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Privatization's Impact on Private Productivity: The Case of Brazilian Iron Ore*

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ABSTRACT

A major motivation for the wave of privatizations of state-owned enterprises (SOEs) in the last twenty years was a belief that privatization would increase economic efficiency. There are now many studies showing most privatizations achieved this goal. Our theme is that the productivity gains from privatization are much more general and widespread than has typically been recognized in this literature. In assessing the productivity gains from privatization, the literature has only examined the productivity gains accruing at the privatized SOEs. But privatization may have significant impact on the private producers that often exist side-by-side with SOEs. In this paper we show that this was indeed the case when Brazil privatized its SOEs in the iron ore industry. That is, after their privatization, the iron ore SOEs dramatically increased their labor productivity, but so did the private iron ore companies in the industry.

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A major motivation for the wave of privatizations of state-owned enterprises (SOEs) in the last twenty years was a belief that privatization would increase economic efficiency. There are now many studies showing most privatizations achieved this goal. Our theme is that the productivity gains from privatization are much more general and widespread than has typically been recognized in this literature. In assessing the productivity gains from privatization, the literature has only examined the productivity gains accruing at the privatized SOEs. But privatization may have significant impact on the private producers that often exist alongside SOEs. In this paper we show that this was indeed the case when Brazil privatized its SOEs in the iron ore industry. That is, after their privatization, the iron ore SOEs dramatically increased their labor productivity, but so did the private iron ore companies in the industry.

As far as we know, there are no studies looking at the impact of SOE privatization on the productivity of private firms. Hence, before we turn to the Brazilian iron ore industry, we briefly argue that this issue (of privatization's impact on private productivity) deserves much more attention. First, we present evidence that it's very common to have public and private production side by side in industries. For example, in over half of the countries studied by La Porta, et al (2002), both government-controlled and private-controlled banks had significant shares of banking assets. Second, we present two reasons (there are likely many more) why privatization of SOEs in an industry would lead to increases in private firm productivity in that industry. One is that it's very common for governments to place production-restrictions on the private competitors of SOEs. A major reason for these restrictions is to limit SOE losses and hence the subsidies paid to them. Even in the United Sates we see important examples of this, such as when the U.S. Postal Service puts restrictions on private delivery

services like FedEx (as when it forbids FedEx to use private mailboxes). Also, in industries where unions represent workers at both SOE and private firms, the union often chooses to initially bargain with the SOE (it chooses the public firm as the "target"). Since SOE managers typically find it less "costly" to give generous wage and work rule packages as compared to private managers, unions reach agreements with SOEs first and then use them as leverage in later negotiations with private firms.

Having established the proposition that privatization's impact on private productivity is an important issue to understand, we turn to the Brazilian iron ore case. We briefly discuss the history of iron-ore privatization in Brazil and our data sources. Prior to privatization, SOEs accounted for roughly 60 percent of Brazilian iron ore production. We then show that there was little labor productivity gain in the Brazilian iron-ore industry until the onset of the privatization process in 1989. Then, industry productivity dramatically increased, more than doubling over the next decade. We then show that this pattern was found in both the public and private firms in the industry. That is, following the onset of the privatization process in 1989, both sets of firms roughly doubled their labor productivity during the 1990s.

Next, we discuss the sources of productivity gains. Interviews with management at the massive public company CVRD (Companhia Vale do Rio Doce) indicated there were two major sources of productivity gains. First, there were gains arising from eliminating layers of redundant administration and management. Second, there were gains from changes in work practices among employees at the mines. Traditionally, employees engaged in only a small range of tasks. With the onset of privatization, employees became responsible for a much wider range of tasks. Privatization impacted the private firms primarily through the second channel discussed above. That is, the union representing iron ore workers traditionally

had been able to extend (at least in good part) the wages and work practices at the public companies to the private firms. With the public companies requiring greater ranges of tasks of its employees, the private firms made similar changes. In section 7 we conclude.

Finally, a brief word on the literature. There is a very large literature examining the impact of SOE privatization on SOE productivity. This literature is reviewed, for example, in Megginson and Netter (2001). The literature typically finds large productivity gains at SOEs following privatization, a leading example being Laporta and Lopez-de-Silanes (1999). There is also a literature that compares productivity in public and private firms, asking which are more efficient (e.g., the reviews by Borcherding, Pommerehne and Schneider (1982) and Megginson and Netter (2001)). But, again, as far as we know, there is no literature that looks at the impact of SOE privatization on private productivity. This is an important issue and we begin examining it here.

1. Public and Private Production Side by Side

In this section we briefly present evidence that public and private production exist side by side in many industries. We won't present a complete list of industries where this is true but one extensive enough to justify our interest in asking how privatization of SOEs influences their private counterparts.

The most extensive cross-country evidence on private and public production is available for the banking industry. La Porta, et al. (2002) have constructed measures of the share of banking assets owned by the government in a wide range of countries. The measures show that within a country it is common to have banking services provided by both public and private firms. Let us focus on one of their measures. They say that a bank is controlled

by the government at the 50 percent level if the government owns 50 percent of the bank. They then look at the top 10 banks in a country in 1995 and ask which, if any, are controlled by the government (at the 50 percent level). They then ask what share of assets these government-controlled banks own relative to all top 10 bank assets. Of the 80 countries in their sample (we have excluded the few socialist countries), the government-controlled banks owned between 20 and 80 percent of top 10 bank assets in 41 of the countries. In over half the countries both government-controlled and private-controlled banks had significant shares of banking assets (that is, both had shares over 20 percent).

