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International Journal of Industrial Organization 21 (2003) 1489–1526
International Journal of Industrial Organization
www.elsevier.com/locate/econbase

A new methodology linking concentration dynamics to current and steady-state profits: Examining Korean industrial policy during take-off

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Accepted 7 March 2003

Abstract

We model the dynamics of industrial structure and market power using Korean manufacturing data during the take-off period (1978–82). Structure–Conduct–Performance [SCP] methodologies have been criticized for using accounting data and because a few superior firms may have greater shares and greater profits. Both are argued to present possible spurious correlations between concentration and profits. This paper follows earlier work which shows that market structure responds to observed accounting profits *as if* these were accurate indices of real profits, and not as if leading firms are perceived to have unmatchable advantages. The methodological contribution of this model is a new latent variable for steady-state profits derived from the speed of structural adjustment. Long run profits are identified by the hypothesis that structural adjustment will be more rapid when industries are farther from steady-state levels. We analyze the long run profits latent variable, finding strong support for this hypothesis. The speed of adjustment is greater for positive and negative deviations from steady-state structure. We show that the profits and structural adjustment relationship is non-monotone. The SCP criticisms above are based on spurious correlations which are monotone in profits and structure. Positing spurious correlations which are at the same time monotone in structure and non-monotone in structural adjustment seems less plausible than accepting the SCP results which are consistent with both. Our analysis also is new in that it is the first direct econometric analysis of Korean industrial policy during its take-off years. We note that in Korea, unlike elsewhere, Industrial Policy was hypothesized to lead to concentration and market power in

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0167-7187/03/$ – see front matter
doi:10.1016/S0167-7187(03)00074-2

the popular press and by professional economists. Ours is the first direct econometric analysis of this hypothesis, and we find it supported.

JEL classification: Primary: L11; Secondary L52, O10, O53

1. Introduction

Critiques of Traditional Empirical Industrial Organization's [TEIO's] use of the Structure–Conduct–Performance paradigm [SCP] cite numerous problems which may occur with relating accounting data for profits with concentration data without having information on firm share data (cf. Demsetz, 1973; Fisher and McGowan, 1983). Both critiques suggest the potential for a monotone spurious correlation between concentration and accounting profits. In earlier work (Masson and Shaanan, 1982, 1987; Jeong and Masson, 1990, 1991; Geroski et al., 1987) we address this issue by demonstrating that market structure responds to accounting profits in the same fashion as would be expected were the accounting data reflecting true profitability and in the same fashion as would be expected if the profitability were associated with market power rather than some form of superior firm rents. The first four papers show that market entry responds to measured profits in the US, Canada and Korea. The fifth paper is closely related to the methodology herein; we found that, for the US, concentration tends to converge towards steady-state levels based on industry variables including profitability.

In this study we add significantly to the first order adjustment process model in the fifth paper. We define a new latent variable for steady-state profits derived from the speed of structural adjustment. Long run profits are identified by the hypothesis that structural adjustment will be more rapid when industries are farther from steady-state levels. We analyze the long run profits latent variable, finding strong support for this hypothesis. The speed of adjustment is greater for larger positive and larger negative deviations from steady-state profits. That is, the relationship between profits and structural adjustment is non-monotone. The criticisms of the TEIO-SCP hypothesis above are based on hypothesized spurious correlations which are monotone in profits and structure. Positing spurious correlations which are at the same time monotone in structure and profits but non-monotone in structural adjustment and profits seems less plausible than accepting the SCP results which are consistent with both. We show that the rest of our results, such as those on long run concentration (another latent variable) are additionally consistent with the traditional model.

Since we are extending a traditional Industrial Organization 'agreement' hypothesis model, we must acknowledge another branch of the literature contrasting the 'agreement hypothesis' with the 'superior firm hypothesis.' This literature

followed the FTC Line-of-Business data for the mid 1970s. ''The contending schools were deadlocked'' declared Scherer et al. (1987) writing collectively with seven other LOB authors (Long, Martin, Mueller, Pasco, Ravenscraft, Scott, and Weiss). But, they continued, the LOB data *broke the deadlock*. The LOB data integrated firm shares and concentration in explaining firm level price-cost margins [PCMs] and found that share (superiority), not concentration (agreement) explained PCMs. The superiority hypothesis was declared the winner.

In contrast to the FTC-LOB work, in Jakubson et al. (2002) we analyze a panel of Korean Line-of-Business data in which we can control for firm shares over a recent 9-year period. In that panel, we can verify that concentration has an effect on profits quite independent of any aggregation biases suggested by leading firms having greater profits than the remainder of the industry.[1] At least for Korea, and this more recent time period, it appears that nesting the 'agreement hypothesis' and the 'superior firm hypothesis' in the same model leads to the agreement hypothesis explaining most of the firm level profits effects.[2]

In this paper, since our primary focus is on the opposite causality, from profits to structure, we have another powerful methodology for verifying the traditional structure–conduct–performance model by examining performance–structure feedbacks.

