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The Effects of Federalism and Privatization on Productivity in Chinese Firms

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THE EFFECTS OF FEDERALISM AND PRIVATIZATION ON PRODUCTIVITY IN CHINESE FIRMS [†]

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ABSTRACT

This study offers empirical evidence about how the structure of government and private ownership affects productivity in Chinese firms. It uses the microdata of China's most recent decennial industrial census, covering all of the 23,000 large and medium industrial firms operating in China during 1995.

The results show that government decentralization – "federalism" – plays an important role in improving the performance of not just collective firms, but also state-owned and mixed public/private ownership firms. This result is strongly confirmatory of much of the recent theoretical work on transition economies that posits a key role for government in the efficient operation of markets.

Privatization makes a big difference in performance for firms administered at the federal level, especially state-owned enterprises. Private ownership also makes a large difference for wholly foreign-owned firms, nearly all located in special districts. In local jurisdictions, however, there is little difference in productivity across the various non-state ownership types, supporting the argument that the regulatory environment played a critical role in successful business performance.

JLE Codes: D23, H73, K23, O14, P31

I. INTRODUCTION

Transition economies have experienced a wide range of economic outcomes, raising important questions about why some countries are successful and others are not. China is widely believed to be the most successful transition economy, yet its reforms are still not fully understood. Although it has relied on a combination of government decentralization – "federalism" – and privatization, most of the empirical work has focused on the latter. Through an analysis of business enterprise microdata, we offer new empirical evidence about how both factors, together, affect business performance in China.

Federalism plays a prominent role in recent theoretical work, which focuses on the interplay of different types of Chinese enterprises and the government entities that regulate them [Qian and Weingast 1997; Che and Qian 1998a, 1998b; Qian and Roland 1998]. For example, improved rules and regulations for business operations, tightening of the so-called "soft budget constraint" and reductions in hold-up problems all have been linked to local governance, and collectives in particular. Gérard Roland [2000] recently reviewed much of this work. While we are not able to fully disentangle the mechanisms at work, we are able to make some useful distinctions about the forces at play.

Figure 1 gives an overview of the key government jurisdictions that administer enterprises. Much of the empirical work on China has focused on small township and village collective enterprises, who have been a source of dynamism for the Chinese economy.[1] Only two econometric studies have looked at the role of government administration, finding support for a positive effect of local jurisdiction on state-owned firms [Jefferson 1999; Sun 2000]. We are not aware of any studies that look at the role of local governance for other ownership types such as joint stock or foreign joint venture firms. By using the microdata from China's most recent decennial industrial census, which covered all of the 23,000 large and medium industrial firms

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1. Generally, studies have found that collective enterprises and other non-state firms are better performers. For example, analysis of the early reforms using industry data showed that these non-state firms had much higher growth in multi-factor productivity than state-owned enterprises [McGuckin et al. 1992, 1993]. Studies using individual firm data refined and extended these findings into the 1990s [Jefferson and Singh 1999; OECD 2000].

operating in China during 1995, we are able to assess the role of government administration in business performance.[2]

Our strongest empirical result is that firms governed by local jurisdictions exhibit superior performance. When county, township, and village governments administer firms, the performance of not just collective firms but also purely state-owned and mixed public/private firms is significantly improved.[3] There are many mechanisms at work in this finding. Locally controlled collectives have incentives closer to those in private firms and they face greater product market competition than other Chinese enterprises. The advantages of locally administered firms are also associated with the ability of local jurisdictions to offset efficiency-destroying actions, including weak institutional and legal support, by the state. On the other hand, it is also likely that local governments selectively predate on the more private firms in their jurisdictions. This kind of tradeoff is suggested by the tendency for performance differences to be minimized across ownership types while performance levels are uniformly higher under local jurisdictional control.

Our results also suggest, consistent with earlier work, that ownership matters for efficiency. Collectives, however, no longer predominate, as other types of "private" ownership and governance structures are able to achieve similar productivity levels. So while collectives perform better than state-owned enterprises, they are not more efficient than ownership types with mixed public and private investment. And collectives are much less efficient than a special category of private firms: wholly foreign-owned firms with no mainland, Hong Kong, Macau, or Taiwan ownership. These firms are located in one special district, suggesting that they operate under very different rules from other enterprises in China.

Examination of the performance of firms with private equity in their ownership structure strengthens the argument that the level of government administration is a key factor. Increasing

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2. These data cover manufacturing, utility, and mining firms, and are considered to be more reliable than most other surveys, because they were directly collected from enterprises, bypassing often-politicized intermediate authorities. Moreover, we focus on the large and medium sub-sample that received the most scrutiny. The data were used to make 20 percent downward corrections to output statistics for the collective sector over the 1991–1995 period [Dougherty 1997].

3. The choice to focus on the county level and below was dictated for both theoretical and empirical reasons. Much of the case study research on China has observed that the strongest incentive effects of fiscal decentralization are present at the county, township, and village levels [Oi 1992; Walder 1995]. Moreover, analysis of the effects of jurisdiction levels on firm efficiency suggested that the jurisdictions

privatization appears to only make a difference for firms administered by "federal" jurisdictions – those at the central, provincial, and prefecture levels. We conjecture that federal jurisdictions have to make more concessions in order to attract the private investment than local areas where operating environments are friendlier to business.

There are several potential econometric issues that cloud our central findings. In particular, it is possible that some of the differences in performance arise from the liberalization process itself. If firms are chosen for private ownership and local jurisdictional control because they are the "best" performers, then this could give a misleading signal of the cause of the performance differences. In addition, firms with private ownership may choose to use "better" workers and more (and better) capital in their operations – beyond what we were able to measure and control for in our cross-section regressions. Both factors can bias the estimated coefficients that capture the impact of ownership and federalism.

We were able to perform some basic tests for endogeneity and selection effects and they indicated that many of the firms that would be expected to perform well remained under state and federal control, suggesting that selectivity from the liberalization process is not driving our empirical results. Moreover, we used several fully interactive versions of our basic production function model to ensure that the results were not driven by the fact that more private and locally governed firms tend to adopt different – such as more capital intensive – technologies. Thus, while it is impossible to fully rule out process-based interpretations of the results with cross-section data, the tests we were able to conduct suggest that such selectivity biases are not driving the principal results.

