on SOEs innovation activity through potential competitive effects or spillovers. Competition from foreign multinationals can either stimulate domestic innovative activity or the effect can turn out to be negative, similar to the ideas discussed recently by Aghion et al. (2005). Furthermore, knowledge spillovers can have positive effects on innovative activity of SOEs.[3]

To investigate these issues we use a rich panel data set of some 30,000 state-owned enterprises (SOEs) in manufacturing industries for the period 1999 to 2003. Our data, hence, allow us to have a first look at the post-WTO response of SOEs to multinational activities in China. We estimate an empirical model of SOEs product innovation activity where we take explicit account of endogeneity of regressors and allow for heterogeneous FDI effects. Our results show that inward FDI at the sector level impacts negatively on the innovative activity of SOEs. We also find that SOEs with foreign capital participation innovate more than other SOEs. Taking account of firm level heterogeneity we find that

[2] Our paper is thus related to the study by Hu et al. (2005) who investigate the impact of domestic and foreign R&D, and foreign direct investment on productivity of Chinese large and medium sized enterprises.

[3] This latter argument is similar to that made in the literature on "productivity spillovers" (e.g., Javorcik, 2004; Aitken and Harrison, 1999) that argues that domestic firms can "learn" from multinationals, e.g., through input-output linkages, demonstration effects or movement of workers.

there is a positive effect of sector level FDI on SOEs which are already innovators, are R&D active, engage in labour training or are exporters.

The remainder of the paper is structured as follows. Section II provides a brief overview of the development of inward FDI in China. Section III describes the empirical approach, while Section IV introduces the data set and provides some summary statistics. Econometric results are discussed in Section V and Section VI concludes.

II. An overview of FDI in China

To motivate the empirical analysis, this section provides a brief overview of the trends of FDI flows into China over the past two and half decades.[4] When the Chinese government initiated economic reforms in the late 1970s, FDI was only allowed in four designated Special Economic Zones (SEZs)[5] and foreign investors were required to have local partners. However by 1986 the government started to implement further policies to attract FDI. Wholly foreign-owned enterprises were allowed for the first time, and export-oriented joint ventures and those employing advanced technology were encouraged through the provision of tax benefits.

As Figure 1 shows the various policies that are designed to attract FDI appear to have paid off. From nearly 0 in 1979, the annual flow of FDI into China reached US$ 53.51 billion in 2003, leaving China to be ranked top FDI destination world-wide. The surge of FDI after 1992 had been mainly attributed to a wave of new policies of further economic liberalisation. Foreign investors were offered better opportunities to sell their products in

[4] Some of the material in this section draws on Chen (1996, 1997), Lemoine (2000) and Wei (2003).
[5] The SEZs consisted of three in Guangdong province (Shenzhen, Zhuhai and Shantou) and Xiamen in Fujian Province .

the domestic market and allowed to invest into hitherto restricted sectors such as retail trade and finance.[6]

[Figure 1 here]

A noteworthy feature of FDI in China is that it is characterised by a very uneven regional distribution. During the period 1987-2000, about 87% of cumulative FDI was located in the coastal regions (Wei, 2003). This is a reflection of the initial policy that restricted FDI to coastal regions and the proximity of those regions to Hong Kong and Taiwan, the main sources of foreign investment, especially at the initial stages of the economic reforms. Although western and central regions (where SOEs have significant presence) have started to gradually attract more and more foreign investors, the skewed distribution of FDI in favour of the eastern coastal regions has raised serious concerns that FDI might exacerbate existing regional disparities.

Given the huge potential of the Chinese market, it is perhaps surprising that only few countries are the major sources of inward investment. Between 1979 and 1991, Hong Kong accounted for nearly two-thirds of total FDI. Most of the investment from Hong Kong is export-oriented and concentrated in labour intensive sectors. During the same period, the share of Japanese and US FDI was 14% and 10% respectively. During the period 1992 to 1998 the average share of FDI from the US has declined to 8% and inward investment from the European Union countries accounted for less than 7% of total FDI. In general FDI from OECD countries tends to be directed to more capital-intensive sectors and is predominantly motivated by the desire to access the huge domestic market.

III. Empirical approach

[6] However, it is worth noting that the devaluation of the Rembini also played an important part in the surge of FDI during this period.

Why would one expect the increased influx of FDI to have had any effect on product innovation carried out by State-owned enterprises? Firstly, the influx of foreign capital can alleviate financial constraints which may hinder innovation. Also, foreign capital participation in an SOE may bring with it an inflow of technology. After all, in standard models of multinational enterprises (MNEs) they are assumed to have a "superior technology" compared to domestic firms (Markusen, 2002). Hence, a foreign capital inflow through an acquisition, joint venture or some other form of capital transfer may lead to the installation of the foreign technology in the SOE. Both of these processes could manifest themselves in increasing innovative activity. However, as multinationals generally undertake their innovative activity in the headquarters large inflows of foreign capital may actually be expected to reduce innovative activity, as these functions may be redirected to the parent company's home country.

At the level of the industry, the superior knowledge brought into the economy through FDI may leak to domestic firms through, e.g., worker movements, imitation etc, similar to the arguments made in the literature on productivity spillovers (e.g., Görg and Greenaway, 2004). If domestic firms learn the better technology from MNEs then this may also lead to more innovation activity in the SOEs affected.

In addition to being potential generators of spillovers, multinationals will also affect the competitive landscape in the domestic economy, leading to an increase in competition for domestic firms. It is well known that competition affects innovative activity (e.g., Geroski, 1995, Blundell et al., 1999, Aghion et al., 2005) and we may therefore expect that an increasing influx of FDI will, through changes in competition, also impact on domestic innovative activity. Aghion et al. (2005) argue theoretically and provide evidence that increasing competition is expected to discourage laggard firms from innovating, but may stimulate innovative activity in firms that are neck-on-neck in terms of technology with

their competitors. Hence, the effect of FDI may depend on the "quality" of domestic firms: if they are laggards relative to multinationals then we would expect a negative competition effect. If, however, they are close to their multinational competitors we would expect increasing levels of FDI to stimulate innovation in domestic firms.