Korea has several advantages for application of TEIO-SCP modeling. First, the real growth rate in manufacturing during the period of our 5-year study was 18% per annum; the median industry more than doubling in size over 5 years. This provides natural 'action' in the data[3] and also minimizes biases due to accounting for historical depreciation. Second, not only did Korea have little antitrust, it even encouraged some consolidations. One of the reasons to study market power is to find out if antitrust policy is beneficial; if antitrust policy itself is effective, there may be little market power where there is strong antitrust, a study of a country with weak antitrust then may provide important insights.[4] Third, Korea is very

[1] For example, concentration affects profits in the traditional TEIO-SCP fashion for the subsample of industries for which share and profits are negatively correlated. Furthermore, exploiting the panel nature of the data, within and between estimators are nearly identical. We also find that with both concentration and share in the model, within estimators lead to the conclusion that the concentration effect on profits dominates the share effects.

[2] In this paper we speculate about why our results are so different than the FTC-LOB results. We model demand elasticities as industry specific, unlike the earlier studies. We offer evidence to the effect that the mid 1970s FTC data were for a strikingly atypical time period in US concentration-profits relationships. We cannot, however, assert that the Korean results generalize to the US (e.g., with US antitrust policy).

[3] For example, we find that deviations from equilibrium are larger in Korea than in the more advanced economies which have been studied using first order adjustment models (these studies are reviewed in Geroski and Masson, 1987). What this generates is much higher adjustment speeds than found in studies of a variety of mature economies.

[4] In earlier work (Madhavan et al., 1994) we examined behavior under antitrust exemptions in the US, finding that at least one milk cooperative was able to operate as a large numbers cartel.

compact geographically, the bulk of the population lives in two greater urban areas separated by only about a 5 hours drive. Markets for most products are hence 'national,' one need not worry about how to define concentration across geographic territories.

This being said, one must keep in mind that Korea is in other ways unique, which can hinder generalization. For the period of our analysis it was a 'newly industrialized country' [NIC], technologies were to some extent derivative from more advanced countries and Korea's industrialization was to a great extent led by heavy industries and chemicals. Furthermore, Korean industrial policy played major roles in Korean development.

Beyond the methodological advances derived in this paper, we also take the opportunity to study the effects of industrial policy in Korea on both industry structure and industry profitability.[5] The government used a 'Pick the Winners' industrial policy which encouraged firms to increase in size, generally with the market leaders being most favored for expansion. In our inquiry we find that in fact industrial policy led to greater concentration, just as posited by many authors, but never shown statistically.[6] Accordingly, to assess our modeling and results, it is imperative to understand the Korean context, both in terms of growth and in terms of policy.

Kuznets (1988) suggests that to know how industrial policy may function "... policy makers in many countries, not only developing ones, need to know more about the ... East Asian model ..." He adds that "government policy has been most important in Korea, more so than in Japan, and it was least important in Taiwan." And borrowing from Lee (1996), "Despite all the interest and controversy concerning the role of the Korean government, surprisingly little empirical investigation has been done."[7] We hope to cast empirical light on these issues as well.

Despite the strong industrial policy, the government used its policies to supplement market forces, not replace them. With a small public sector, domestic prices were mostly determined by business firms. Jeong and Masson (1990, 1991) demonstrate that entry patterns in Korean industry are similar to those found in the United States and Canada; entry was more pronounced when industry profits were

[5] Previous analyses of mature economies suggest that markets in the long run often adjust to workably competitive outcomes in the sense that market concentration generally tends toward that predicted by economies of scale. See for example Bain (1954) and Geroski and Masson (1987).

[6] *The Economist* (February 20, 1988) states that the legacy of this focus on growth alone was high concentration and a predominance of large independent business groups, *Chaebols*. (The *Chaebols* are combinations of 'independent' firms in different industries connected through financial ties, such as a common credit pool and [partial] equity interests. They provide an internal capital market for related firms.) See also Kuznets (1988), Behrman (1983), and Adams et al. (1983).

[7] Lee (1996) statistically examines policy measures versus factor productivity growth.

higher and when industry entry barriers were lower.[8] So the Invisible Hand was not totally restrained.[9] Our analysis examines to what degree Korea's industrial policy in this period altered market structure and what impact this may have had on domestic competition.

It is important to note what this adds to the evaluation of the new methodology introduced herein. Many leading economists presented a priori (e.g., anecdotal rather than statistical) reasons to believe that Korean industrial policy raised concentration in Korea relative to what it would otherwise have been. Our model finds not only results consistent with the SCP 'agreement' hypothesis, but also results supporting these hypotheses from others. This in turn lends credence to the validity of our new methodology.

The paper is organized as follows: the next section examines Korean development and industrial policy; the third section presents the model of structural adjustment and explains how our new latent variable for long run profits is identified by structural dynamics; the empirical results are discussed in the fourth; more recent experience is covered in the fifth; conclusions follow.

2. Development experience in Korea

We begin by examining Korea's development strategies. It is important to recognize that during our period of analysis Korea emphasized dynamic growth at the expense of static efficiency. Industrial concentration and market power were intermediate policy goals. Of particular importance is understanding the role of subsidized loans as one of several policy tools, as these are the metric we use for calibrating the effects of industrial policy.

2.1. Korea's industrialization patterns

The economic growth of Korea since the 1960s, until the recent Asian financial crisis, has been remarkable. For the period of 1965–85 Korea achieved an average annual growth rate of 6.6% in real per capita GNP (in dollar terms), third only to Botswana (8.3%) and Singapore (7.6%) among 108 countries reported by the World Bank (1988). Its growth in manufacturing and in exports ranked first in the same study. Manufacturing for 1965–80 grew at an annual rate of 16.6% in real terms and at 9.6% for 1980–86. Exports grew at 27.2% in constant terms for 1965–80; 14.3% for 1980–87. Even the 1990s, despite the financial crisis, were

[8] An international comparison of market entry demonstrated that in the mature economies entry was strongly related to exit—high entry signals high turnover. Korea was unique in having strong growth leading to mostly entry, with little turnover. Cf., Cable and Schwalbach (1991) and Jeong and Masson (1991).