Public and private production exist side by side in manufacturing as well. For manufacturing and the other industries we discuss below, there is nothing like the data constructed by La Porta, et al. (2002) for banking. Rather, we must make due with evidence for a few countries. Turning to manufacturing, in Egypt the government's share of production in the machinery, nonmetallic minerals, metal products and transportation equipment industries in 1966-67 was 75, 65, 51 and 59 percent, respectively. In Turkey, the government's share of production in the same industries in 1968 was 15, 31, 46 and 50 percent, respectively (for these statistics see Schmitz (2001)). In Mexico, La Porta and Lopez-de-Silanes (1999) report that SOE enterprises produced throughout the manufacturing sector, in industries such as beverages, textiles, chemicals, basic metals and transportation equipment. Unfortunately, for our purposes, they do not report the SOE share of production in these industries.

Both public and private production is also common in transportation industries. Take the case of railroads. In Canada, there were historically two major railroads that accounted for most freight hauling, a large pubic railroad, Canadian National (CN) and a large private one, Canadian Pacific (CP). In 1990, CN accounted for 51.4 percent of ton-miles of freight,

with the private railroads accounting for 48.6 percent (CP accounted for 39 percent and small, non-class I railroads 9.5 percent).[1] A report by the Productivity Commission in Australia on railroads (1991) shows that public and private freight railroads exist side by side in many other countries. In Australia, government and private railroads accounted for 62 and 38 percent of ton-miles of freight in 1988-89, respectively.

What is true in railroads is also true in airlines: public and private air carriers exist side by side. In Australia, there were historically two major domestic airlines, Trans Australian Airways (TAA), a government firm, and Ansett Australian National Airways (Ansett ANA), a private firm. The public airline accounted for 34 and 45 percent of freight and passenger traffic, respectively, in 1968-69, with the private airline accounting for the rest (see Davies, 1971). In most European countries there has traditionally been a large government carrier and a host of smaller, private carriers.

Finally, mail and package delivery is also an industry with both public and private services. In the United States, there is a single SOE—the U.S. Postal Service. There also are a large number of private producers, most notably FedEx. The same situation exists in most European countries as well, that is, of a single government mail service and a host of private carriers.

2. Privatization's Impact on Private Productivity: Theory

In this section we ask why privatization of SOEs in an industry would lead to increases in private firm productivity in that industry (or, similarly, why government production in an industry would lead to low productivity of private producers). We argue that "stakeholders"

[1] These figures can be constructed from Coates and Downie (1999) and Timur and Ponak (2002).

in the SOEs (like members of the ruling party or SOE managers) take actions that lead to lower private productivity. Here, we discuss two types of actions.

A. Production Restrictions Placed on Private Producers

It is very common for governments to place production restrictions on the private competitors of SOEs. For example, private firms are sometimes severely limited in the input or technology choices they can make. Here, we sketch some simple logic as to why such production restrictions would emerge in an industry with SOEs, and then present a few examples of such restrictions around the world.

It is widely recognized that members of government often use SOEs as a vehicle to reward their constituents. SOEs are often used to provide jobs to supporters.[2] Such job "programs" can, of course, lead to losses for the SOE. It is not hard to imagine that with private firms in the industry, the losses associated with SOE job programs can grow over time and become very large. For example, suppose that private labor productivity grows faster than public. There will then be a tendency for private producers to capture more of the market. If the SOE's share of the market is falling, then the losses for the SOE associated with maintaining a given level of employment grows over time.

Large losses by SOEs means that subsidies must be paid to them. This can be politically costly since the subsidies can be interpreted (in this case, correctly) as signals of nepotism, corruption, and the like. Hence, the government has a strong incentive to eliminate these subsidies. One method is to put restrictions on private firm behavior so as to limit

[2]There is some theory to explain why government members would make transfers to constituents in ways (like providing jobs) that did not involve simply monetary payments, that is, in seemingly inefficient ways (see, e.g., Coate and Morris (1995)).

their efficiency. By limiting the productivity growth of private firms, the government can alleviate the problem alluded to above where private producers capture market share over time. While such tactics do lead to less subsidies, there are obviously costs to the economy. It's as if the government moves the subsidies "off-budget" where they are much more difficult to detect.

We give two examples where governments protect their SOEs by putting production restrictions on private firms. Recall that Australia had a policy of permitting only two domestic airlines, one private and one public. As Davies (1971) reports, the government endeavored to insure that the private airline did not harm the SOE. For example, for each route in Australia, the government would determine biannually the expected capacity in ton-miles for the route over the next six months. The two airlines would then receive the right to carry exactly one-half that ton-mile capacity over the period. Neither airline could carry more than that capacity over the period. But the government soon realized that this was not enough to protect the SOE. By choosing a better mix of aircraft, the private airline was able to make profits (and cause the public airline to make losses). So the government started requiring that the airlines have the same fleet of aircraft! In summarizing the consequences of such government intervention, Forsyth and Hocking (1980, p. 182) argue

> In such a situation, there is little scope for the private airline to be more efficient than the public one, and it is doubtful whether individuals associated with the private one are permitted to have any more incentives to improve efficiency. Any incentives in this system must finally be reduced to very low levels by the strong de facto controls on the profits of the private airline.

As another example, consider the mail and package delivery industry. In the United States, the U.S. Postal Service is able to put restrictions on private delivery services. These restrictions include the regulation that private companies are prohibited from placing items in mailboxes. Amazingly, the Postal Service itself has the power to issue regulations regarding mail service (see Smith, 2004). In his statement before the U.S. Senate regarding the issue of postal reform, Fred Smith, the CEO of FedEx, stressed how the restriction on private firms from placing items in mailboxes led these companies to be less efficient. He urged dropping this restriction, arguing that "the end result of this reform will be to make the nation's delivery services sector more efficient by extending the efficiencies of the national mailbox system to private delivery services."