The paper is organized as follows. In the second section we provide a brief overview of the empirical findings in the literature. Section three outlines our basic empirical model – a gross output production function – and the data we use to estimate it. This section also outlines the variables we use to measure administration and ownership. Section four presents our key empirical findings. The fifth section offers some concluding comments.

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at the county level and below were quite distinct from those at the prefecture level and above, which we term *federal* in this study.

II. PREVIOUS EMPIRICAL WORK

Virtually all studies – regardless of data and methodology – agree that collectives performed better than state-owned enterprises [Woo et al. 1994; Jefferson et al. 1996]. Since local governments more often administer collectives than their state-owned counterparts, the standard results are suggestive of the role of jurisdiction, although they do not separate out the effect of administration from ownership.

Although interactions between jurisdiction and ownership have not been explored, private equity has generally been associated with better performance.[4] For instance, higher levels of non-state equity have been found to improve productivity in publicly listed joint stock firms [Xu and Wang 1998]. Research by the World Bank and OECD has found that collectives, foreign funded enterprises, and mixed private enterprises all have higher profitability and return to asset ratios than state-owned enterprises [Jefferson et al. 1999c; OECD 2000b]. Similar results have been found using other measures of efficiency, with the more private forms of ownership performing best [Zhang et al. 2001].[5] Whether these results hold up in both local and federal jurisdictions generally remains to be determined.[6]

There is some work on the issue of jurisdiction specifically. Case studies have supported the view that local governance in collectives and state-owned enterprises improves performance [Granick 1990; Oi 1992; Walder 1995]. In addition, a World Bank firm-level study finds some indications that the level of jurisdiction plays a role in state-owned enterprise performance [Jefferson 1999]. And in perhaps the most rigorous study of this issue, Jian Sun [2000] finds an economically large and statistically significant central/sub-central jurisdictional effect on

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4. The amount of private equity in a firm is not entirely captured by its registered ownership type [Qian 1995; Gregory et al. 2000]. There is only one firm-level study, Xiaonian Xu and Yan Wang [1999], that examines the performance impacts of equity involvement. The Xu and Wang study looks at publicly listed joint stock firms in 1993, finding that higher levels of state equity tend to reduce productivity.

5. Numerous firm-level studies on the performance of Chinese enterprise compare state-owned enterprises with collectives, especially the township and village collectives. Most of this work is based on special surveys covering the period before 1995. Perhaps the most ambitious empirical research is a series of recent World Bank studies collected in Gary Jefferson and Inderjit Singh [1999]. As part of this effort Jefferson et al. [1999c] review this empirical literature at length. Yanrui Wu [1996] also provides an extensive survey of this literature.

6. In a study of garment and metal casting industries in the Yangtze River region, Sonobe and Otsuka [2001] find evidence that privatization of township and village enterprises has significantly improved productivity, with a lag of several years.

productivity – of about 25 percent during the years 1991 to 1994 – for a sample of state-owned enterprises.

III. EMPIRICAL DESIGN

We use a firm-level gross output production function to isolate differences in jurisdictional governance and ownership structure from other factors that affect productivity. The production function approach has been found to yield reasonable results in a wide range of economies [Tybout 2000]. Moreover, the coefficient estimates we obtain are reasonable compared to analogous studies conducted in the United States and elsewhere.

The gross output production function has strong theoretical advantages over value added production functions for productivity measurement [OECD 2000a]. This is particularly true at lower levels of aggregation such as firm or industry where the problems of double counting are not severe and separability assumptions are not needed. Their use can make a substantial difference in the results obtained. McGuckin and Nguyen [1993] demonstrated this fact for China using relatively aggregated industry data. And in studies with U.S. Census microdata, Bartelsman and Doms [2000] also report very different results for value-added and gross output production functions.

Most firm-level studies of China have used a value added production function. The use of value added has a particular disadvantage in studies of Chinese firms because many of them have negative value added. This leads to substantial reductions in sample size since the log-linear functional form drops these firms from the analysis. Exit is not an option for many Chinese firms, so this is potentially a misleading practice. About nine percent of our sample, or 1,885 firms, have negative value added in 1995. Compared with other firms, their productivity is about half as large, they exhibit far lower profits, and have about half as many workers.

A. The Basic Model

The production function is specified in log-linear labor productivity terms as:

$$L = \alpha + X \cdot \beta + W \cdot \gamma + S \cdot \delta + \varepsilon \tag{1}$$

Where L is a vector of log gross output per worker, X is a matrix of standard input variables, W is a matrix of the dummy control variables, and S is a matrix of the key variables of

interest: jurisdiction, ownership, and/or equity variables. The form of Equation 1 means that the coefficients on dummy variables represent average total factor productivity (TFP) differences between groups of firms.

Equation 1 constrains the technologies of all firms to be the same because the specification insists that the elasticities of each input with respect to the output of the firm are the same. While dummy variables will pick up some of there differences by controlling for the types of activities the firms undertake, there are two issues of great import to our primary goal of estimating the impacts of ownership and governmental jurisdiction on productivity. First, if the technology that a firm chooses is systematically related to its ownership type or jurisdiction, a reasonable conjecture, based on simple tabulations of capital/labor ratios, is that Cobb-Douglas estimates of the impacts will be biased. Second, the choice of firms to be privatized and shifted to local jurisdiction may be systematically related to productivity so that we attribute the impacts of the choice process to the ownership and jurisdiction.

Concerns about bias led us to estimate the ownership and jurisdiction coefficients using fully interactive versions of Equation 1. The fully interactive specifications allow the input coefficients to vary for each ownership type and jurisdictional grouping. Comparison of the interactive models with the model with no interactions indicates that our variables of interest are not appreciably affected by failure to allow for this type of production technology difference. In addition, since firm-level data generally show wide heterogeneity within industries (see Jensen and McGuckin [1997]), we also tested Equation 1 within two-digit industries. Although the number of observations in many industries limits the strength of the estimates, these tests also support the results we present.

To account for potential selection and endogeneity effects in the decentralization and privatization process, we also estimate an instrumental variable model. Because our data are cross-sectional, we are limited in what we can do about this issue. However, there is some information in the data set that is potentially useful, so we estimated a two-stage instrumental variable estimator, with the first stage estimated using Probit to determine the probability of decentralization. These estimates were generally supportive of our results, particularly with respect to the jurisdiction issue.