[9] In Jeong and Masson (1991) we show that subsidized policy loans did not affect entry rates, entry was responding to profits (including subsidies), not directly to subsidies or protection.

mostly characterized by growth. Exports and Manufacturing grew in dollar terms every year of the decade except for 1998 (−4.7 and − 7.4%, respectively), leading to growth for the decade averaging 9.1% in Exports (contrasted with Japan at 4.5% and Taiwan at 7.1%) and 7.7% in Manufacturing growth (contrasted with 0.5% for Japan and 4.5% for Taiwan).

GNI per capita is also worthy of note. Between 1982 and 2000 per capita real GNI *in dollar terms* has grown at an annual rate of 9.7% in Korea, slightly less than 9.8% for Taiwan but greater than 8.1% in Japan. More recent *dollar* real per capita GNI figures are less impressive, they collapsed in 1997/98. Despite the collapse, these grew at 4.30% per annum in dollar terms for the decade of the 1990s even though they fell by 8.95% per annum for 1996–99 (contrasted with Japan, which fell by 1.6% and Taiwan which fell by 0.1% per annum for the same period). These annual rates mask the fact that real per capita GNI in dollar terms actually rose for all years but 1997 (−9.4%) and 1998 (−34.8%). The dollar denominated numbers reflect international purchasing power and are, of course, dominated by the devaluation of the Won by almost 50%.

The dollar denominated figures are misleading with respect to domestic purchasing power. Real GDI per capita in terms of the purchasing power of the Won (including foreign goods) only fell in one year, 1998, and this decline was 11%; by 2001 GDI per capita in real Won was 3.7% greater than in 1996.[10]

Korea attained its growth despite persistent political and social instability since its liberation from 36 years of Japanese colonial rule in 1945. After liberation, Korea was divided into North and South. Under the Japanese, agriculture was dominant in the South with little modern manufacturing. The civil war, 1950–53, destroyed what little industrial base existed in the South.

For 1953–60 the Korean economy remained agrarian and experienced only modest real growth, 4.3% per annum. Major changes followed a military coup in 1961. In 1962 per capita income was only $87; 63% of the labor force worked in primary industries; manufacturing accounted for only 9% of GNP. Korea then initiated its first 5-year Development Plan. This plan included monetary reform, increased interest rates to encourage savings, devaluation of the currency, and realignment of tariffs and taxes. Policies promoted export industries (more than import substitution).

In these earlier years the government used successive ‘5-year plans’, to influence resource use and investment programs.[11] Despite these interventions, primary reliance was on the private sector. Maintaining a small public sector, the government used numerous incentives to influence private sector resource allocation.

[10] Data from the Bank of Korea. Most Korean would find the economic statistics indicating that GDI per capita in Won was back to pre crisis levels hard to believe; the crisis had significant personal costs for many, and appears to have widened income inequality.

[11] For a comprehensive analysis of Korean economic development over this period, see Mason et al. (1980).

Along with high growth rates came structural shifts. The manufacturing share of GNP jumped from 9.1% in 1962 to 22.4% in 1972 and 28.3% in 1982, and per capita GNI rose to $11 385 by 1996,[12] but plummeted to $6744 in 1998 following the financial crisis and devaluation of the Won. Dollar GNI is expected to be over $10 000 for 2002, and as noted above, GNI in terms of domestic purchasing power in Won (including imported goods) is about 4% higher than it was in 1996.

Korea was not alone in its rapid growth; some other Pacific-rim economies also were becoming Newly Industrialized Countries over the same period. And since their industrial policies differed, one cannot definitively attribute Korea's growth to its industrial policy.[13] Our contribution is in showing a new methodology which fits the data and the SCP hypothesis in a fashion not predicted by the superior firm hypothesis acting alone. It also documents the influence of Korean industrial policy on Korean markets; we do not contribute at all to the discussion of the relative merits of the different industrial policies pursued by the different successful East Asian economies.[14]

[12] As noted earlier, Lee (1996) studied the effects of policy on factor productivity over 1963–1995, finding that it had no influence on factor productivity growth. For a period of such momentous change, the ceteris paribus assumptions used may influence the ability to ferret out such influences. He then concludes that Korea grew 'in spite of' rather than 'because of' interventions. Young (1995) suggests that in the various East Asian countries it was factor accumulation (labor force participation, education, and capital investment rates, which in Korea rose from 20% of GDP in the 1960s to 30% in the 1970s and approaching 40% by 1991) not factor productivity growth, that led to extraordinary growth. Beason and Weinstein (1996) also find, for Japan, that industrial policy did not raise productivity, but they do find that it raised growth in target industries. (The thesis of their paper is that the target industries were the wrong ones, like mining, and that targeting other industries may have led to more country wide growth.) If Korea's industrial policy led to greater investment, and hence growth, in the 'correct' industries, the policy may have worked, even without raising factor productivity. And this is also consistent with the possibility of a policy stimulus for increased export performance also leading to growth.