B. SOEs Used as "Targets" in Pattern Bargaining

In industries where unions represent workers at both an SOE and private firms, the union often chooses to initially bargain with the SOE (it chooses the public firm as the "target"). After reaching an agreement, the union uses the deal as leverage in bargaining with the private firms. The goal, of course, is to achieve a better deal than if the bargaining was not done sequentially. Here, we sketch some simple logic as to why SOEs are often used as targets and then present a few examples of such bargaining around the world.

While the theoretical literature on pattern bargaining is small, and results limited, it's not hard to imagine models where the union would first bargain with the firm most willing to give a generous agreement and then use this to threaten other firms with strikes, etc., if they do not follow the target. In this regard, it is widely recognized that managers of SOEs are

likely to have weaker profit incentives than managers of private firms.[3] Hence, SOE managers find it less "costly" to give generous wage and work rule packages as compared to private managers. This would suggest bargaining first with the SOE and then private firms. Where private productivity enters this discussion is through the work rule agreements and the like that are part of these labor agreements (see below).

Let us give two examples where unions use SOEs as targets to leverage generous private agreements. Recall Canada's railroad industry was comprised of two firms, one public, one private. In trying to extend benefits to their workers, rail unions typically followed this pattern of first bargaining with the public railroad. As one example, Timur and Ponak (2002) discuss how in the late 1980s the public railroad gave significant job protection to employees. In particular, shop craft employees with more than eight years of experience were guaranteed full pay if their jobs were eliminated through new technology and if no suitable substitute position was found. Timur and Ponak quote a senior private firm executive as saying "CNR [the public firm] first negotiated it [the job guarantees]. Then it became a tactical issue whether we would take a strike, lose business permanently perhaps, and the decision was taken not to strike."

In Brazil, there was a single union, Sindicato Metabase (Sindicato dos Trabalhadores da Industria de Metais de Base), that represented workers at both the public and private iron ore mines. The union followed the same practice as that in the Canadian railroad industry. That is, the union would first reach agreement with public firms and then use this as leverage with the private mines. Interviews with Sindicato Metabase staff indicated that the types

[3]It is difficult to arrange compensation schemes for SOE managers that approximate those of private firm managers.

of pressure applied to private producers was sometimes different than that used in Canada (i.e., of strikes). The labor union sometimes allied itself with local government officials to jointly apply pressure on private mines to accept (in large part) the public contracts. Local government officials could add to the union's power since they often had to approve zoning and other regulations under which the mines operated.

3. Brazilian Iron Ore Privatization: Background

In this section we briefly discuss the history of iron ore privatization in Brazil and also the sources of our data.

A. Iron Ore Privatization

In the Brazilian iron ore industry there were two public companies that owned mines, CSN (Companhia Siderugica Nacional) and CVRD (Companhia Vale do Rio Doce). CSN was primarily a steel producer; in fact, it was Brazil's largest (see Andrade, Cunha and Gandra (2002)). It owned a single mine. CVRD was primarily an iron ore producer, a massive one. In 1990, CSN produced about 6 million metric tons (mmt), CVRD 85 mmt, and Brazil 152 mmt. The only country that produced more iron ore than CVRD in 1990 was Australia (110 mmt). The next closest country was the United Sates (56 mmt).[4]

The CSN mine was the first sold to private investors. Steel industry privatization was initiated in 1988 with the Plan for Restructuring the Siderbras System. Siderbras (Siderurgia Brasileira SA) was a holding company of numerous steel companies (including CSN) owned by the government. The process of privatizing CSN's steel operation was completed in 1993,

[4]These statistics are from the United States Geological Society *Minerals Yearbook*. We are excluding China and the U.S.S.R. from these rankings since these countries reported production differently than the rest of the world.

when the CSN mine was also sold.

While an official plan to privatize CSN (and other steel makers) was announced in 1988, CVRD did not appear on official privatization lists until much later, in fact, 1995. The government had decided to sell CVRD well before this date (see below) but knew it was going to face stiff resistance to selling it (see Kandell (1997) for some of the difficulties faced in selling CVRD). Hence, it delayed a formal announcement. CVRD was the crown jewel of Brazilian state enterprises. The government had to placate many nationalist interests before the sale. One restriction on the sale was that Australian iron ore producers (who were the largest producers after Brazil) could not be part of a bidding consortium. Also kept out of the bidding were Japanese steel producers. In the end, only two consortium, both led by local entrepreneurs, bid on CVRD. It was finally sold in 1997.

While the CVRD privatization process was not completed until 1997, both CVRD-management and union officials were unanimous in agreeing that by 1989 it was evident that CVRD would be privatized. By the early 1990s, CVRD was undergoing major reforms and changes in its organization to prepare for privatization. Hence, in choosing a date that marks the onset of the privatization process we chose 1989. While it probably became clear before 1989 that the CSN mine would be privatized (since a formal steel sector privatization program was announced in 1988), for simplicity we have chosen a single year to mark the onset of the privatization process.

B. Data Sources

The basic source of data for mining industries in Brazil, including iron ore, are annual mine reports submitted to regional DNPM's (Departamento Nacional de Producao Mineral

- National Mineral Production Department). These reports include the mine's production (tons of iron ore by type of iron ore) and employment (as of the middle of December). These reports are then submitted to the Ministry of Mine and Energy-MG for tabulation of aggregate production and aggregate employment levels for Brazil. These are published in Relatorio Anual de Lavras. We have aggregate industry data from 1972-1999.