B. Data[7]

Our data are derived from the Third National Industrial Census, which covers all of the roughly 23,000 large and medium size industrial firms operating in China during 1995.[8] We used 20,992 firms for which all data are available in most of our analysis.

This data has a number of attractive features. First, it offers a complete census. Second, the year it covers is more current than many of the studies in the literature. Third, the National Bureau of Statistics (NBS) adopted a number of improvements over previous surveys in this once-a-decade industrial census [NBS 1996].

The data quality appears to be better than most survey data. For example, NBS analysis indicated that output for many township and village enterprises was overstated in its own earlier annual surveys. This finding was reflected in substantial downward adjustments to the previously released official 1991–1995 output figures [Dougherty 1997]. Overstating output tends to overstate productivity, possibly leading to inflated performance for collectives in studies based on earlier data. Our focus on large and medium firms, which are more rigorously surveyed than smaller firms, further reduces exaggeration.

The Industrial Census provides a wealth of detailed information on each enterprise. The range of available data is far wider than that used in most studies. We not only have data on inputs and outputs, but also measures of capital and labor quality that are included in the production function estimating equation. The data include firm-specific information on ownership, jurisdiction and equity, as well as four-digit industry, location, and age of the firm.

We now turn to a discussion of the data and the variables used in estimating the production function.

C. Variables

The input variables (in X) from Equation 1 are log capital per worker, log materials per worker, log workers, log average wage, and the proportion of production equipment book value with 1990s vintage. Essentially, it is an unconstrained Cobb-Douglas production function supplemented with input quality measures.

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7. A data appendix with more details about the dataset, variable definitions, and model estimates is available upon request.

The capital measure is, like most measures of capital, subject to substantial caveats. It includes all capital of the firm and is calculated as the sum of the year-end book value of net fixed capital plus other capital.[9] Net book value is based on standard Chinese depreciation rates on plant and equipment.

We supplemented the capital stock measure with a capital equipment vintage variable that measures the value share (%) of total production equipment manufactured in the 1990s. Although the capital stock vintage variable is the leading cause of lost observations, reducing the data set size by 935 observations, the variable was very significant in all estimates of the model.

The number of production workers, technicians, and managers measures labor input. Service and other employees unrelated to production are excluded from the measure. The average worker's total wage is used as a proxy for labor quality. Wages include base salaries and quantity-based compensation, incentive and other bonuses, as well as various subsidies and living allowances.

Materials are the cost of raw material inputs and other intermediate costs, including overhead and interest charges. The average ratio of materials to gross output is 83 percent overall, with non-state-owned firms tending to have insignificantly higher average ratios, except for joint stock firms, that have a lower ratio, at 78 percent.

Dummy control variables were included for age, region, and industry in order to account for the effects of technology, the output and price structure of the firm, and other variations that could affect measured productivity. Age captures firm age effects, and is based on the enterprise's year of origin (in five categories). Region is based on enterprise location, by districts (332 districts) when sample size allows, and by province-level region (30 regions) elsewhere. Industry is represented by four-digit industry code (559 industries), which uses the 1994 Chinese standard based on ISIC Rev. 3 (NBS 1993).

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8. Large and medium firms, which represent 39 percent of industrial output in 1995, are defined by the National Bureau of Statistics (NBS) of China using criteria based on industry-specific production capacity [NBS 1993].

9. Other capital includes floating capital, which is defined as single-use or rapidly depreciated material products that are used in the course of production or sales, distinguished from material inputs because they do not enter directly into production [NBS 1996]. In sensitivity tests, we tried several different measures of capital, including net fixed capital as well as only production machinery. The use of alternative capital measures did not affect the reported results.

The key variables of interest in S are dummy variables for the level of jurisdiction administering the firm and the types of ownership structures. Given their importance, they are described in some detail.

D. Key variable: Jurisdiction

Jurisdiction is defined as the administrative level of government that supervises the enterprise, collects its taxes, and most directly enforces local and national laws. The levels include central government, provincial, prefecture and municipality, county, township, and village. We treat county, township, and village jurisdictions as *local*, and other jurisdictions above the local level as *federal*. [10]

There are several reasons to expect jurisdiction to affect performance. Unfortunately, they are not entirely exclusive and therefore identifying the relative importance of each is problematic. Nevertheless, we expect that firms administered by local jurisdictions should outperform other firms.

The first reason is that enterprise decision rights to use, sell, and receive proceeds from its assets are more concentrated inside locally administered enterprises [Groves et al. 1994; Qian 1995; Lin 1998; Jefferson and Singh 1999]. Thus in more locally administered enterprises manager and owner objectives are likely to be more closely aligned – reducing agency costs. Surveys appear to confirm that local government enterprises have more areas of decision-making authority than most state-owned enterprises, and therefore may be able to act more like private firms in the face of competition [Jefferson et al. 1999a, 1998b].

A second idea is that soft budget constraints are "hardened" for local governments [Granick 1990]. Competition between jurisdictions over investment and resources has intensified with regional decentralization so that enterprises may not always be bailed out in the event of failure [Oi 1992; Walder 1995; Li et al. 2000]. This effect is reinforced by limited access by local government jurisdictions to state bank financing [Gregory et al. 2000; Qian 2000]. The resulting fear of failure creates stronger profit incentives for locally administered firms even when they are government owned [Qian and Weingast 1997; Qian and Roland 1998; Che and Qian 1998a].

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10. Op cite note 3. In addition, some firms (671) have no jurisdictional information. These firms are excluded when we analyze jurisdiction.

A third idea is that hold-up problems, such as those that arise with incomplete contracts, can be better resolved by locally administered firms where the incentives for contract enforcement are more closely aligned with governments' interests. Such incentives could also arise from competition amongst local governments for outside investment. Firms offering the most benefits to the local government would likely be favored [Che and Qian 1998b; Li 1998]. While this may benefit firms with government involvement more than private firms (who are more difficult to tax), it may improve performance for all ownership types relative to centrally controlled firms where strong incentives for contract enforcement are less likely to be present.[11] A variety of models of this nature are discussed in Roland [2000].