In our empirical model a SOE (indexed by *i*) either innovates at time *t* with positive rate of innovation ($S_{it} > 1$) or it does not ($S_{it} = 0$). To determine the relationship between FDI and the rate of product innovation, defined as the share of new products in total sales, we formulate a Tobit model in terms of a latent variable model as follows:

$$\begin{aligned} S_{it}^{*} &= \beta' X_{it} + \gamma' FDI_{it-1} + D_{it} + \varepsilon_{it} \\ S_{it} &= 0 \qquad\qquad if\ S_{it}^{*} \le 0 \\ S_{it} &= S_{it}^{*} \qquad\qquad if\ S_{it}^{*} > 0 \end{aligned} \quad . \tag{1}$$

X is a vector of firm level determinants of innovation which includes exporting intensity, R&D intensity, age, the ratio of employee training expenditure to total wage bills and the firm's market share within the three-digit industry. The choice of these firm level covariates is guided by theoretical considerations as well as existing empirical evidence (e.g. Crepon et al., 1998, Blundell et al., 1999, Jefferson and Huamao, 2004). On the other hand, *FDI* is a vector of *lagged* firm level and industry-region specific FDI indices,[7] and *D* consists of regional, industry and time dummies. A quadratic term of the firm level foreign participation variable is considered to allow for a more general non-linear relationship between foreign capital and innovation.

In the above specification R&D intensity is potentially endogenous since it is a major input into the product innovation process, and the choice of this input is arguably correlated with factors that determine the firm's decision to innovate. Similar arguments can also be made regarding the potential endogeneity of market share, employee training and exporting.

[7]The variables in the econometric model will be described in more details the next section.

In order to deal with the problem of endogeneity, we use the instrumental variables technique for Tobit models due to Blundell and Smith (1986).

Lagged values of the potentially endogenous variables are used as instruments. In addition lagged firm debt (total bank loans/asset) and the share of the state sector in the industry and region are also used as extra instruments. The share of the state sector is a proxy for state dominance in the sector/region, and to the extent that firms in state-dominated sectors/regions are less efficient (due to, for example, insufficient competitive stimulus) this variable is a relevant instrument for R&D activity or investment in human capital. Similarly, the level of debts or credit constraints is likely to affect product innovation through its effect on R&D activity or human capital investment, and possibly exporting, and is therefore arguably a sensible instrument for the endogenous regressors.[8]

The estimation of Tobit models with endogenous regressors essentially involves two steps:[9] (i) generate residual terms from linear regressions of each endogenous variable on the instrumental variables and all other exogenous regressors, and (ii) estimate a standard Tobit model by including the residual terms from step (i) in the list of covariates. The residual terms are correction terms for the endogeneity problem, and jointly statistically significant coefficients can be taken as evidence in favour of the hypothesis that instrumented variables are indeed endogenous.

IV. Database description and variable construction

We draw on the Annual Report of Industrial Enterprise Statistics compiled by the State Statistical Bureau of China, covering firms with annual turnover of over five million Renminbi. The data set includes information on firm ownership structure, industry

[8] A test for the validity of the instruments is conducted in the next section.

[9] A one-step variant of this estimator involving stronger distributional assumptions is also available (see Newey, 1987). However, the estimator fails to attain convergence in our data. This type of convergence problem is frequently encountered when there are more than one endogenous regressors.

affiliation, geographic location, establishment year, employment, gross output, sales, product innovation (defined as the production of goods involving new technologies), value added, net fixed assets, exports, R&D and employee training expenditures.[10] The data available to us cover the period 1999 to 2003.

Data considered in this paper relate to State-owned enterprises as well as affiliates of foreign multinationals (defined as those with at least 25% share of foreign capital). We use the latter information to calculate the variables on sector level FDI. Multinational enterprises which have owners from Hong Kong, Macao, or Taiwan are labelled Ethnic Chinese multinationals, whereas other MNEs (the majority of which are from OECD countries) are defined as foreign multinationals. State-owned enterprises have, in some cases, also some minor ownership stakes (less than 25 percent) held by foreign owners. Similar to MNEs we also distinguish foreign capital participation in SOEs from Ethnic Chinese or other foreign sources.

As has been pointed out in recent literature on productivity spillovers from FDI, domestic firms can benefit from horizontal or vertical spillovers from FDI. Indeed, it is argued by Javorcik (2004) and Girma et al. (2004) that vertical spillovers may be more important than horizontal spillovers. Essentially, horizontal spillovers arise when domestic firms benefit from multinationals in the same industry through, e.g., demonstration effects, movement of labour or direct competition reducing X-inefficiency. Firms can also benefit through customer-supplier linkages with multinationals in different industry, this is termed vertical spillovers.

Accordingly, we firstly calculate a variable to capture horizontal spillovers, i.e., effects on domestic firms from multinationals operating in the same industry and region. The degree of horizontal FDI in industry j at time t, say $HRFDI_{jt}$ is constructed as the

[10] Various sub-samples of this rich data set have been used by other authors (e.g., Hu et al., 2005).

proportion of output accounted for by multinational companies in the same region (as is common in the literature).[11] This and all other indices of FDI are constructed for each of the 180 three-digit industry within each of the 31 provinces of China. As a result, the FDI variables under consideration in this paper exhibit very good sample variability.