In order to examine production and employment by mine, both private and public, we used the archives of yearly mine reports at DNPM-MG. We limited our search of these archives in the following way. First, there are a large number of very small iron ore firms in Brazil. Hence, to limit the search we gathered mine records for the public companies, CSN and CVRD, and for the three largest private companies, Ferteco (Ferteco Mineracao SA), MBR (Mineracoes Brasileiras Reunidas SA) and Samitri. Second, it was difficult to collect records prior to 1986. Many reports for that period were not found. So we gathered mine reports from 1986-98.[5]

We also decided to examine the data at the firm level and not the mine. While the companies are supposed to report employment by mine, in practice the mines of a firm are often close to each other so that some staff (like repair staff) may work in more than one mine. Hence, it is up to the firm how to assign workers to mines in the reports. Moreover, there are some mines that report production but no employment. Because of this, we have chosen to look at production and productivity records at the firm level.

We have made one exception to this strategy of looking at performance at the firm level. CVRD has operations in the South and the North of Brazil. Since these operations

[5]We collected the data in the mine reports in 2000 and at that time only reports through 1998 were available.

are separated by more than two thousand miles, the issues of repair staff working in different mines, etc., is not a major issue. Hence, we break CVRD into two "firms," CVRD-South and CVRD-North. What we have constructed, then, is the output and employment records of three public firms, CSN, CVRD-South, and CVRD-North, and the three largest private firms, Ferteco, MBR and Samitri, from 1986 to 1998.

In Table 1, we present the production and productivity of these six firms, together with the rest the industry, for 1990. Production by public firms (90.8 mmt) amounted to almost 60 percent of total production (152.2 mmt) in 1990. Production by the three largest private firms (41.5 mmt) amounted to about 27 percent of total production. The small private firms contributed about 13 percent of production. The production of the three largest firms (again, 41.5 mmt) would have ranked them as the fourth largest national producer, behind Australia (110 mmt), the United States (56 mmt) and India (54 mmt), but ahead of the next largest producers, Canada (35 mmt), South Africa (30 mmt) and Venezuela (20 mmt).

Productivity (defined as thousands of metric tons per employee per year) varies widely across firms. CVRD-North, which is the huge Carajas mine, has very high productivity, over twice the industry average. CVRD-North's high productivity was due to its very high quality deposits. MBR and Ferteco had higher productivity than the other two public firms, CVRD-South and CSN. The third large private firm, Samitri, had low productivity. However, Samitri produced a type of iron ore, pellets, that requires more labor per ton than other ores. Hence, its low productivity is not surprising. Also not surprising is that the "rest of the industry" had very low productivity, less than half the industry average. The rest of the industry was mostly comprised of very small firms that worked marginal deposits.

4. Privatization's Impact on Productivity: Evidence

In this section we show that there was little productivity gain in the Brazilian iron ore industry until the onset of privatization. Then industry productivity dramatically increased. We also show this pattern was found in both the public and private firms in the industry.

A. Productivity and Production: Aggregate Industry

The production and productivity records of the Brazilian iron ore industry over the period 1972-99 are given in Figure 1. In the figure we have drawn a vertical line at 1989 to indicate the year when the privatization process began. In the figure, and all that follow, production and productivity are normalized to one in 1990. Production increased by about a factor of four from 1971 to 1990.[6] There was very little increase in productivity over this period. If we examine the decade of the 1980s, there was a small increase in productivity in the middle to late 1980s. This was primarily driven by the opening of CVRD-North, the Carajas mine, in the middle 1980s. As we saw, CVRD-North had significantly higher productivity than all the other Brazilian producers, private and public. Its opening pulled the industry average up a bit.[7]

Figure 1 shows that industry productivity increased significantly with the onset of privatization in 1989. It increased by a factor of more than two over the period 1990-99. There were significant gains prior to the culmination of the privatization process in 1997, that is, from 1990-97, and then a major increase after CVRD was sold, that is, from 1997-99.

[6] Note that we have aggregate output from 1971, but aggregate employment only from 1972.

[7] The existence of the Carajas (CVRD-North) deposits had been known well before the middle 1980s. However, they were located in the interior of the Amazon and massive infrastructure investment was needed before the iron ore could be extracted and shipped to the coast. A World Bank project supplied these funds in the middle 1980s.

B. Productivity and Production: Public Firms

The productivity and production of the public firms over the period 1986-98 are given in Figures 2 and 3, respectively. As can be seen in Figure 2, the general pattern of productivity fro public firms is similar to the aggregate pattern: little productivity growth prior to the onset of privatization in 1989 and then strong growth afterwards, from 1990-98. Here, of course, we only have a few years of data prior to the onset of privatization. Also, we do not have data for 1999 as we did for the aggregate industry.

Turning to the individual firms, CVRD-South had very little productivity gain from 1986-1989. Over 1990-98, its productivity more than doubled. CSN had few productivity gains between 1987 and 1989 (for CSN, 1987 is our first year of data). Over 1990-98, its productivity dramatically increased, by more than a factor of four. Recall that CSN's productivity had been significantly lower than CVRD-South's. Its spectacular productivity growth likely reflects that it was run much more poorly than CVRD prior to privatization. With its dramatic productivity growth it was essentially catching up to CVRD-South's level.