E. Key variable: Ownership

The ownership variable is based on a firm's registered ownership classification as defined by NBS. While we anticipate that "more private" ownership types will contribute positively to productivity, determining what is private is not so simple. These categories include state-owned, domestic joint venture (*lianying*), collective, joint stock (*gufenzhi*), private (*siying*), Hong Kong, Macau, or Taiwan-invested (*gangaotai qiye*), foreign joint ventures (*zhongwai hezou/hezi*), and wholly foreign-owned (*waizi*).[12] Many of these ownership categories are unique to China, and do not necessarily have direct analogies in other countries. While the pure foreign-owned firms are closest in internal structure to a competitive private firm in a country like the United States, these firms face special regulations in China which may help or hinder them, such as tax breaks and limits on the range of their activities.

The vast majority of large and medium firms in China have substantial government ownership, with the largest number being state-owned (15,433 firms). In principle, these firms are owned by the central government, and it reserves the ultimate right to allocate residual cash

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11. Local governments themselves may engage in predatory behavior if not restrained by self-interest, and federalist systems may give them the opportunity to engage in "capture" from private firms at local levels [Bardhan and Mookherjee 1999; Yao 2001]. This type of behavior would benefit collective firms at the expense of more private ownership types such as foreign joint ventures [Che and Qian 1998b].

12. There were three domestic private firms in our database of "medium and large" firms in 1995. Until the late 1990s, it was extremely difficult for private firms to obtain the necessary business licenses that would allow them to grow beyond "*getihu*" status of eight or fewer employees [Gregory et al. 2000]. The domestic joint ventures are a small (217-firm) group, and there seems to be little remarkable about them. These firms are ventures between state and collective owners. In addition, there are 19 firms with "other" forms of ownership that we do not examine.

flow and assets [Qian 1995]. However, under the policy of regional decentralization, local governments in China were delegated control over many enterprises from the beginning of the reform period [Granick 1990]. This has led to provincial, prefecture, and county administration of many state-owned firms.

Government-owned firms suffer from a problem of moral hazard called "soft budget constraints," where expectations of bailout in the case of failure destroy profit objectives [Kornai 1980]. These distortions are reinforced by societal obligations imposed by government to provide employment and retirement benefits. This problem should affect state-owned enterprises the most strongly, but can also affect other government-dominated firms such as publicly traded companies that have diversified their ownership, as some recent high-profile cases have demonstrated [*Wall Street Journal* 12/4/2000]. Government involvement in business also means that the incentives of government to provide public goods such as contract enforcement are affected by their own business activities [Gadal and Shirley 1995; Li 1998].

A large number of government firms are classified as collectives (3,966 firms), which are owned by government jurisdictions below the central government [Jefferson and Rawski 1999]. These firms are usually given more autonomy in their operation than state-owned firms, and the control rights of their provincial, prefecture, county, township, and village government owners are not usually subject to central government intervention. While these firms generally have less access to state bank financing and monopoly rights, the better alignment of the interests of the owners and managers in these firms may reduce agency costs [Che and Qian 1998a].

Boards of directors and standardized financial disclosure practices characterize joint stock firms (959 firms), which have been corporatized. Most of these firms were state-owned before conversion, and most are still dominated by central government and state institutional equity. Several hundred of the joint stock firms are listed on stock markets, primarily on the Shanghai and Shenzhen exchanges, including some overseas as well. However, domestically traded shares have many restrictions [Xu and Wang 1999]. A recent ranking put these firms near the bottom in a worldwide governance index [*CLSA Emerging Markets* 2000], due to inequitable treatment of minority shareholders and lack of timely and accurate disclosure of firm financials.

While official ownership types do not fully describe the ownership status of Chinese firms [Li 1996; Gregory et al. 2000] ownership equity information is reported for most of the

firms in our sample.[13] There are four identifiable classes of equity: state shares, legal person shares, individual shares, and foreign shares. Since legal person shares typically belong to institutions controlled by the government, we treat only individual and foreign shares as private equity. We identify those firms that have 50 percent or more private equity, 10 percent or more private equity, and any private equity for analysis (dummy variables representing each threshold are defined and used in the estimates of Table 6).[14]

Some private ownership may improve performance because it helps to reduce perverse incentives in government owned firms through better monitoring of managers and pressure for profit objectives [Kornai 1980; Gadal and Shirley 1995; Sachs and Woo 1997]. However, the effectiveness of outside ownership may be reduced by lack of control or autonomy and excessive constraints on decision-making [Jefferson et al. 1999b; Lin et al. 1998]. On the other hand, the existence of private ownership may signal that the state has reduced constraints in order to attract private capital, for example by offering "guarantees" against hold-up of the firm.

Although some foreign private equity has been tolerated in joint stock companies and (to a much more limited extent) in state-owned and collectively held enterprises, the primary vehicle for foreign direct investment (FDI) has been foreign joint ventures. Joint venture firms (1,849 firms) typically involve a foreign company and a state-owned domestic enterprise, with equity reflecting their respective stakes in the enterprise. While there are many restrictions on these enterprises—particularly with respect to the sectors open for entry—this has been a popular vehicle for foreign direct investment, the accumulation of which exceeded US$200 billion by 1995. Over half of the joint venture enterprises involve partners in Hong Kong, Macau, or Taiwan (933 firms). We distinguish these non-mainland Greater China-invested enterprises from other foreign enterprises, since they usually face different regulations and have more operational flexibility.

Wholly foreign-owned enterprises (97 firms) are allowed, but face even more restrictions. They are prohibited from operations in a number of industries and, until October 2000, were required to either provide advanced technology or be primarily export-oriented [USDoS 1996]. Consistent with this observation, Table 1 indicates that 62 percent of the output of these firms

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13. A sizable number of firms (1,738) did not provide equity information in the census. These firms are excluded when we analyze private equity.

14. Tests using various formulations of the equity variable suggest that our results are fairly robust with respect to the threshold effect.

was exported. Almost all of these ventures are located in special economic zones, where they receive exemptions or substantial reductions in various types of taxes and fees, and have streamlined regulations [Litwack and Qian 1998].