[13] A reviewer for this journal felt that this disclaimer was potentially too little. There are, and will be, those who have strong opinions that Korea's policies either did or did not lead to growth. We will simply try to present some perceptions of other respected economists.

Korea's development, and contrasts with the development of other countries, can be seen in Adams et al. (1983), Adelman (1974), Jones and Sakong (1980), Kim and Roemer (1979), Kuznets (1977, 1988), Mason et al. (1980), Rhee et al. (1984), Scitovsky (1986), Inoue et al. (1993) and Hong (1993). Kuznets (1988) notes common features with Taiwan and Japan, such as high investment, a small public sector and labor market competition. He points to Korea as having the most prominent government intervention. Korea backed ''Winners'' with policies like subsidized loans, while Taiwan did not. The result being, ''...the number of manufacturing firms in Taiwan increased by 150%, while the average size... increased by only 29% [whereas in] Korea the number of firms increased only 10%, while [size] per enterprise increased by 176%'' (Scitovsky, 1986). Japan also focused on industry wide policies, not a ''Pick the Winners'' firm specific set of policies.

[14] It is quite possible that if Korea had used identical policies as those used in Taiwan, for example, that their export mix would have looked quite similar to Taiwan's, and inter-firm/inter-country competition could have led to both policies being far less successful; similarly had Taiwan adopted a policy identical to Korea's.

2.2. Korea's industrial policy

A brief review of Korea's multifaceted industrial policy is required for interpreting the results presented below. Korea's industrial policy had four phases: the export promotion phase of the 1960s and early 70s; the drive to develop the heavy industries and chemical sectors [HICs] in the mid 1970s and early 1980s (the period of this analysis); the liberalization and structural adjustment phase from the mid 1980s to the financial crisis of 1997; the corporate reform period post crisis.

Our tests are performed for the fourth 5-year plan, 1977–81, in which the government promoted HICs. During this second phase of industrialization, Korea focused on such HICs as iron and steel, petrochemicals, machinery, electronics, ship building, and automobiles.[15] The HIC promotion employed a wide array of policy instruments including preferential credits, tax benefits, import protection, and preferential policy loans.[16] The government directly allocated limited capital to strategic firms and industries to encourage investment.

The 'visible hand' functioned using what has been called a 'Pick the Winners' or 'National Champions' policy. The government picked 'winners', firms within an industry to which it provided special incentives. ''In exchange for stunning performance in the areas of exports, R&D, or new product introduction, leading firms were rewarded with further licenses [and loans] to expand'' (Amsden, 1989). Conversely, designated winners which did not perform, were abandoned for special treatment. In some cases the stock holders were left with nothing as the firm would be absorbed (by merger, even governmentally forced merger) by one of the selected [possibly newly selected] 'winners' for that industry. ''Big business consolidated its power in response to the government's performance-based incentives'' (Amsden, 1989). The top *Chaebols* substantially expanded during this period, to a great extent by entering HICs.[17] Some other policies were more available to a spectrum of firms within an industry. For example, all firms in key industries also were given special tax treatment during this period.[18]

Korean industrial policy evolved over time and learned from 'mistakes', but it

[15] The policy, commonly called HIC promotion, focused on switching from labor intensive to capital intensive production in high value-added industries. A few of the target industries, like Synthetic Fabric Spinning, were not HICs.

[16] In the earlier export promotion phase Korea used tariffs, exchange rates, tax incentives, and export subsidies to support export-oriented activities. Export expansion was 32% of total output growth for the 1963–75 period (Kim and Roemer, 1979).

[17] The top five and thirty *Chaebols'* shares of total manufacturing sales in 1987 were 22 and 37%, respectively. The shares of the top five were 41% of heavy industry and 27% of chemicals; the shares of the top thirty were 49% of both sectors (Jeong, 1993).

[18] From late 1975 to 1981 key industries enjoyed special tax treatment including tax holidays, investment tax credits, and special depreciation rates.

remained reasonably consistent over this phase.[19] Despite mistakes, several of the target HICs comprise Korea's industrial base of today. The HICs share of gross output jumped from 11.9% in 1970 to 26.3% in 1980 (comparable to Japan's 29.6%).[20] The export share of the HICs also increased from 20.5% of manufacturing exports in 1970, to 52.1% in 1980, and 61.3% in 1985.

While many economists feel that, despite some failures and significant costs, Korea's second phase of industrial policy led to efficient, internationally competitive firms and achieved rapid growth, it is widely believed to have led to higher industrial concentration. And, as noted in Jeong and Masson (1990), and demonstrated herein, the profit–concentration relationship in Korea during this period was strong. So if the price of growth was high concentration and market power, then it is interesting to assess this. In the mid 1980s Korea entered its third phase of development policies. In this phase Korea began liberalizing its economy. It introduced some antitrust policy and permitted heretofore proscribed union activities. It reduced, then eliminated, credit allocation and industry specific subsidies while liberalizing trade. Importantly, it needed to liberalize its financial markets to become a member of the OECD in the 1990s. Although the major banks remained regulated, this led to a virtually deregulated merchant banking sector with access to foreign short-term debt in the mid 1990s. This along with very high leverage ratios for corporate debt (which was predominantly short-term bank debt) played a role in the financial crisis of late 1997.