We also calculate two measures of foreign presence in backwardly and forwardly linked industries in line with the literature. To gauge the extent of backward linkages (spillovers received by domestic firms in upstream sectors), the backward measure of FDI for industry *j* at time *t* is computed as:

$$BRFDI_{jt} = \sum_{\forall k \neq j} \alpha_{kj} HRFDI_{kt} \quad (2)$$

where α_{kj} is the proportion of sector *j*'s output supplied to industry *k*. It is assumed that the greater the proportion of output supplied to an industry with foreign multinational presence, the greater the degree of linkages between foreign and local firms. The index of sector-region specific FDI in upstream (forwardly linked) sectors is calculated similarly as

$$FRFDI_{jt} = \sum_{\forall k \neq j} \beta_{kj} HRFDI_{kt} \quad (3)$$

where β_{kj} represents the proportion of sector *k*'s output supplied to industry *j*. This measure captures the extent of forward linkages between local firms in downstream sectors and MNEs in upstream sectors. The information to construct the backward and forward linkage indices (that is the αs and βs) is obtained from the 1997 Input-Output Table of China published by the State Statistical Bureau.

To summarise, we hypothesise three potential sources of FDI effects: horizontal, backward and forward FDI. Each of these FDI indices is further divided according to the geographic origin of the foreign investment (Ethnic Chinese versus Foreign multinationals).

[11] Total industry output includes output from foreign firms, SOEs, private firms and collectively owned enterprises.

Beside these variables that capture the indirect effects of FDI on firm level innovation, we also include indicators of direct foreign participation at the level of the SOE, measured by the share of foreign capital in the SOE.

For 1999 and 2003, Table 1 gives the shares of state-owned enterprises (including those with less than 25 percent foreign capital participation) and foreign-owned multinational enterprises in the database across two digit industries.[12] It is apparent that foreign-owned firms have significant presence in most industries. Industries particularly important to foreign investors include some high tech industries such as Electronic & Telecommunications and Instruments & Meters, but also more traditional manufacturing sectors such as Garments, Leather, and Timber Processing.

[Table 1 here]

Since the focus of this paper is on SOEs, we base our empirical analysis on those firms only. Hence, equation (1) will be estimated using data on some 30,000 SOEs for which adequate information is available. Table 2 provides some summary statistics of the variables used in the analysis.

[Table 2 here]

In Table 3 we report the pattern of product innovation development between 1999 and 2003 for SOEs across the two-digit industries. There are a number of noteworthy points. Firstly, the proportion of innovating firms has slightly declined over time in most sectors. However, the share of new product sales in total sales is quite significant and has risen in most sectors. Secondly, labour intensive sectors (e.g., food manufacturing and paper products) have in general the lowest proportion of innovators. However, export-competing labour intensive sectors (e.g., textile industry) exhibit a relatively large number of

[12] Recall, however, that the variables used in the analysis, as discussed previously, are defined at the three digit level.

innovators. Finally, the product innovation intensity is remarkably similar across labour intensive (e.g. plastic products), capital-intensive (transport equipment) and technology intensive (e.g. medical and pharmaceutical products) sectors.

[Table 3 here]

V. Discussion of the results

Table 4 presents the estimations of the benchmark Tobit model using data for SOEs. column (1) shows results from a Tobit estimation treating all variables as exogenous, while column (2) relates to the estimation of an endogenous Tobit model as discussed in Section III. Note that the hypothesis of exogeneity (which is equivalent to testing the joint significance of the endogeneity-correction terms) is emphatically rejected, vindicating our approach to employ instrumental variable techniques in the estimations. Of course, the reliability of the endogenous Tobit hinges on the validity of instruments used. To our knowledge there are no formal tests of the validity of instruments within the context of these endogenous Tobit specifications. Nevertheless, in order to gauge the appropriateness of the instruments we estimate a linear instrumental variables model (using the same set of instruments as for the endogenous Tobit) and obtain a Sargan test statistic of the implied overidentifying restrictions. Reassuringly the test result, which is reported in column (2), suggests the validity of the instrumental variables.[13]

Turning to the estimates from the endogenous Tobit model in column (2) we find that R&D intensity exerts a positive and significant influence on the rate of product innovation. This is reassuring given that R&D intensity is a major input in the product innovation process. We also find that SOEs that invest in employee training have a higher propensity to innovate. This suggests that there may be complementarity between human capital investment and innovation as discussed by, for example, Redding (1996). Also,

[13] The results of the linear instrument variables regression are not reported here to save space. They are available from the authors upon request.

firms that enjoy higher market shares in their industry are more likely to engage in product innovation activity.

In contrast to Jefferson and Huamao (2004), we find that older firms are more likely to engage in product innovation than their younger counterparts. This is consistent with the idea that older SOEs might be realising that their survival depends on the constant upgrading of their productive capabilities and changing their existing way of doing things. We also find a positive relationship between product innovation and exporting intensity. This accords with Kraay (1999)'s view that amongst Chinese enterprises exporting is an indicator of superior performance.[14]

More closely related to the central issue of our paper, we find evidence that SOEs with some foreign capital participation are more likely to engage in product innovation. We, however, also find that the relationship between foreign capital participation and innovation is concave. This suggests that foreign capital participation increases innovation up to a critical value, after which the marginal effect of changes in foreign capital on innovative activity starts to decline. This probably reflects the fact that generally multinationals undertake their innovative activity in their headquarters (Markusen, 2002). Hence, while some foreign capital participation may bring with it knowledge transfer which initially increases innovative activity, further increases in the foreign ownership share may lead to innovation activity being relocated to the parent of the foreign owner abroad. However, according to the point estimates presented in column (2) of Table 4, the implied optimal value for foreign capital participation is about 48% (for foreign) and 53% (for Ethnic Chinese) respectively, well above the sample maximum of 25%.[15]

[14] However Eckaus (2004) argues that there exists a strong correlation between subsidies received by loss-making SOEs and their export performance. This would appear to indicate that exporting amongst Chinese SOEs is not necessarily an indicator of superior performance.