IV. EMPIRICAL RESULTS

Table 1 shows that the variation in gross output per worker (labor productivity) and other characteristics across ownership types is very large. Raw labor productivity in pure foreign firms (496,000 yuan per worker) is over five times higher than that in state-owned enterprises, which have the lowest labor productivity (81,000 yuan), and next to lowest capital intensity. Pure foreign firms have the highest capital intensity, newest vintage of capital, and highest paid workers (955 yuan per month). They also export the largest share of their sales (62 percent) and are relatively young firms (average 1991 founding). Joint venture firms are similar in many respects, although they export less than half as much of their sales.

The firms with the lowest capital intensity – collectives – have higher labor productivity (118,000 yuan/worker) than state-owned enterprises. This is true despite collectives' significantly smaller size (in workers and capital) and lower wages. Remarkably, they export nearly twice as much as state firms and almost as much as joint ventures. Only joint stock firms – who have moderate labor productivity – stand out in terms of the large size of their capital. Nevertheless, their workforce size and education is similar to state firms. They export marginally more than state firms.

Raw differences in labor productivity between locally and federally administered firms vary greatly by type of ownership. Among state-owned enterprises, locally administered firms are not different, yet among collectives, they are higher. However, for other forms of ownership, federal firms have higher raw labor productivity, but locally administered firms have about half the capital base and make do with less skilled workers. Moreover, they tend to export as much or more than their federally administered counterparts.

A. Production Function Estimates

We first estimate the production function (Equation 1) on the entire dataset. As shown in Table 2, the coefficients on the input variables are quite reasonable when compared to results typically found in microdata cross-section production functions. The estimated coefficients for

jurisdiction and ownership structure give the productivity differences relative to the default category (state ownership and federal jurisdictional administration). The effect of local government administration relative to federal administration is remarkably strong, with a highly significant estimated difference of 7.7 percent. This result is highly supportive of the idea that local governance affects business performance, regardless of ownership.

The controlled difference between the wholly foreign and state-owned ownership types is 18.6 percent. While the other ownership categories are more productive than state ownership, they do not achieve the level of the wholly foreign enterprises. The regression results suggest that the ownership types can be grouped into three productivity categories: (*i*) the lowest level for state-owned enterprises, (*ii*) a moderate level for collective firms, joint stock corporations, and joint venture firms (with 6.0 percent to 7.6 percent more productivity than state-owned), and (*iii*) the highest level for pure foreign owned firms (18.6 percent). The differences between the lowest level and the other two classes are highly significant. The difference between the highest and the moderate level is just significant at the 95 percent confidence level.

As noted earlier, using a fully interactive model, we find that the implied estimates of the impact of ownership and jurisdictional governance are not substantially affected. Local government administration continues to have an impact of at least 7.7 percent relative to federal administration. And collective firms, joint stock corporations, and joint venture firms still perform 5 to 7 percent better than state-owned firms. In addition, the difference between the purely private foreign firms and state ownership types is still around 19 percent.

B. Endogeneity

In order to determine whether selectivity from the liberalization process might be biasing our results, we re-estimated the production function using an instrumental variable model. We first examined whether the local jurisdictional administration variable might be endogenous, and second considered the additional possibility of endogeneity of both local jurisdiction and privatization. And while the information available is limited, endogeneity does not seem to be substantively distorting the key results.

We used two instruments in the estimations. The first is the administrative size classification of the enterprise, which was likely used in determining which firms to restructure, as part of the "*zhuada fangxiao*" (hold onto the large, release the small) policy. Second, we have

financial performance information from the previous year, for which measurement error should not be correlated with that in the current year.

Since local jurisdiction is a dichotomous variable, we use Probit in the first stage estimation, regressed on the two instruments and the remaining "exogenous" variables. The standard cumulative normal of the estimated values gives a prediction of the probability that a firm is administered locally. We use this probability as an instrument in a second stage least squares estimate of the augmented production function, thus accounting for the potential endogeneity of jurisdiction. The pseudo R-squared of this first stage implies that this equation explains about 38 percent of the variation, suggesting that it is a plausible model of decentralization.

This instrumental variable estimator yields qualitatively similar results for the effects of jurisdiction, with a larger coefficient (.51) in the same direction as the OLS estimate (.10) of the model.[15] If endogeneity is biasing the results, then the most likely direction of the bias is to hide some of the beneficial effects of local jurisdictional administration. Put differently, there was probably a tendency on the part of supervisory governments to select poorer performing firms for hand-off to local governments. This comports with the intuition that the central government would want to rid its hands of the worst performers since it has the power to force a local subordinate government jurisdiction to take the firm.

Selection may also bias the results for ownership since many of the joint stock and joint venture firms were converted from state-owned (or collective) ownership types. If the best enterprises are chosen for conversion, this will tend to overstate the impact of privatization. Since we do not have detailed information on which enterprises were converted, we cannot make a clear determination. However, there was a dramatic increase in the productivity of state-owned and collective enterprises over 1995 to 1999 (Appendix, Table A-1). The size of this increase is large enough to suggest that it is quite possible that the worst performers were converted,

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15. This result is strengthened by a sensitivity test of the instruments using only the size category dummies. A similar two-stage instrumental estimate with Probit in the first stage yields a coefficient on local jurisdiction almost twice as large as a comparable OLS estimate (0.18 compared with .10), but smaller than the estimate described here.

although if enough poor performers were closed *and* new firms entered, this could also explain this change.[16]

Despite limited information about specific conversions, we performed a similar test to that described above for jurisdiction. In the first stage, we pooled the state-owned, collective firms, and mixed public/private ownership firms to estimate the probability of conversion.[17] The production function was re-estimated using the predicted probability of mixed ownership, and local jurisdiction from above. The results for jurisdiction remained comparable with the earlier estimates. For ownership, the mixed ownership effects were larger than what was obtained in the OLS estimates, which is consistent with the idea that the worst performers were converted; but the large standard error in these estimates suggests that the instruments are quite weak.

C. The Effects of Jurisdiction

The effects of ownership and jurisdiction were examined by estimating the impact of jurisdiction separately for each ownership type: Separate production function estimates were made for state-owned, collective, joint stock, HK/TW-invested, and foreign joint venture firms. This specification gives distinct estimates of the impact of jurisdiction for each ownership type, and also allows the input elasticities and other production function coefficients to vary by ownership type.