Since 1997 the industrial policy has been one of 'corporate reform,' carried out under the 'Policy Framework' attached to the IMF's emergency loan in response to the crisis. The reforms included more transparent governance, stronger management accountability, reduced leverage, and a phasing out of cross-firm debt guarantees.[21]

2.3. The role of policy loans in increasing market concentration

We examine the effects of industrial policy, as measured by subsidized policy loans, on market structure and profits in the second phase of development policies.

[19] Korea's policy required meeting world competition in overseas markets. By supporting industries that could compete internationally, many economists believe that this policy did not perpetuate inefficient vested interests, as was frequently the result of protection in other developing countries (cf., Adams et al., 1983; Behrman, 1983; Westphal, 1990). As Kuznets characterizes Korea's experience:

Though the growth imperative has not prevented major mistakes, it has focused priorities so that policies are reasonably consistent and efficient. This is very different from the sort of stop-go, ad hoc, contradictory policies found elsewhere.

[20] Gross output is gross domestic product plus intermediate goods. Korea's manufacturing share of gross output was 51% in 1980, and Japan's was 43% in 1985.

[21] It also has focused on 'restructuring,' having leading Chaebols concentrate in individual core industries, spinning off of smaller divisions to market leaders in these other industries. For more details, see Jung and Jeong (2002).

Ideally we would like to have measures of each policy: control of credit access, preferential tax structures, exchange rate controls, etc. Unfortunately we cannot directly measure many facets of Korea's industrial policy,[22] but we can measure its policy loans—government backed or subsidized loans, including foreign loans—for each industry.

During this period the government was the major owner of the five commercial banks and it also owned six specialized banks. Unlike Japan, where commercial banks as private institutions may have pushed their borrowers to expand output beyond purely profit maximizing levels (cf., Weinstein and Yafeh, 1995), the bankers and government were essentially the same unit. As Amsden (1989) put it for this period ''Where Korea differs from most other late industrializing countries is in the discipline its state exercises over private firms . . . The sternest discipline imposed by the Korean government on virtually all large sized firms . . . related to export targets . . . Government control of the purse strings has helped orient the chaebol toward accumulation of capital rather than toward seeking rents.'' Wade (1990), Lee (1996), Han (1993) and others point out that in contrast to other late industrializing countries, Korea experienced persistent excess demand for credit. The government, through control of banks, allocated credit to specific industries, and to particular firms within these industries. Access to credit was a plum, and the government made it clear that access could be lost unless firms performed up to expectations, especially with regard to export targets. As Wade (1990) refers to it, ''use [of] targeted credit as a steerage instrument''.

Subsidized policy loans were perceived to be the most important of Korea's industrial policy tools. With excess demand for credit, there is 'credit rationing' (see, for example, Jaffee and Russell, 1976; Stiglitz and Weiss, 1981). With credit rationing there is an upward sloping (or vertical) borrower specific supply curve of funds. An upward sloping supply curve for funds, when shifted to the right, leads to greater investment (see for example Duesenberry's (1958), marginal cost of funds) and the expansion of target firms relative to rivals.[23] The government allocated credit to specific firms within industries in return for meeting export goals.[24]

This was perceived to have led to greater concentration within industries for

[22] Exchange rate data are highly aggregate. With corporate taxes of about 45%, some target firms within some HICs paid rates around 32%. Tax incentives have been measured at a two-digit level (Choi and Kwack, 1990). We use their data for our four- and five-digit industries to construct an instrumental variables test to be explained later.

[23] As Myers and Majluf (1984) note, there are analogies between credit rationing and financing hierarchies, in which firms exploit one form of access to financial capital before others.

[24] By granting funds to only a subset of firms in an industry the government achieves three things over and beyond economies of scale. First, it is simpler to monitor a small number of firms. Second, export performance can be judged against the yardstick of non-subsidized firms' exports in the same industry. Third, and less laudable, individuals in government could reward specific individuals whom they favored, or from whom they may have even received bribes.

three reasons. First, credit availability led to greater capital accumulation; decreasing the marginal opportunity cost of funds for the target firms, and greater investment. With greater investment, the greater capital base means a lower marginal cost of production at any given level of output, which is well known to lead to asymmetries (e.g., in Cournot models). Second, firms were granted some of these funds for inframarginal loans at highly subsidized rates of interest. For inframarginal loans, these are valuable subsidies that the firms would not wish to sacrifice. And there was a quid pro quo needed to continue with these valuable subsidies in the future: capital base expansion for export expansion relative to the industry as a whole. In the same fashion that Weinstein and Yafeh (1995) argue that bankers could induce output expansion relative to present value maximizing levels in Japan, this quid pro quo would induce greater output levels for target firms than they would have selected but for their incentive to keep in the good graces of the government to continue receiving these subsidies.[25] Third, not only were funds typically provided for only a limited number of firms in an industry, as more funds are allocated to designated winners, this actually shrinks the availability of remaining funds to allocate to others.[26]

Discretionary policy loans were provided through banks in the forms of a machine-industry promotion fund, a foreign loan fund, an export equipment fund, an industry rationalization fund, a long-term policy fund, a medium-industry fund, etc. The bank interest rates on policy loans were controlled at substantially lower interest rates than other bank loans and a substantial portion of bank credit was allocated directly to designated firms and sectors. Foreign loans which carried much lower interest rates than domestic non-policy loans were also subject to government approval, and permitted only to specific firms in designated industries. The government facilitated and mandated restructuring (e.g., mergers and capacity reductions) in financially distressed, low capacity utilization industries. These were generally accompanied by subsidized loans to a designated firm to finance the restructuring by absorbing financially distressed firms.