[15] This indicates that innovative activity decreases once the firm is nearly majority-foreign owned, which is in line with our argument. Recall that once foreign participation exceeds 25% the firm is no longer classified as a domestically-owned SOE but as a foreign multinational.

Turning our attention to the spillover effects of FDI, it is evident from Table 4 that the nature and extent of these effects vary according to the type of FDI under consideration. Specifically, we do not find any positive effects from backward or forward linkages between multinationals and domestic firms. In contrast, we find strong negative effects of horizontal Ethnic Chinese FDI on innovative activity. This suggests that the competition effect is important. In particular, with a view to the ideas developed by Aghion et al. (2005), our results are in line with the notion that SOEs are "laggards" relative to the competition from multinationals and, hence, their innovative activity is stifled following increases in competition.

However, we also find moderate positive spillovers from foreign MNEs, which are generally more technologically advanced than Ethnic Chinese MNE, suggesting that for the average SOE, the competition effect resulting from foreign MNEs is more than compensated by technological externalities from those firms. However an important lesson that can be drawn from the literature on FDI spillovers is that average effects are seldom representative, and the incidence of positive spillovers from MNEs to indigenous enterprises is a function of the characteristics of the latter. For example, it is suggested that the extent of FDI spillovers is a function of domestic firms' ability to absorb technology (e.g. Girma, 2005).

[Table 4]

Accordingly, we explore the role of absorptive capacity in the present setting by interacting the FDI variables with alternative indicators of firm learning and competitive capabilities. Throughout, we work with a parsimonious model which excludes the vertical indices of FDI, as these were found to be jointly insignificant in our benchmark model.[16] The indicators of absorptive/competitive capacity include past experience in product

[16] A test of the joint significance of the vertical variables in the benchmark model is reported in column (3) of Table 4. The vertical FDI variables also proved to be insignificant when interacted with the indicators of absorptive capacity.

innovation, R&D activity, labour training and exporting. As shown in Table 4, SOEs with more R&D, labour training expenditure and exports are more likely to innovate. Hence, they may be less likely to be "laggards" and may actually be able to increase their innovative activity in the presence of increasing competition from FDI.

Table 5 shows the results of these regressions, where the interaction terms are generated by interacting the measures of horizontal FDI in turn with dummy variables for past product innovation (column 1), R&D (column 2), labour training (column 3) and exporting (column 4). The results show that, controlling for absorptive capacity, we find strong unconditional negative effects of horizontal foreign presence (both Ethnic Chinese and foreign MNEs) on innovative activity of purely domestic. However, allowing for different coefficients of these variables conditional on the various indicators of absorptive capacity, we establish that there are statistically significant positive effects from horizontal foreign presence on the innovative activity by SOEs.

This can be interpreted in two ways: either, there are indeed positive knowledge spillovers from foreign multinationals to these types of firms, or the increase in competition stimulates innovative activity a la Aghion et al. (2005), indicating that these firms are "neck-on-neck" with foreign multinationals in their industry. Either way, policy makers involved in the reform of SOEs should ensure that managers have the right incentives to make long-term investments in absorptive capacity development, rather than rely on unconditional and uniformly distributed spillovers from multinationals.

[Table 5 here]

Recall that our FDI variables are defined using data on foreign owned multinationals only, which are those firms with at least 25 percent foreign ownership. However, there are domestically-owned enterprises which have foreign capital participation of less than 25 percent which are not considered in this definition. Our argument for doing

so is that while these firms benefit from foreign capital participation in terms of innovation (as shown in our estimations) there may be less potential for spillovers from them as foreign owners are unlikely to transfer the best technology. This is in line with the evidence by Javorcik and Spatareanu (2003) who find that, in Romania, foreign MNEs tend to transfer more technology to their wholly-owned projects than to those owned partially.

However, to allow for potential spillovers/competition from such domestic firms with less than 25 percent foreign capital participation and to check the robustness of our estimations thus far we use an alternative definition of sectoral FDI. Specifically, rather than defining horizontal FDI in industry *j* at time *t* (i.e. $HRFDI_{jt}$) as simply the proportion of output accounted for by multinational companies we exploit the richness of our data set and weigh the output of firms with foreign capital by the extent of their foreign participation, measured by the share of foreign capital at the level of the firm. Under this definition of sectoral FDI, firms that are classified as domestic but have some foreign capital will also (proportionally) contribute to aggregate output of the foreign sector. The results based on the local participation-weighted FDI indices are reported in Table 6. It is reassuring to note that the conditional and unconditional estimates exhibit the same pattern as observed in Table 5 both in terms of magnitude and statistical significance.

[Table 6 here]

In a further extension of the benchmark model, we consider whether the market orientation of multinationals (as opposed to their nationalities) matter for spillovers. The estimates from the endogenous Tobit model are given in Table 7. For SOEs with some experience in product innovation, R&D activity, labour skill upgrading and exporting, the benefits from domestic market oriented FDI are more substantial than those from export-

oriented FDI. This suggests the importance of market competition in spurring the innovative activities of SOEs which used to dominate the industrial landscape of China.

[Table 7 here]

VI. Conclusions

This paper investigates whether inward FDI, at the level of the firm and industry, has any impact on the rate of product innovation by the Chinese State owned enterprises (SOEs). To do so we use a rich firm level panel data set of some 30,000 SOEs covering the period 1999 to 2003. Controlling for the endogeneity of the regressors and allowing for heterogeneous FDI effects, our results show that that foreign capital participation in an SOE is associated with higher innovative activity. Inward FDI in the sector has a negative effect on innovative activity in SOEs. However, there is a positive effect of FDI on SOEs that export, invest in human capital or R&D, or have prior innovation experience. We also find that SOEs with internal R&D activity and human capital development are successful innovators.