Contrary to the other public firms, CVRD-North shows some productivity gains between 1986-88. This was primarily due to the fact that the Carajas mine had just opened in the middle 1980s. When iron ore mines open, their productivity starts low for the first few years, until mine output reaches its rated capacity. CVRD-North was still in the process of ramping up production during 1986-88. This can be seen in Figure 3. Here we see that CVRD-North more than doubled output over 1986-88. Following the onset of privatization, CVRD-North's productivity roughly doubled over 1990-98.

Both CVRD-South and CVRD-North showed significant productivity growth prior to their formal sale in 1997 (and strong growth afterward too). This pattern of major productiv-

ity gains in public firms before their formal privatization date is found in many privatization studies. For example, Laporta and Lopez-de-Silanes (1999) examine the employment levels in their sample of privatized firms in the four years leading up to the formal sale. On average, employment fell significantly in each of these years. In their Figure I, they show average employment falls from a bit over 1450 in the fourth year before privatization to a bit over 1050 one year before privatization (a three year period). In the last year before privatization, employment falls from a bit over 1050 to a bit over 550. Laporta and Lopez-de-Silanes surmised that these major reductions in employment before privatization were part of the government's effort to prepare the SOEs for sale. That is certainly what happened in this industry: the large productivity gains at CVRD and CSN prior to privatization were due to the government's effort to prepare these companies for sale (see below).

C. Productivity and Production: Large Private Firms

The productivity and production of the three largest private firms over the period 1986-98 are given in Figures 4 and 5, respectively. As can be seen in Figure 4, the general pattern of productivity for private firms is similar to the aggregate pattern: little productivity growth prior to the onset of privatization and then strong growth afterwards. If there is a difference between the patterns in Figures 2 and 4 it is that much of the private productivity gains were bunched closer to the formal sale of CVRD in 1997. Here, again, we only have a few years of data prior to the onset of privatization, and also not for 1999.

Turning to the individual firms, Ferteco had very little productivity gain from 1986-1989. Over 1990-98, its productivity nearly doubled. MBR had little productivity growth between 1986-88. Its productivity growth started earlier than the other firms and it experi-

enced significant growth over 1988-91. It experienced another surge in productivity beginning in 1995, as CVRD's sale was announced. Over the course of 1990-98, its productivity more than doubled. At Samitri, productivity showed much larger year to year swings than at the other five firms (that is, the three public and two private firms). This may have been due to problems at some of its mines (such as major breakdowns of processing facilities) as its output also shows much greater variation than the other firms (see Figures 3 and 5). Samitri's productivity in 1993 is, in fact, similar to that in 1986. Subsequent to 1993, its productivity trends upward, with its biggest gains starting in 1995 when CVRD's sale was announced.

5. Sources of productivity gain

In this section, we briefly address the question of the sources of the very large labor productivity gains at both the public and private mines following the onset of privatization.

Interviews with management at CVRD indicated there were two major sources of productivity gains. First, there were gains due to reorganization of management. For many management tasks, there was a separate management team in the south and the north. But for many of these tasks, only a single management team was needed. During the privatization process, in the early 1990s, much of this management redundancy was eliminated.

The second major source of gain at CVRD was due to changes in work practices among employees at the mines. As was common in the United States and Canada, work practices in Brazilian iron ore mines were such that employees engaged in only a small range of tasks. For example, there was typically a sharp separation of repair and production work. Those workers who ran machinery, for example, were not permitted to tend to their machines — this was reserved for repair staff. As another example, there were many repair job classifications.

Repair staff with a certain classification were not permitted to conduct repairs assigned to other job classifications. In the US and Canada, these work practices changed in the early to middle 1980s, as these iron ore industries were faced with the possibility of closure (see Galdon-Sanchez and Schmitz (2002) and Schmitz (2004)). But they persisted in Brazil until the onset of the privatization process. In the early 1990s, the management at CVRD began changing contracts so as to require workers to be responsible for more tasks. This process was called *polivalente,* the Portuguese term for jack of all trades.

Let us emphasize that both these major changes at CVRD were introduced before its formal sale. They were instituted so as to make CVRD a more attractive firm to purchase thus enabling the government to raise more at its sale.

Many of the changes at CVRD were also be introduced at the private firms; in particular, the move toward *polivalente*. The workers at the private firms had benefited from the narrow job classifications at CVRD as a result of the pattern bargaining. But once such benefits faded at CVRD, they were also lost at the private companies. That such changes in work practices that occurred at CVRD and the private firms could have had significant effects on labor productivity is clear from the work of Schmitz (2004). He studies the U.S. and Canadian iron ore industries, which doubled labor productivity over the middle 1980s. He has access to more industry data than was available in Brazil. In particular, the United States and Canada publish capital stock and materials data for their iron ore industries. He shows that much of the doubling of labor productivity in the United States and Canada in the middle 1980s was due to changes in work practices, changes similar to those in Brazil.

6. Conclusion

Our theme has been that the productivity gains from privatization are much more general and widespread than has typically been recognized in the literature. This is because privatization of SOEs in an industry will typically lead to increases in private firm productivity in that industry — an influence that has been ignored in the literature.

We began by establishing that this issue, the impact of SOE privatization on private firm productivity, is an important one. We did this by showing that public and private production exist side-by-side in many industries and in many countries. We then presented some reasons why SOE privatization would raise private firm productivity.

We then turned to the privatization of SOEs in Brazil's iron ore industry. We showed that there was little productivity gain in the industry until the onset of privatization. Then there was significant productivity growth at both the public and private firms in the industry. We then argued that much of the private productivity gain was due to forces set in motion with the privatization of the public companies.