Total bank loans increased from 15% of GNP in 1962–66, to 39% in 1972–76,

[25] Wade (1990) refers to a ''well developed policy network between the economic bureaucracy and those firms ... long-term exchange relationships ... in which the government makes help available in return for specified performance on the firms' part ...''

Note even inframarginal loan subsidies may have effects at the margin if target firms believe that they will receive more inframarginal subsidized loans the better is their export performance relative to their industry. Even though the threat to remove subsidies, abandoning a 'winner' may have played a role in some industries, marginal changes in subsidy levels was probably the mechanism in others.

[26] ''Especially through being able to influence ... details of particular loans, industrial development officials have ... a range of detailed instruments able to discriminate between individual firms'' (Amsden, 1989). And, as she points out, the government had ''two interrelated dimensions: (a) *penalizing the poor performers* [emphasis added]: and (b) rewarding only good ones''. She goes on with examples of individual companies which were abandoned in industries with otherwise successful firms, and also mentions that the government in some industries ''has imposed discipline by limiting the number it has allowed to enter (although usually to not fewer than two firms per industry)''.

and 47% in 1977–81 (declining thereafter). Discretionary policy loans were 40% of total bank loans in 1977–81.[27] Bank loans are about 50% of firm capital in our data set. For the HICs, subsidized loans amounted to 26% of total industry capital (and the designated 'winners' in these HICs received most of these loans). The subsidies were substantial. Policy loan interest rates were generally below bank rates of at least 6% per annum. The HICs in our data paid bank interest of -6.7% per annum in real terms (the target firms in the industry paying much lower rates than this average), whereas the real rate was -1.1% for the rest of our sample.[28] At the same time the curb rate, which was accessed often even by large firms, averaged 19.6% in real terms.[29] Hence, credit control has been a powerful policy instrument and a measure of subsidized loans captures a substantial element of the entire industrial policy.[30]

Key HICs were provided with preferential tax rates and other advantages not provided to others. Industry wide advantages, such as tax rates, are not as clearly linked to increased concentration within an industry, but could interact with loan access and other steering of 'winners' within an industry in a fashion that leads to greater concentration. Directly, some policy loans were granted specifically to implement a government demand that a winner purchase a specific floundering rival. Less directly, suppose that there are zero profits for most firms, but due to subsidies a 'winner' has positive profits, then a lower profits tax would be

[27] These data understate total preferential loans; they exclude short-term export credit and foreign loans, among others. For our sample we treat these other preferential loans as policy loans; they were government controlled and provided at substantially lower interest rates (6% below regular bank loans). Hong (1990) estimates government bank loan subsidies as the difference between the estimated rate of return on capital and the weighted average of interest rates on domestic bank loans. He finds subsidies were 3% of GNP for 1962–71 and 10% for 1972–1979. In addition, he finds foreign loan allocation subsidies were 6% of GNP.

[28] Data sources are discussed in Appendix A.

[29] Non governmental loans, even curb rate loans, would be more accessible by firms known to be selected policy 'winners,' as the government would be expected to 'bail them out' in bad times if it appears that these were not caused by mismanagement (e.g., an industry recession affecting all firms). The government also guaranteed some commercial loans (recall, although it was the dominant stockholder of the commercial banks, it was not the sole stockholder). Furthermore, there is a 'signaling effect' associated with the policy loans (see for example Wade, 1990), even without guarantees, curb market lenders may feel that target firms are not likely to be abandoned (and for reputational reasons would not wish to default on non-guaranteed loans).

[30] It is generally accepted that credit provision was the most powerful policy instrument during this period, although no statistical study compares the relative effectiveness of credit versus tax incentives and exchange rates. Inoue (1993), World Bank (1987), Hong (1993), Westphal (1990), Kuznets (1988) and Rhee et al. (1984) cite credit allocation and foreign loan guarantees as particularly potent policy instruments. The government was the major shareholder of all the nationwide commercial banks until the early 1980s. Although this has weakened, Hong (1993) states ''the banking activities are still those of a command economy in Korea''. Han (1993) finds that credit availability, rather than interest rates or other incentives, was the most influential determinant of investment in Korea's industrialization. This fits the credit rationing interpretation noted above, but places less emphasis on the incentives created by the desire to retain subsidized low cost inframarginal loans.

beneficial for the winner, but not for its rivals. Hence our policy loan measure captures, at least in part, the effects of other policy tools in addition to credit policy. Estimates of the effects of a measure of credit policy cannot be reliably interpreted as those of credit policy alone. Should this be interpreted as an imperfect proxy for industrial policy as a whole, considering that proxies may entail errors in variables bias? Or should this be interpreted as being the effects of loan subsidies, in which case effects may be inflated by excluded variable bias?[31] Certainly, the effects associated with this variable exceed those of loan subsidies alone,[32] but probably do not capture all industrial policy. For expository simplicity we shall treat our measure as a proxy for industrial policy, occasionally reminding the reader of the potential for bias. This not only follows our priors, it also is the statistically conservative approach because the effects of the loans per se are potentially inflated by the effects of correlated policies. We return to this later in text, and present estimation from an instrumental variables treatment of errors in variables bias in Appendix B.