We can interpret our findings in terms of the ideas developed by Aghion et al. (2005) on the role of competition for innovation. Poorly performing SOEs may be "laggards" and hence their innovative activity is discouraged due to increasing competition through FDI. By contrast, Chinese SOEs with higher level of absorptive capacity may be "neck-on-neck" with foreign multinationals and, hence, their innovative activities are stimulated. This points to the conclusion rather than just rely on unconditional FDI spillovers to improve domestic innovative activity, policy makers should focus more on getting the firm-level fundamentals right.

Table 1:
Output share of state-owned (SOEs) and foreign-owned enterprises by industry :

Two-digit industry classification	**SOE**		**FMNE**		**HTM**	
	1999	***2003***	***1999***	***2003***	***1999***	***2003***
13-Food Processing	0.519	0.391	0.117	0.165	0.12	0.118
14-Food Production	0.462	0.258	0.122	0.275	0.108	0.113
15-Beverage Industry	0.519	0.289	0.128	0.298	0.171	0.106
16-Tobacco Processing	0.474	0.432	0	0.007	0.072	0.027
17-Textile Industry	0.412	0.344	0.218	0.179	0.147	0.134
18-Garments and Other Fibre Products	0.325	0.26	0.267	0.319	0.203	0.189
19-Leather, Furs, Down and Related Products	0.341	0.376	0.275	0.258	0.182	0.131
20-Timber Processing	0.329	0.233	0.219	0.354	0.158	0.123
21-Furniture Manufacturing	0.453	0.29	0.141	0.177	0.155	0.307
22-Papermaking and Paper Products	0.409	0.542	0.106	0.33	0.133	0.107
23-Printing and Record Medium Reproduction	0.501	0.454	0.118	0.225	0.14	0.108
24-Cultural, Educational and Sports Goods	0.361	0.324	0.285	0.271	0.202	0.189
25-Petroleum Refining and Coking	0.621	0.331	0.068	0.101	0.07	0.173
26-Raw Chemical Materials and Chemical Products	0.439	0.383	0.173	0.14	0.12	0.126
27-Medical and Pharmaceutical Products	0.56	0.303	0.072	0.074	0.12	0.086
28-Chemical Fibre	0.451	0.314	0.168	0.269	0.221	0.135
29-Rubber Products	0.435	0.251	0.157	0.261	0.104	0.158
30-Plastic Products	0.472	0.351	0.213	0.207	0.145	0.14
31-Nonmetal Mineral Products	0.495	0.331	0.11	0.223	0.092	0.089
32-Smelting and Pressing of Ferrous Metals	0.461	0.473	0.115	0.103	0.096	0.22
33-Smelting and Pressing of Nonferrous Metals	0.547	0.435	0.085	0.169	0.211	0.116
34-Metal Products	0.449	0.374	0.169	0.219	0.121	0.119
35-Ordinary Machinery	0.515	0.42	0.153	0.143	0.088	0.101
36-Special Purposes Equipment	0.527	0.345	0.075	0.174	0.118	0.093
37-Transport Equipment	0.462	0.371	0.088	0.186	0.12	0.131
39-Other Electronic Equipment (Weapon)	0.467	0.313	0.175	0.137	0.184	0.196
40-Electric Equipment and Machinery	0.514	0.285	0.169	0.211	0.169	0.139
41-Electronic and Telecommunications	0.381	0.275	0.379	0.197	0.202	0.281
42-Instruments and meters	0.399	0.318	0.212	0.256	0.251	0.177
43-Other Manufacturing	0.486	0.356	0.255	0.272	0.176	0.131

Notes:

i. Authors calculations based on the database used in this paper.

ii. The numbers preceding the industry description refer to the two-digit codes used by the State Statistical Bureau of China.

iii. HTM stands for foreign-invested enterprises from Hong Kong, Taiwan and Macao. FMNE represents subsidiaries of other foreign multinational enterprises.

Table 2:
Summary statistics

Variables	Mean	Std. Dev.
SOE level variables		
Product innovation indicator	0.1123	0.3157
New product sales /total sales (innovators only)	0.2902	0.2723
Export sales / total sales	0.0537	0.0936
Labour training expenditure/wage	0.0059	0.0329
R&D expenditure/ total sales	0.0016	0.0235
Age	27.1209	17.6688
Three-digit industry market share	0.0010	0.0066
Share of foreign MNEs' capital*	0.142	0.195
Share of Ethnic Chinese MNEs' capital*	0.108	0.207
Sector-Region level variables		
Horizontal FDI indices		
Foreign Multinationals	0.1113	0.1620
Ethnic Chinese	0.0793	0.1351
Upstream FDI indices		
Foreign Multinationals	0.0007	0.0069
Ethnic Chinese	0.0005	0.0044
Downstream FDI indices		
Foreign Multinationals	0.0005	0.0060
Ethnic Chinese	0.0004	0.0029

Note: The total number of observations used in the econometric analysis is 72706. These are based on 29830 SOEs

(*) The average share of MNE capital in is calculated over SOEs with positive foreign capital only.