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Table 1
Brazilian Iron Ore Production and Labor Productivity, 1990
By Public Firms, Large Private Firms and Rest of Industry

Public Firms	Production	Firm Production as Percent of Industry	Productivity	Firm Productivity Relative to Industry
CSN	5.83	3.83	7.40	0.81
CVRD-South	52.12	34.24	9.66	1.06
CVRD-North	32.85	21.58	24.17	2.66
Large Private Firms				
Ferteco	10.93	7.18	10.58	1.17
MBR	19.97	13.11	14.92	1.64
Samitri	10.61	6.97	5.63	0.62
Rest of Industry	19.93	13.09	4.02	0.44
Total Industry	152.24	100.00	9.08	1.00

Note: Production in millions of metric tons (mmt)
Productivity is thousands of tons per employee per year
Source: see text.

Figure 1. Production and Labor Productivity, Brazilian Iron Ore Industry, 1971-99

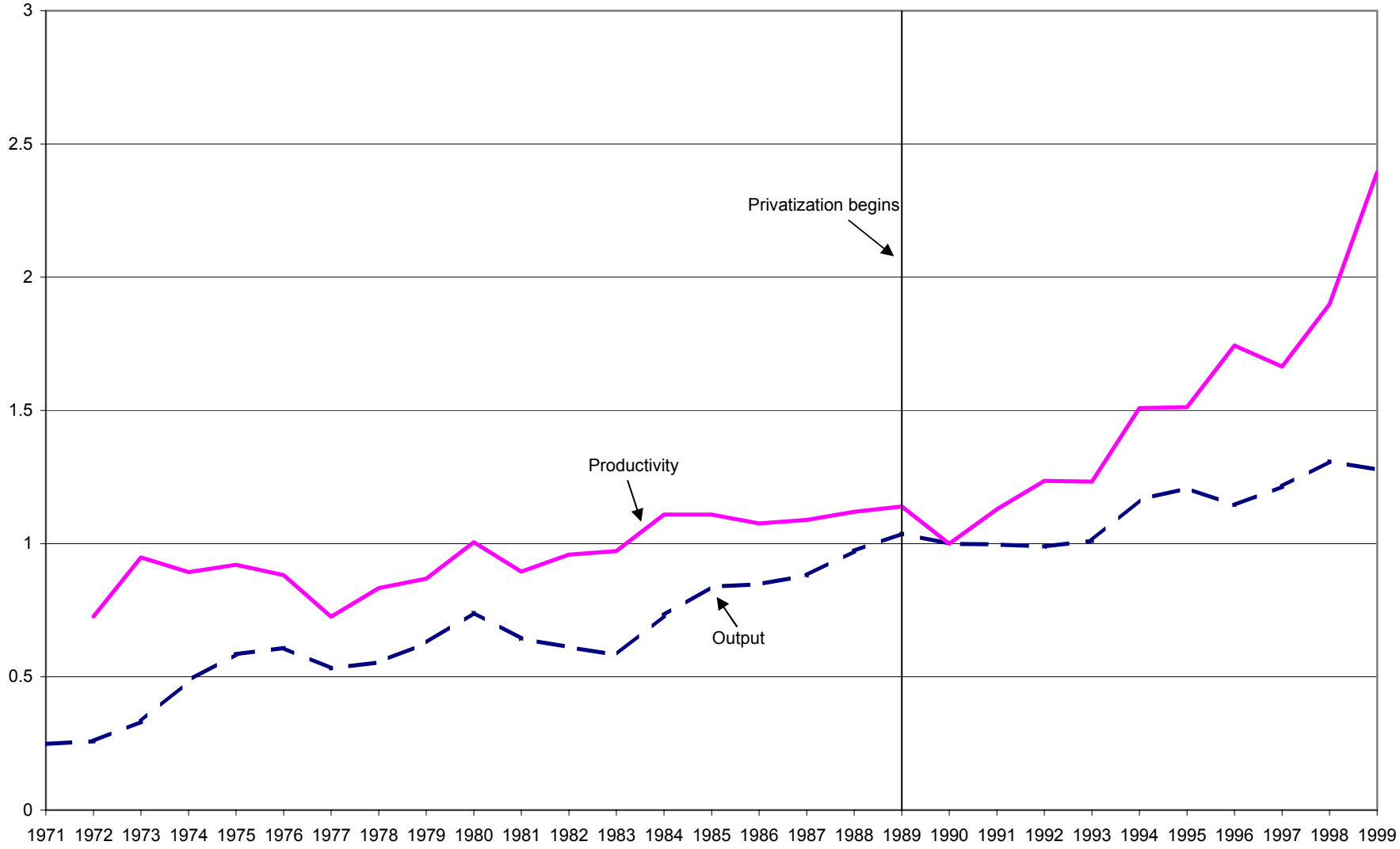

Figure 2. Labor Productivity, Public Firms, Brazilian Iron Ore, 1986-98

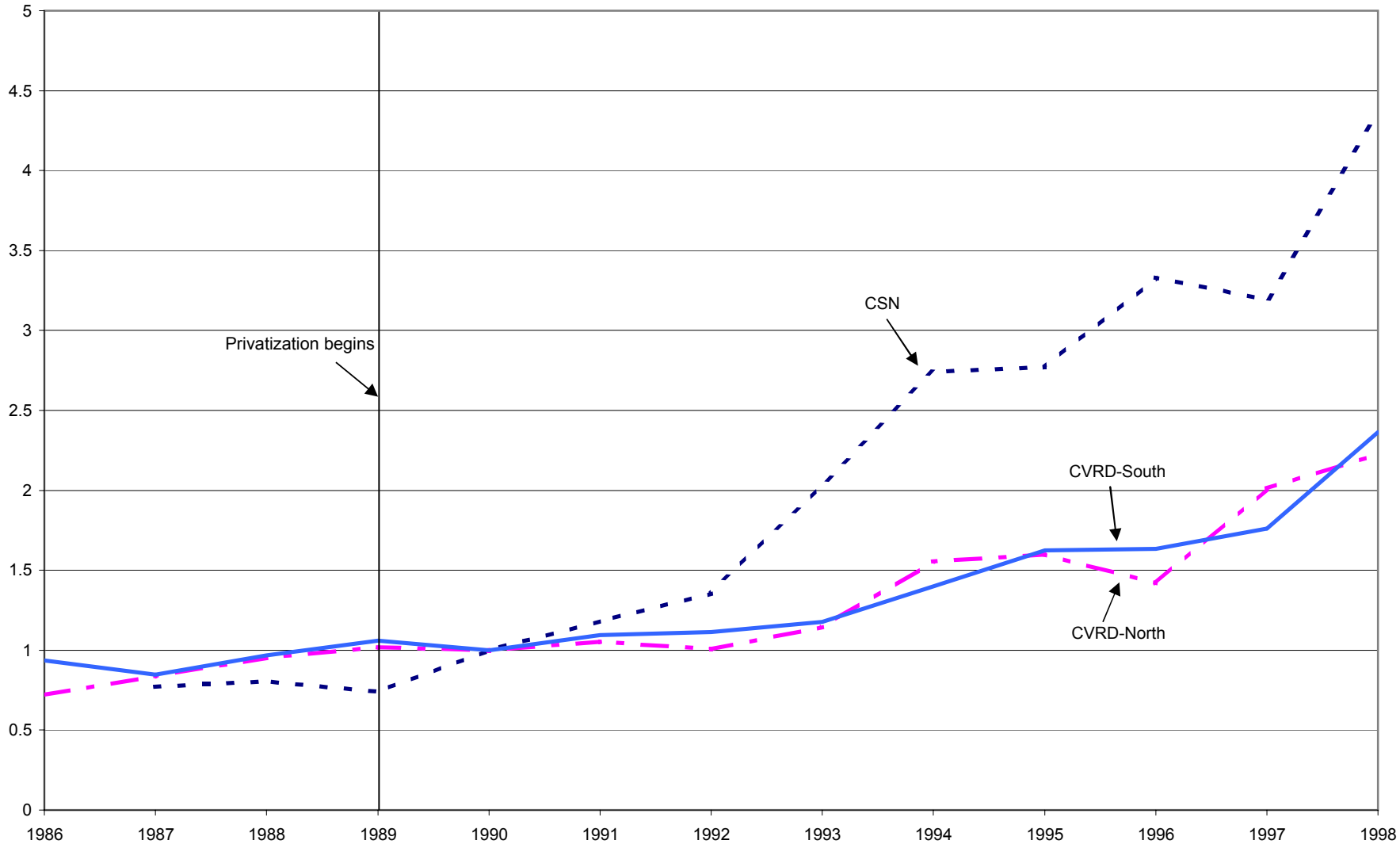

Figure 3. Production, Public Firms, 1986-1998

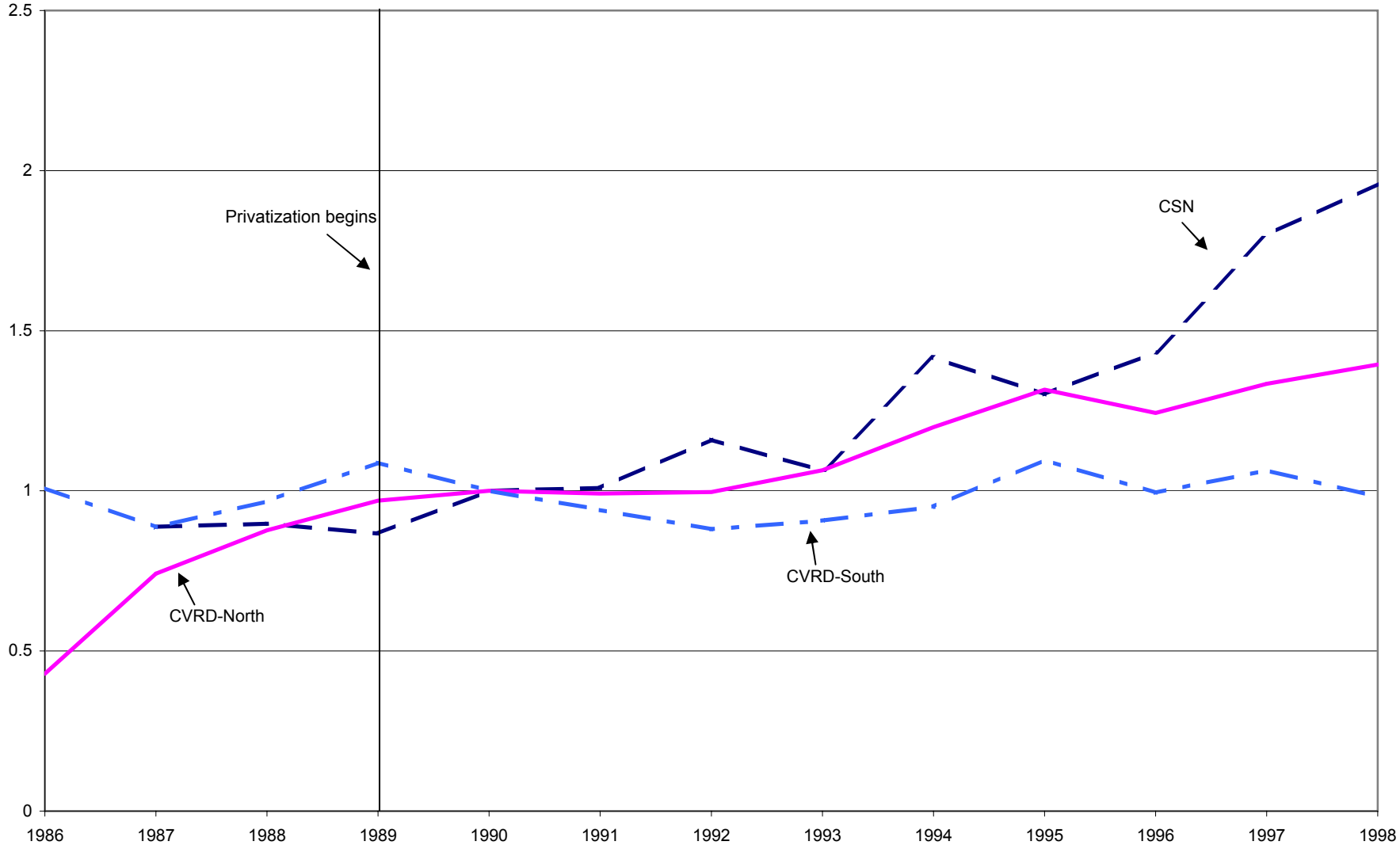

Figure 4. Labor Productivity, Large Private Firms, Brazilian Iron Ore, 1986-98

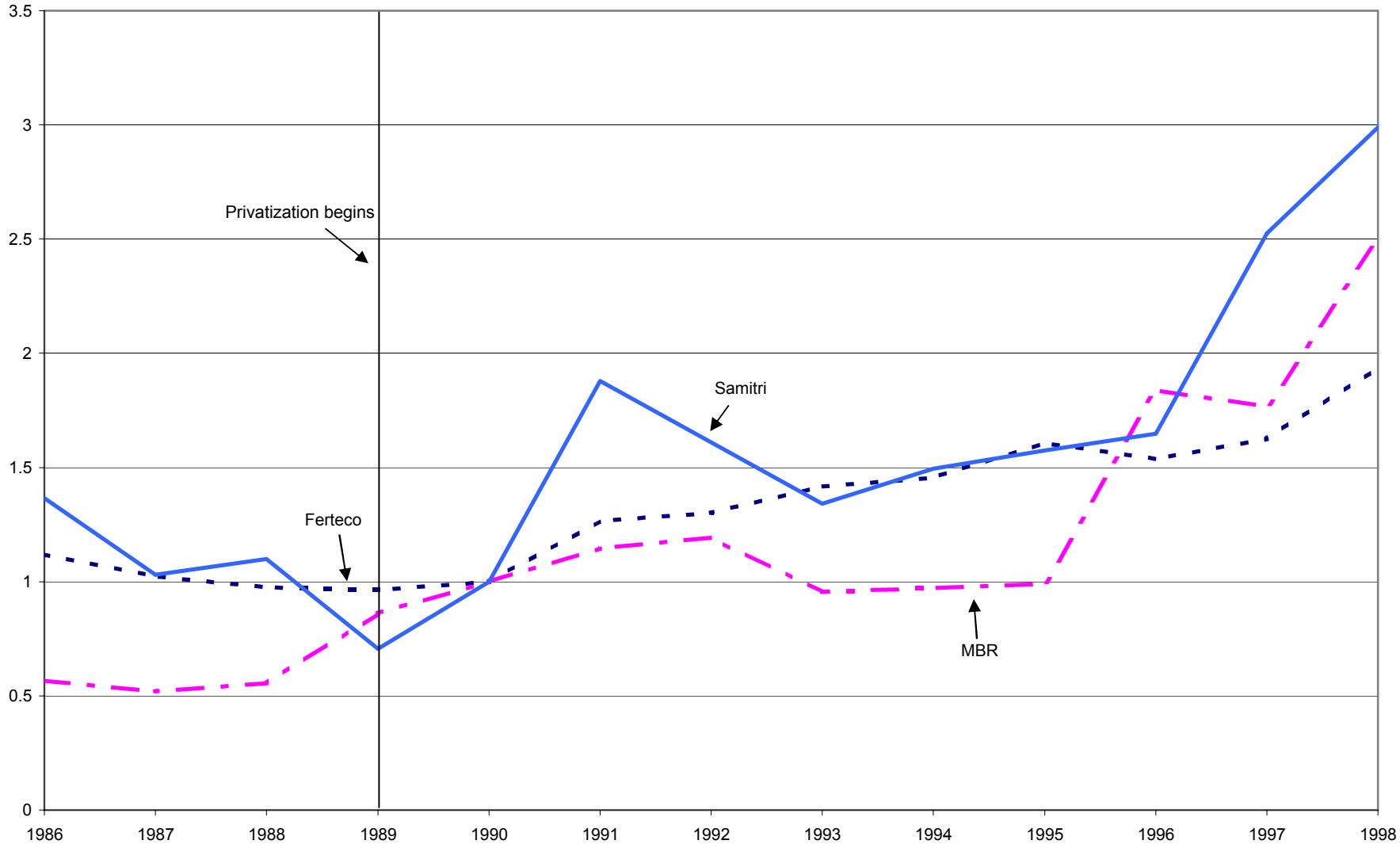

Figure 5. Production, Large Private Firms, 1986-1998