With this background about policy and its effect on the interpretation of our measure of industrial policy loans, we turn to the model.

3. The model

The model starts with one tested on US data by Geroski et al. (1987), which extended a series of models tested by others (reviewed in Geroski and Masson, 1987). A significant addition in this work is a latent variable for long run profits derived from the speed of structural adjustment and characterization of this variable. The test is based on the simultaneous estimation of concentration and

[31] Other policy tools are excluded variables. The true model must be $Y = a_0 + a_1 SUB + a_2 POL$, where $SUB \equiv$ loan subsidies, $POL \equiv$ other policy instruments, but we estimate only $Y = b_0 + b_1 SUB$. If *SUB* and *POL* are perfectly correlated, then b_1 captures all effects of policy. (E.g., if $POL = \alpha SUB$, then $b_1 = a_1 + \alpha a_2$.) If *POL* and *SUB* are positively correlated, but not perfectly correlated, then b_1 must be greater than a_1. Since the policy loans and other instruments are correlated, we will overestimate the loan effects *to the extent those policies are concentration increasing*, but possibly underestimate the effects of the entire policy, an errors in variables bias. As a statistical point, it is even conceivable that $a_1 = 0$, yet to arrive at an estimate for b_1 which is positive and significant if a_2 is positive.

[32] Some targeted (high subsidy) large firms were ordered to acquire specific rivals; some firms with high subsidies were also given firm specific licenses to import inputs and/or to negociate international technical expertise agreements, leaving rivals with domestic inputs and/or known and non-patented technologies.

profit rates, also treating advertising, imports and exports as endogenous.[33] The model starts with a concentration adjustment equation:[34]

$$C_t = C_{t-1} + \lambda(C^* - C_{t-1}) \tag{1}$$

where C_τ is concentration in time τ ($\tau = t-1,t$), C^* is steady state (or 'long run') concentration and λ is adjustment speed.[35] λ is estimated as a function of the deviation of profits from steady-state profits plus domestic market growth.[36] More specifically, the earlier literature treated the adjustment speed (λ) as a parameter and steady-state concentration (C^*) as a latent variable. Geroski et al. (1987) added a specification for λ as a latent variable, in addition to C^*. We now define three latent variables, by adding steady-state profits, π^*, to the list. Our three latent variables are defined by:

$$\lambda = b_1\{\pi_t - \pi^*\}^2 + b_2 G \tag{2}$$

$$\pi^* = a_0 + a_1 MES^c + a_2 A + a_3 SUB + a_4 IMP + a_5 EXP + a_6 G \tag{3}$$

$$C^* = c_0 + c_1 MES^c + c_2 A + c_3 CONS + c_4 SUB + c_5 EXP + c_6 G \tag{4}$$

Combining (2)–(4) into (1) yields a nonlinear concentration equation (λ, π^* and C^* are all latent variables contained in the single estimating equation):

$$\begin{aligned} C_t = C_{t-1} &+ \{b_1[\pi_t - (a_0 + a_1 MES_t^c + a_2 A_t + a_3 SUB_t + a_4 IMP_t + a_5 EXP_t \\ &+ a_6 G_t)]^2 + b_2 G_t\} \\ &*[(c_0 + c_1 MES_t^c + c_2 A + c_3 CONS_t + c_4 SUB_t + c_5 EXP_t + c_6 G_t) - C_{t-1}] \end{aligned} \tag{5}$$

where π is the profit rate; MES^c is a cost-adjusted measure of minimum efficient scale (MES); A is advertising intensity; $CONS$ is a consumer goods dummy; G is

[33] Reviewers encouraged us to endogenize *IMP* and *EXP*, the results of which are quite reasonable and presented in Appendix C. One reviewer felt that we should also treat domestic market growth as endogenous. It was harder to identify this to make it endogenous. Domestic market growth was not so much the policy focus in this period, it was export growth. Domestic market growth was negatively correlated with export market growth (−0.07) and import growth was positively correlated with domestic market growth (0.25, $p > 0.95$). We have chosen to treat domestic market growth as exogenous.

[34] Structural adjustment models reviewed by Geroski and Masson (1987) are based upon either entry or changes in concentration. Steady-state profits, π^*, occur when concentration is at its steady state, C^* (analogous to Bain's 'entry forestalling' profit level). C^* and π^* should be functions of entry or mobility barriers. Realized profits in turn will be a function of realized concentration and barriers. See Masson and Shaanan (1982) for a limit pricing model with this type of structure.

[35] The subscripts denoting different industries are suppressed.

[36] Geroski et al. (1987) contribute the functional form for λ; we identify the further latent variable π^*. Note that industrial policy was designed to promote exports, and that our measure of domestic growth does not contain export growth induced by these policies.

market growth (domestic sales including imports); *SUB* is a measure of policy loans in the industry; *C* is the three-firm concentration ratio; *EXP* is the export-sales ratio; and *IMP* is the import-sales ratio.

We also estimate a profit equation of the form:

$$\pi_t = d_0 + d_1 C_t + d_2 MES_t^c + d_3 A_t + d_4 SUB_t + d_5 IMP_t + d_6 EXP_t + d_7 CAP_t + d_8 G_t + d_9 EFT \quad (6)$$

where *CAP* is a measure of the capital required for an *MES* plant and *EFT* is the effective tariff rate.