The results of this exercise are shown in Table 3, which gives local jurisdiction dummy variable coefficients from separate estimates on each of five ownership types, except for pure foreign firms where no variation in jurisdiction is present. These estimates offer strong support for the importance of jurisdiction in enterprise performance.

Productivity differences between local and federal jurisdictions are observed within each type of ownership. Within collectives, jurisdiction accounts for an 8.5 percent productivity difference, with a similar difference, 8.7 percent, for state-owned firms.[18] Both differences are

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16. Li and Lui [2001] find evidence that governments in China indeed privatize the worst performing (loss-making) state firms in order to reduce the subsidies that they have to pay.

17. We also estimated the probability of conversion for each of the mixed public/private ownership types separately (joint stock firms, HK/TW joint ventures, and foreign joint ventures). The results were very similar.

18. If local jurisdictions are re-defined as township and village only (with federal as county and above), the contribution of local jurisdiction for collectives is somewhat less – 5.7% – yet still highly significant. For other ownership types, the local effect is as large or larger than with the original definition

highly significant. For joint stock companies the difference between local and federal is even larger, 9.3 percent. The impact of local governance is a smaller yet still significant 5.4 percent for Hong Kong, Macau, and Taiwan-invested enterprises, and a not quite significant 4.6 percent for foreign joint ventures.

While previous studies have found that locally administered collectives perform better than state-owned enterprises, these results are broader: they suggest that for any type of government-invested enterprise, including state-owned enterprises and joint stock enterprises, local administration yields significant benefits. Moreover, since the effect is also present in the more private firms in our sample – those in which firm autonomy and profit incentives are already likely to be strong – the improved performance is likely a result of a better regulatory and institutional environment.

D. The Effects of Ownership

We also looked at the effects of ownership interactively, by splitting the sample and estimating the ownership effect separately within sub-samples of locally and federally administered firms. This specification allows the effects of ownership to differ depending on the level of the governing jurisdiction. The estimated productivity differences across ownership types are shown in Table 4.[19]

For enterprises governed by federal jurisdictions, ownership is a key determinant of productivity performance, with foreign joint ventures performing significantly better than collectives. In contrast, except for state-owned enterprises, productivity differences across ownership are virtually non-existent for those firms within local jurisdictions. Still, for all ownership types (as shown in Table 3), the local jurisdiction variable is linked to better performance.

It is impossible with the data at hand to fully explain these findings. Nevertheless, it appears that under local government administration the regulatory environment tends to equalize performance across ownership types ("the playing field is leveled"). This is probably a result of a

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(and just as significant), although only 60 to 144 firms in each non-collective ownership type have township or village jurisdictions.

19. A version of this specification that allowed production input elastiticities to be fully interactive with ownership type was also estimated, first for local and then for federal jurisdictions. The implied differences among ownership types were very similar to the figures shown in Table 4.

complex mix of factors with differences in internal incentives and corporate governance procedures being weighed against rules and regulatory enforcement procedures to yield a rough balance in enterprise efficiency across enterprises. This is consistent with the fact that state-owned enterprises still perform poorly relative to other types of enterprises. The problem for state-owned enterprises is that even though they are locally administered, they are still less likely to fail: Since they know state banks are likely to save them, they do not operate as efficiently as other enterprises.[20]

E. Jurisdiction and Private Equity

As noted previously, ownership type alone does not fully capture the extent of privatization in China. Almost 25% of all large and medium enterprises have some private equity. This equity includes shares sold to employees and outside investors, both foreign and domestic.

Private equity appears to only benefit firms classified as state-owned under federal governance, as shown in Table 5, but the effect is substantial, particularly for firms with a majority of ownership in private hands. We find a highly significant effect on productivity of 5.3 percent for any private equity in these firms, "10% or more" private equity yielding a 6.2 percent productivity effect, and "50% or more" private equity yielding an 8.5 percent effect. Surprisingly, the presence of private equity makes nearly two-thirds of the difference.[21]

In contrast, at the local level, private equity appears to have no significant effect for state-owned enterprises. This is consistent with the idea that local government administration may already confer many of the advantages that private equity offers. Federally administered state-owned enterprises may offer specific concessions to get outside investment. These concessions may involve financial restructuring, relief from the burdens of retired workers, and guarantees against interference with business activities. Alternatively, this may reflect some selectivity on

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20. Access to bank financing can be a double-edged sword. While certainty of access leads to severe moral hazard, severe financing constraints can make business impossible. Some local jurisdictions have experienced extraordinary turnover of collective enterprises in recent years, because of lack of commercial bank financing. This is despite their typically higher productivity.

21. One possibility is that the new owners are not able to exercise effective control rights. Poor representation of private shareholders on corporate boards plagues Chinese enterprises [Wang and Xu 1999]. And as shown in a study of Russia, when only insiders retain control of a partly privatized firm, management changes do not take place, and performance is not improved [Barberis et al. 1996].

the part of investors; however, it is not clear why they would not be equally able to select the best firms in local jurisdictions.

V. CONCLUDING COMMENTS

The statistical analysis shows that decentralized administration has been a key factor in determining business productivity in China. Apparently local authorities with better incentives and facing competition from other jurisdictions for business investment offer environments more conducive for business than more centralized governments.

Nonetheless, the performance gap between the wholly foreign enterprises in special districts, and both state-owned and mixed-ownership enterprises, suggests that the regulatory and business environment in China can be improved as the reform program continues. A rough comparison of the productivity of the purely private foreign-owned enterprises with the productivity in an industrial enterprise in the United States suggests that value added per worker is less than a quarter of what might be achieved in the United States.[22]

China's imminent entry into the World Trade Organization (WTO) will more closely align it with the global economy, and accelerate the process of restructuring by broadening and deepening the privatization and decentralization process. The WTO should also reduce barriers to entry by foreign firms, and complement the privatization of Chinese firms and the shift to local administration. Competition among jurisdictions is likely to increase as the opportunities for foreign capital expand.[23] Thus, the reforms brought about by the WTO are likely to extend to more Chinese enterprises the operational advantages—in terms of flexibility and freedom to operate—that are now available in local jurisdictions and special districts. Measuring and tracking these regulatory changes is imperative for future research.