Table 3:

Sectoral and temporal pattern of product innovation for SOEs

	Fraction of innovators		**New product sales/total sales**	
Two-digit industry classification	1999	2003	1999	2003
13-Food Processing	0.018	0.015	0.322	0.119
14-Food Production	0.038	0.031	0.215	0.36
15-Beverage Industry	0.071	0.052	0.213	0.171
16-Tobacco Processing	0.144	0.207	0.143	0.187
17-Textile Industry	0.164	0.122	0.264	0.249
18-Garments and Other Fibre Products	0.071	0.046	0.423	0.331
19-Leather, Furs, Down and Related Products	0.097	0.088	0.539	0.496
20-Timber Processing	0.021	0.021	0.469	0.371
21-Furniture Manufacturing	0.048	0.029	0.209	0.487
22-Papermaking and Paper Products	0.062	0.036	0.268	0.424
23-Printing and Record Medium Reproduction	0.012	0.007	0.375	0.471
24-Cultural, Educational and Sports Goods	0.085	0.067	0.251	0.433
25-Petroleum Refining and Coking	0.09	0.076	0.223	0.242
26-Raw Chemical Materials and Chemical Products	0.111	0.093	0.243	0.282
27-Medical and Pharmaceutical Products	0.193	0.157	0.265	0.369
28-Chemical Fibre	0.164	0.114	0.231	0.157
29-Rubber Products	0.207	0.18	0.252	0.235
30-Plastic Products	0.078	0.099	0.351	0.26
31-Nonmetal Mineral Products	0.047	0.045	0.283	0.312
32-Smelting and Pressing of Ferrous Metals	0.121	0.148	0.195	0.252
33-Smelting and Pressing of Nonferrous Metals	0.146	0.103	0.271	0.353
34-Metal Products	0.101	0.073	0.229	0.188
35-Ordinary Machinery	0.235	0.203	0.228	0.25
36-Special Purposes Equipment	0.196	0.173	0.271	0.324
37-Transport Equipment	0.192	0.195	0.311	0.306
39-Other Electronic Equipment (Weapon)	0.541	0.205	0.282	0.268
40-Electric Equipment and Machinery	0.217	0.295	0.269	0.428
41-Electronic and Telecommunications	0.363	0.267	0.398	0.386
42-Instruments and meters	0.336	0.02	0.32	0.452
43-Other Manufacturing	0.029	0.022	0.455	0.258

Table 4:
FDI and Innovation : Benchmark model

	(1)	(2)	(3)
	Exogenous Tobit model	Endogenous Tobit model	Restricted endogenous Tobit model
Export intensity	0.123	0.124	0.124
	(0.041)***	(0.075)*	(0.075)*
R&D intensity	0.658	0.893	0.894
	(0.096)***	(0.134)***	(0.134)***
Labour training	0.352	0.509	0.507
	(0.084)***	(0.143)***	(0.143)***
Market share	4.831	14.141	14.146
	(0.332)***	(0.807)***	(0.807)***
Age	0.006	0.006	0.006
	(0.0001)***	(0.0001)***	(0.0001)***
Firm level FDI			
Foreign MNEs	2.319	2.003	2.005
	(0.226)***	(0.228)***	(0.228)***
Foreign Squared	-2.352	-2.088	-2.090
	(0.388)***	(0.390)***	(0.390)***
Ethnic Chinese MNEs	1.700	1.624	1.617
	(0.281)***	(0.281)***	(0.281)***
Ethnic Chinese squared	-1.612	-1.526	-1.516
	(0.461)***	(0.460)***	(0.460)***
Horizontal FDI spillovers			
Foreign MNEs	0.005	0.037*	0.038
	(0.023)	(0.020)	(0.021)*
Ethnic Chinese MNEs	-0.225	-0.194	-0.196
	(0.033)***	(0.032)***	(0.032)***
Forward FDI spillovers			
Foreign MNEs	0.014	0.021	
	(0.608)	(0.610)	
Ethnic Chinese MNEs	-0.546	-0.472	
	(1.046)	(1.051)	
Backward FDI spillovers			
Foreign MNEs	-1.280	-1.231	
	(0.765)*	(0.760)	
Ethnic Chinese MNEs	0.381	0.130	
	(1.326)	(1.330)	
Exogeneity test (p-value)		0.02	0.02
Observations	72706	72706	72706
p-value from Sargan test of overidentifying restrictions		0.282	
Test of joint insignificance of vertical FDI variables			Chi2(4) = 3.22 p-value = 0.521

Notes;

(i) Standard errors in parentheses
(ii) significant at 10%; ** significant at 5%; *** significant at 1%
(iii) All regressions include industry, region and time dummies
(iv) As discussed in the text, Sargan test is based on linear instrumental variables estimation.

Table 5
FDI and Innovation: The role of absorptive capacity

	(1)	(2)	(3)	(4)
	Product innovation	R&D	Labour training	Exporting
Export intensity	0.126	0.112	0.131	-0.134
	(0.069)*	(0.064)*	(0.075)*	(0.079)*
R&D intensity	0.705	0.344	0.803	0.863
	(0.121)***	(0.140)**	(0.134)***	(0.133)***
Labour training	0.380	0.324	0.124	0.481
	(0.132)***	(0.147)**	(0.158)	(0.144)***
Market share	10.868	13.017	13.741	13.667
	(0.700)***	(0.790)***	(0.800)***	(0.803)***
Age	0.003	0.005	0.005	0.006
	(0.0001)***	(0.0001)***	(0.0001)***	(0.0001)***
Firm level FDI				
Foreign MNEs	1.197	1.711	1.875	1.915
	(0.210)***	(0.224)***	(0.228)***	(0.227)***
Foreign MNEs squared	-1.451	-1.859	-1.954	-2.008
	(0.365)***	(0.382)***	(0.391)***	(0.388)***
Ethnic Chinese MNEs	1.158	1.339	1.554	1.490
	(0.265)***	(0.273)***	(0.278)***	(0.279)***
Ethnic Chinese squared	-1.324	-1.127	-1.375	-1.393
	(0.447)***	(0.438)**	(0.450)***	(0.457)***
Unconditional horizontal FDI spillovers				
Foreign MNEs	-1.046	-0.274	-0.348	-0.768
	(0.039)***	(0.028)***	(0.035)***	(0.068)***
Ethnic Chinese MNEs	-1.239	-0.407	-0.510	-0.718
	(0.056)***	(0.037)***	(0.048)***	(0.090)***
Horizontal FDI spillovers * conditioning variable				
Foreign MNEs	2.147	0.975	0.633	0.895
	(0.046)***	(0.040)***	(0.039)***	(0.068)***
Ethnic Chinese MNEs	2.567	0.835	0.554	0.589
	(0.069)***	(0.063)***	(0.057)***	(0.093)***
Exogeneity test (p-test)	0.04	0.04	0.04	0.02
Observations	72706	72706	72706	72706

Notes;
(i) Standard errors in parentheses
(ii) significant at 10%; ** significant at 5%; *** significant at 1%
(iii) All regressions include industry, region and time dummies

Table 6
Robustness check:
Alternative definition of horizontal FDI

	(1)	(2)	(3)	(4)
	Product innovation	R&D	Labour training	Exporting
Export intensity	0.137	0.100	0.124	-0.032
	(0.071)*	(0.055)*	(0.075)*	(0.077)
R&D intensity	0.811	0.587	0.858	0.891
	(0.124)***	(0.135)***	(0.133)***	(0.133)***
Labour training	0.452	0.401	0.191	0.476
	(0.141)***	(0.147)***	(0.152)	(0.144)***
Market share	10.772	12.802	13.783	13.946
	(0.743)***	(0.796)***	(0.797)***	(0.799)***
Age	0.004	0.006	0.006	0.006
	(0.0001)***	(0.0002)***	(0.0001)***	(0.0001)***
Firm level FDI				
Foreign MNEs	1.447	1.830	1.975	1.994
	(0.220)***	(0.225)***	(0.230)***	(0.228)***
Foreign MNEs squared	-1.778	-1.982	-2.092	-2.104
	(0.390)***	(0.382)***	(0.397)***	(0.390)***
Ethnic Chinese MNEs	1.064	1.509	1.509	1.505
	(0.269)***	(0.277)***	(0.280)***	(0.280)***
Ethnic Chinese squared	-1.102	-1.352	-1.358	-1.431
	(0.443)**	(0.451)***	(0.458)***	(0.460)***
Unconditional horizontal FDI spillovers				
Foreign MNEs	-0.987	-0.207	-0.299	-0.559
	(0.044)***	(0.029)***	(0.039)***	(0.081)***
Ethnic Chinese MNEs	-1.034	-0.309	-0.422	-0.837
	(0.053)***	(0.037)***	(0.049)***	(0.117)***
Horizontal FDI spillovers * conditioning variable				
Foreign MNEs	2.335	0.935	0.594	0.683
	(0.057)***	(0.050)***	(0.046)***	(0.083)***
Ethnic Chinese MNEs	2.329	0.872	0.617	0.850
	(0.069)***	(0.062)***	(0.059)***	(0.120)***
Exogeneity test (p-test)	0.10	0.06	0.03	0.02
Observations	72706	72706	72706	72706

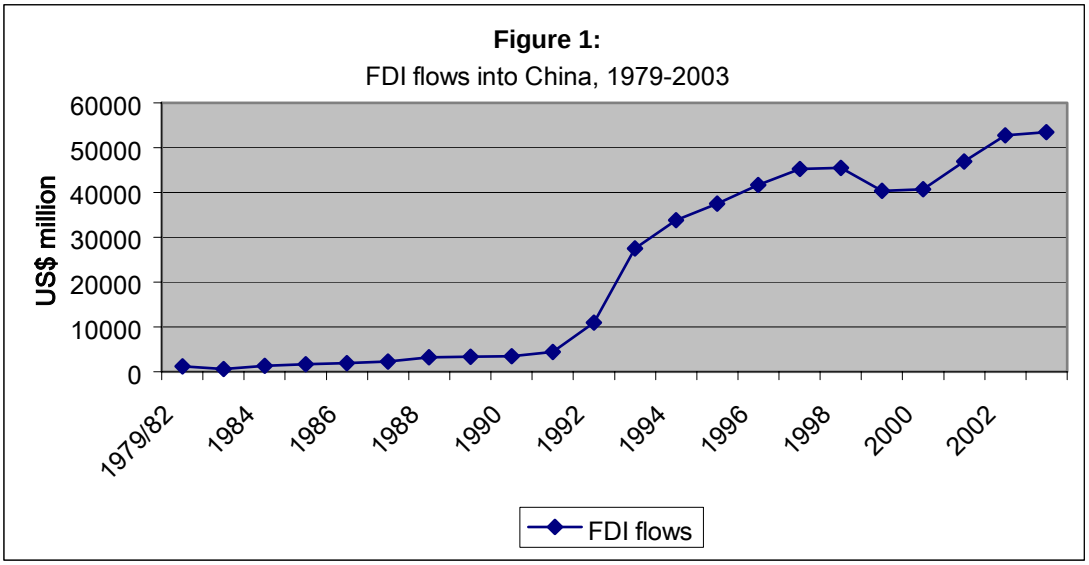
Notes;

(iv) Standard errors in parentheses
(v) significant at 10%; ** significant at 5%; *** significant at 1%
(vi) All regressions include industry, region and time dummies
(vii) Definition of horizontal FDI includes domestic enterprises with less than 25 percent foreign ownership, weighted by share of foreign capital at firm level

Table 7
Domestic innovation and the market orientation of FDI:

	(1)	(2)	(3)	(4)
	Product innovation	R&D	Labour training	Exporting
Export intensity	0.125	0.111	0.127	0.148
	(0.069)*	(0.054)*	(0.075)*	(0.079)*
R&D intensity	0.671	0.369	0.808	0.877
	(0.120)***	(0.140)***	(0.134)***	(0.133)***
Labour training	0.381	0.313	0.108	0.482
	(0.131)***	(0.147)**	(0.159)	(0.144)***
Market share	10.819	12.932	13.689	13.600
	(0.697)***	(0.791)***	(0.800)***	(0.803)***
Age	0.003	0.005	0.005	0.006
	(0.0001)***	(0.0001)***	(0.0001)***	(0.0001)***
Firm level FDI				
Foreign MNEs	1.198	1.782	1.920	1.957
	(0.209)***	(0.224)***	(0.228)***	(0.227)***
Foreign MNEs squared	-1.455	-1.955	-2.006	-2.059
	(0.363)***	(0.383)***	(0.392)***	(0.389)***
Ethnic Chinese MNEs	1.213	1.318	1.538	1.465
	(0.261)***	(0.274)***	(0.278)***	(0.280)***
Ethnic Chinese squared	-1.339	-1.111	-1.366	-1.381
	(0.439)***	(0.439)**	(0.451)***	(0.460)***
Unconditional horizontal FDI spillovers				
Domestic-oriented FDI	-1.248	-0.349	-0.436	-0.878
	(0.040)***	(0.028)***	(0.035)***	(0.070)***
Export-oriented FDI	-0.825	-0.269	-0.340	-0.511
	(0.059)***	(0.042)***	(0.056)***	(0.099)***
Horizontal FDI spillovers * conditioning variable				
Domestic-oriented FDI	2.681	1.093	0.720	0.957
	(0.048)***	(0.042)***	(0.039)***	(0.071)***
Export-oriented FDI	1.462	0.596	0.377	0.458
	(0.071)***	(0.070)***	(0.065)***	(0.103)***
Exogeneity test (p-test)	0.05	0.06	0.04	0.02
Observations	72706	72706		72706

Notes;
(i) Standard errors in parentheses
(ii) significant at 10%; ** significant at 5%; *** significant at 1%
(iii) All regressions include industry, region and time dummies



Data Source: China Statistical Yearbook, various issues

References

Aghion, P., N. Bloom, R. Blundell, R. Griffith and P. Howitt (2005), Competition and innovation: An inverted U relationship, *Quarterly Journal of Economics*, May 2005, pp. 701-728.

Aitken, Brian J. and Ann E. Harrison (1999): "Do Domestic Firms Benefit from Direct Foreign Investment? Evidence from Venezuela", *American Economic Review*, Vol. 89, pp. 605-618.

Bajona, Claustre and Tianshu Chu (2004), China's WTO Accession and its effect on state-owned enterprises, East-West Center Working Papers, No. 70

Blundell, R., R. Griffith and J. van Reenen (1999), Market share, market value and innovation in a panel of British manufacturing firms, *Review of Economic Studies*, 66, 529-554.

Chen, Chien-Husn (1996), "Regional determinants of foreign direct investment in mainland China", *Journal of Economic Studies*, 23(2), 18-7

Chen, Chunlai (1997), "Provincial characteristics and foreign direct investment location decision within China", *Chinese Economy Research Unit Working Paper* No. 97/16, University of Adelaide

Crepon, B., Duguet, E. and Mairesse (1998), "Research, innovation, and productivity: An econometric analysis at the firm level. NBER Working Paper 6696,

Eckaus, R.S (2004), "China's exports, subsidies to state owned enterprises and the WTO", MIT Department of Economics Working Paper 04-35.

Geroski, P. (1995), *Market structure, corporate performance and innovative activity*, Oxford: Oxford University Press.

Girma, S (2005). Absorptive capacity and productivity spillovers from FDI: a threshold regression analysis. *Oxford Bulletin of Economics and Statistics*, 67, 281-306.

Girma, S., H. Görg and M. Pisu (2004), Exporting, linkages and productivity spillovers from foreign direct investment, GEP Research Paper, University of Nottingham

Görg, Holger and David Greenaway (2004), "Much ado about nothing? Do domestic firms really benefit from foreign direct investment?", *World Bank Research Observer*, Vol. 19, pp. 171-197.

Hu, A.G.Z, G.H. Jefferson and Q. Jinchang (2005). "R&D and technology transfer: Firm level evidence from Chinese industry", *Review of Economics and Statistics*, forthcoming.

Jefferson, G.H. and Huamao, B. (2004) "R&D performance in Chinese industry". *Economics of Innovation and New Technology*, 13:1/2.

Javorcik, Beata S. (2004), "Does foreign direct investment increase the productivity of domestic firms? In search of spillovers through backward linkages", *American Economic Review*, 94, 605-627.

Javorcik, Beata S. and Spatareanu, Mariana (2003), "To Share or Not To Share: Does Local Participation Matter for Spillovers from Foreign Direct Investment?" World Bank Policy Research Working Paper 3118.

Kraay, A. (1999), "Exports and economic performance: Evidence from a panel of Chinese enterprises", *Revue d'Economie du Développement*, pp. 183-207.

Lemoine, F. (2000), "FDI and the opening up of China's economy", *CEPII Working Paper*, No. 00-11, June

Lin, Justin.Y., Fang, Cai, Zhou, Li, 1998. Policy Burdens, and State-Owned Enterprise Reform. *American Economic Review*, Papers and Proceedings of the One Hundred Eleventh Annual Meeting of the American Economic Association 88(2), 442-427.

Markusen, James R. (2002), *Multinational firms and the theory of international trade*, Cambridge MA: MIT Press.

Newey, W.K. (1987) "Efficient estimation of limited dependent variables models with endogenous explanatory variables". *Journal of Econometrics* 36, 231-250.

Redding, S. (1996), The low-skill, low-quality trap: Strategic complementarities between human capital and R & D, *Economic Journal*, March 1996, 458-470.

Smith, R. J. and Blundell, R.W., "An exogeneity test for a simultaneous equation Tobit model with an application to labor supply". *Econometrica*, 54:4, 679-686.

Wei, Y. (2003), "Foreign Direct Investment in China", Lancaster University Management School Working Paper 2003/002