Our final comment focuses on the need to examine these issues using firm-level time-series and cohort data. Longitudinal firm level data sets will improve our ability to assess the effects of transitional changes on performance and the relative costs and benefits of various strategies. Developing data for this research is where we our efforts are currently focused.

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22. Calculation uses Ren Ruoen [1997] and Adam Szirmai's bilateral comparison studies.
23. The extent of persistent inter-regional price differences observed by Young [2000] demonstrates the considerable room that remains to reduce these barriers in the future.
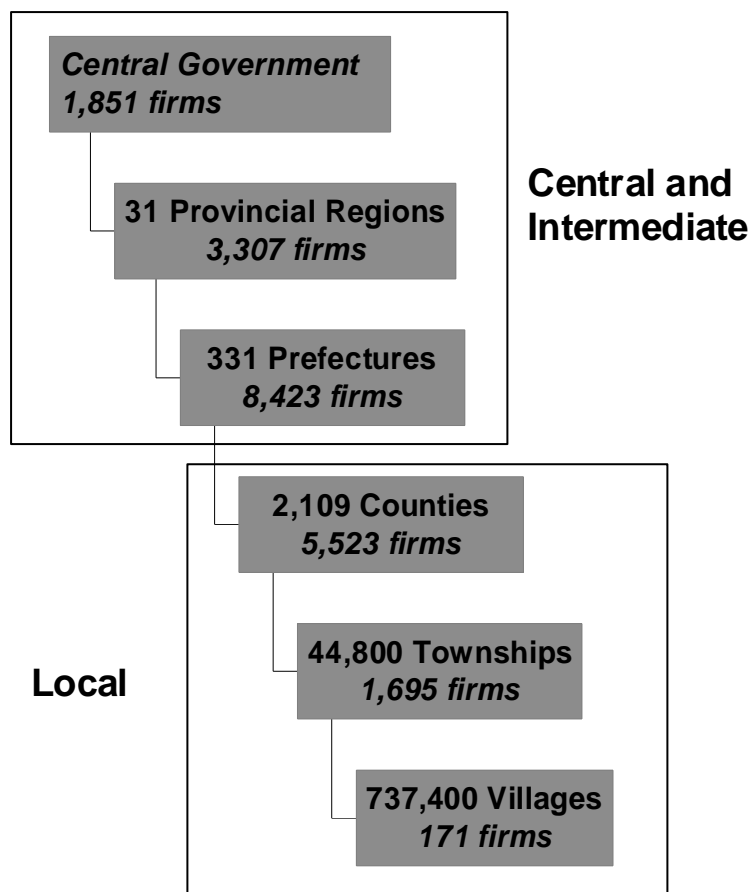
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FIGURE 1:
How Chinese Jurisdictions are Defined

Central Government
1,851 firms

31 Provincial Regions
3,307 firms

331 Prefectures
8,423 firms

Central and Intermediate

2,109 Counties
5,523 firms

44,800 Townships
1,695 firms

Local

737,400 Villages
171 firms

Note: Number of Large and Medium Enterprises under Supervision in *Italics.*
Firms with missing or ambiguous jurisdiction information are excluded.

TABLE 2

Production Function Estimates, Full Sample

Regression of Gross Output per Production Worker (log) on:	OLS Estimates		Implied Difference in Productivity
	Coefficient	t-Statistic	
Constant	-.098	-2.7	
Total Capital per Prod. Worker (log)	.029	4.8	
Intermediate Materials per Prod. Worker (log)	.882	140	
Number of Production Workers (log)	.035	12	
1990s Machinery Vintage Value Share	.077	10	
Average Worker Wage w/ Benefits (log)	.195	20	
Relative to State-owned (14,752):			*State-owned = 0%*
Collective Enterprises (3,747)	.058	9.6	5.9%
Joint Stock Companies (887)	.060	7.2	6.2%
HK/TW-invested (770)	.071	5.8	7.4%
Foreign Joint Ventures (756)	.073	5.6	7.6%
Pure Foreign-owned (80)	.171	3.3	18.6%
Relative to Federal (13,608):			*Federal = 0%*
Local Jurisdiction (7,384)	.074	13	7.7%
Dummy variable controls (joint t-statistic):			
Age of Firm	*5 periods*	6.1	
Location of Firm	*333 districts*	38	
Detailed Industry	*554 industries*	105	
	Adj. R^2 = .9310		
	n = 20,992		

NOTE.—The White Heteroskedasticity-consistent covariance matrix is used for t-statistics. Mean log Gross Output per Worker is 4.10. The 228 domestic joint ventures, which look very similar to state-owned enterprises (Coeff.=.009, t=.48), are included in the state-owned grouping. Note that a fully interactive version of the above model yielded estimates of the impact of ownership and jurisdictional governance very similar to those shown above.

TABLE 3(a)

The Effects of Jurisdiction on Productivity for Each Ownership Type

Regression of Gross Output	OLS Coefficient Estimates				
per Production Worker (log) on:	State-owned	Collectives	Joint Stock	HK/TW-inv.	Foreign JVs
Constant	-.106**	-.067	.099	-.067	.036
Total Capital per Prod. Worker (log)	.029**	.023**	.093**	-.026	.057
Intermediate Materials per Prod. Worker (log)	.861**	.925**	.812**	.984**	.880**
Number of Production Workers (log)	.039**	.020**	.022*	.028**	.025
1990s Machinery Vintage Value Share	.101**	.034**	-.006	.067	-.003
Average Worker Wage w/ Benefits (log)	.229**	.108**	.180**	.084**	.093**
Relative to Federal:					
Local Jurisdiction	.074**	.082**	.089**	.053*	.045
Controls are jointly significant for:					
Age of Firm	*Yes*	*Yes*	*No*	*No*	*No*
Location of Firm	*Yes*	*Yes*	*Yes*	*Yes*	*No*
Detailed Industry	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Adjusted R^2	*.912*	*.949*	*.946*	*.937*	*.939*
Number of Observations	*14,752*	*3,747*	*887*	*770*	*756*

NOTE.—A separate estimation of Equation 1 is run for each of the five ownership types in which jurisdiction varies.

TABLE 3(b)

Locally Administered Firms are More Productive, under all Types of Ownership

Impact of Local Administration:	Productivity of Local Admin. Firms within each Ownership Type				
exp(Coefficient) - 1 =	State-owned	Collectives	Joint Stock	HK/TW-inv.	Foreign JVs
Relative to Federally Administered	8.7%**	8.5%**	9.3%**	5.4%*	4.6%

NOTE.— Percentages are based on a dummy variable that equals one if a firm is administered by a local jurisdiction.
* Significantlly different from zero at the 90% confidence level. ** Significant at the 99% confidence level.

TABLE 4(a)

The Effects of Ownership on Produtivity for Each Jurisdiction Level

Regression of Gross Output per Production Worker (log) on:	OLS Coefficient Estimates	
	Federally Administered	Locally Administered
Constant	-.053	-.019
Total Capital per Prod. Worker (log)	.010	.044**
Intermediate Materials per Prod. Worker (log)	.874**	.896**
Number of Production Workers (log)	.036**	.024**
1990s Machinery Vintage Value Share	.096**	.057**
Average Worker Wage w/ Benefits (log)	.226**	.129**
Relative to State-owned:		
Collective Enterprises	.046**	.051**
Joint Stock Companies	.063**	.057**
HK/TW-invested	.077**	.052**
Foreign Joint Ventures	.092**	.032*
Controls are jointly significant for:		
Age of Firm	*Yes*	*No*
Location of Firm	*Yes*	*Yes*
Detailed Industry	*Yes*	*Yes*
Adjusted R^2	*13,530*	*7,382*
Number of Observations	*.923*	*.948*

NOTE.—A separate estimation of Equation 1 is run for each of the five ownership types in which jurisdiction varies.

TABLE 4(b)

More Private Firms are More Productive under Federal Administration

Impact by Ownership Type:	Productivity Relative to State-owned Firms	
exp(Coefficient) - 1 =	Federally Administered	Locally Administered
Collective Enterprises	4.7%** ⎤	5.2%** ⎤
Joint Stock Companies	6.5%** ⎦	5.9%**
HK/TW-invested	8.0%** ⎤	5.3%**
Foreign Joint Ventures	9.6%** ⎦	3.3%* ⎦

NOTE.—Percentages are based on a dummy variable that equals one if firm is of the respective ownership type. Bracketed groups are statistically indistinguishable at the 95% level. * Significantly different from zero at the 90% confidence level. ** Significant at the 99% level.

TABLE 5

Private Equity only Matters for State-owned Enterprises with
Federal Administration

State-owned Enterprises	Productivity Relative to Remaining Firms	
Amount of Private Equity	Federally Administered	Locally Administered
1) Any Private Equity	5.3%*	0.8%
2) 10% or More Private Equity	6.2%*	1.4%
3) 50% or More Private Equity	8.5%*	1.1%
Total firms (1, 2, and 3 use same samples)	*n = 10,679*	*n = 3,731*

NOTE.—Percentages are based on a dummy variable that equals one if a firm has the given threshold of private equity. A separate OLS estimation of Equation 1 is run for each of the three definitions and under both levels of administration (six estimates). * Significant at the 99% confidence level.

TABLE A-1

Firm Characteristics by Ownership Type and Jursidiction Level

Ownership Type and Jurisdiction Level	Gross Output/ Worker	Total Capital/ Worker	1990s Vintage Share	Avg. Book Val. of Capital	Avg. Num. of Workers	Avg. Monthly Wage	College Grad. Share	Avg. Year of Origin	Sales Export Share
SOEs w/ DJVs (15,714)	81	161	38%	251,622	1,619	562	8%	1963	9%
Local Firms (4,054)	81	118	44%	86,071	879	417	4%	1970	9%
Federal (11,321)	81	177	36%	310,905	1,883	614	10%	1961	9%
Collectives (3,984)	119	139	51%	82,043	731	479	4%	1973	22%
Local Firms (2,801)	137	145	56%	85,275	758	463	3%	1976	22%
Federal (1,111)	76	126	39%	73,894	662	520	6%	1965	22%
Joint-stock (959)	144	238	51%	392,961	1,714	676	9%	1967	13%
Local Firms (329)	126	156	56%	170,307	1,067	499	5%	1972	16%
Federal (583)	155	284	47%	518,609	2,079	775	11%	1964	11%
HK/TW-inv. (933)	262	401	58%	194,485	682	768	9%	1988	27%
Local Firms (305)	219	286	64%	117,347	586	598	5%	1988	32%
Federal (508)	288	470	55%	240,798	739	870	11%	1988	25%
Foreign JVs (917)	366	608	60%	255,213	657	955	14%	1989	26%
Local Firms (229)	305	419	65%	138,790	604	606	6%	1988	29%
Federal (603)	389	679	58%	299,426	677	1,087	17%	1989	26%
Pure Foreign (97)	472	771	70%	246,216	567	955	15%	1991	62%
Firm Mean (22,604)	113	189	43%	225,257	1,388	576	8%	1967	13%

Note: Output and Capital in 1,000 yuan. Wage is in yuan/month. Number of firms with valid worker data in parenthesis. Totals do not always match due to lack of jurisdiction information or missing values on one or more variables.

Table A-2
Substantial Trend Toward More Private Firms

Ownership Type	Number of Large and Medium Firms		Change over	Share of Total Sales Revenue		Change over	Sales/Worker		Change over
	1995	1999	1995-99	1995	1999	1995-99	1995	1999	1995-99
State-owned Firms	15,940	11,495	-4,445	71%	60%	-10%	81	107	32%
Collective Firms	4,068	2,738	-1,330	9.3%	7.8%	-1.5%	108	144	33%
Joint Stock Firms	959	2,473	1,514	7.5%	10%	2.3%	143	158	11%
HK/TW-invested	933	1,549	616	5.2%	7.9%	2.7%	265	290	9.5%
Foreign Joint Ventures	916	1,508	592	6.4%	10%	3.3%	347	444	28%
Pure Foreign Firms	97	476	379	0.9%	3.6%	2.6%	490	385	-21%
Domestic Private Firms	3	316	313	D	0.7%	0.7%	D	153	D
Total	22,916	20,555	-2,361	100%	100%	0%			