The definition and analysis of the latent variable for steady-state profits, π^*, is new. Although the idea of π^* is implicit in the construction of λ by Geroski et al. (1987), this was not recognized by them at the time. Conceptually, π^* is set up like a reduced form (in the sense that neither *C* nor *C** is entered as a determinant of π^* directly, but the determinants of *C** also determine π^*). Steady-state profits may depend upon entry barriers,[37] government subsidies, demand growth and international trade. The effects of these variables on π^* may be either direct, or indirect through their effects on concentration in the long run. Higher minimum efficient scale and greater product differentiation (as proxied by advertising intensity) are associated both with higher concentration and with higher profits in traditional industrial organization models. One interprets the coefficient on economies of scale in π^* as both the effect of scale given concentration and the effect of greater scale economies leading to greater concentration and hence greater profits. Although we argue in Jeong and Masson (1990) that limit pricing would be unlikely in Korea, the measures of entry barriers (estimated minimum efficient scale and advertising intensity) in π^* may reflect the impact of entry barriers on the realized market structure.[38] The profit enhancing potential of subsidies should be clear. Greater import penetration could reduce long run profitability. Exports are included, because if export markets are more competitive than domestic markets, higher export intensity may be associated with lower profit rates.[39] We return to the relationship between π^* and concentration in the long run after discussing long run concentration, *C**.

[37] We use the term as it has been used in the past. What is important is that industrial structure should be a function of economies of scale and product differentiation in the long run, whether or not the process is one of entry.

[38] Jeong and Masson (1990, 1991) examine entry in Korea during almost the same time period as the one used in this analysis. We showed that entry responds to advertising intensity and minimum efficient scale as if they were entry barriers. In the 1991 paper we show that *SUB* reduced a measure of net entry, but had little effect on other entry measures. We also showed that profitability did not respond to the entry barriers in a fashion consistent with limit pricing.

[39] Profit maximization is not the same as profit rate maximization. A profit maximizing domestic monopolist may increase profits, while decreasing its profit rate, by exporting to competitive world markets. That is, if the marginal efficiency of investment is close to, but above, the interest rate, increased investment will typically raise profits and lower ROI.

The methodologically most interesting property of this new latent variable is that it is a measure of long run profitability derived not from looking at an equation explaining profits, or changes in profits, but from looking at how rapidly structural adjustment responds to profit signals and deviations from a hypothesized long run or steady-state profits latent variable.

This brings us to a closer evaluation of the adjustment speed, λ. As actual profits deviate farther above steady-state profits, λ should rise as entry and fringe expansion should respond more rapidly. Similarly (and to the extent that exit barriers mirror entry barriers), exit should be more rapid as profits deviate farther below π^*. A simple quadratic term is used to capture the fact that λ should be highest when either $(\pi - \pi^*)$ is very high or very low. Growth also is included in the linear part of λ as high growth rates might lead to faster structural adjustments.[40]

Steady-state concentration, C^*, is handled as is traditional in the literature (e.g., Martin, 1979). Greater minimum efficient scale should lead, *ceteris paribus*, to greater concentration. Greater product differentiation (*A* and *CONS*) may lead to greater concentration (through inhibiting entry) or lower concentration. (Free entry monopolistic competition equilibria have more firms when products are differentiated.) Growth is important to include. The relevant C^* should include the effects that growth may have in lowering anticipated future C^* due to a larger future market.[41] The export-sales ratio is added to the C^* equation because measured concentration includes both the domestic and export sales of domestic producers (as we explain later). Government intervention also may play a significant role in determining C^*, both through the decisions about which firms receive subsidized loans, and through more direct intervention. We define a measure of policy loans, *SUB*, as policy loans as a percentage of total capital. In our sample *SUB* averaged 13% for non-HICs and 26% for HICs. These are industry averages; for the chosen 'winners' within an industry the percentages would be (often substantially) greater. Iron and Steel had the highest *SUB* with 40%. (As subsidies were from late 1975, to the early 1980s, the subsidized fraction of new investment would be somewhat higher.[42]) The inclusion of *SUB* reflects these subsidies and also may serve as a proxy for effects of other industrial policies.

The profit equation requires a little further explanation. Each of the factors hypothesized to reflect long run profits (π^*) also should affect short run profits (π). Additionally, in the short run, concentration is not assumed to be at long run

[40] Capital investment each year is great relative to installed base, so shares of installed base may change more rapidly than in a mature economy. Geroski et al. (1987) include a measure of plant construction time in the linear part of λ, but similar data are not available for Korea. We added *SUB* to the linear part of λ and it performed poorly and reduced significance more generally.

[41] Geroski and Pomroy (1990), for example, estimate C^* and ΔC^*.

[42] Further, since the heavy reliance on such loans started in the late 1970s, the fraction of capital composed of policy loans increased considerably over the sample period. As noted earlier, the real rate paid on *all* bank loans by our HICs was about 5% lower than for the non-HICs.

levels, so C is in the profit equation as well. Following Masson and Shaanan (1982) and Jeong and Masson (1990), the posited concentration effect in the profit equation is interpreted as a short run effect. We also include a traditional measure of capital requirements, *CAP*, which is discussed in the next section.

Before turning to the empirical implementation, it is important to discuss the relationship between long run concentration, C^*, and long run profits, π^*.

We illustrate with a naive (incumbents and potential entrants suppose all rivals will hold output at previous levels) Cournot model with endogenous entry.[43] Suppose that there is a linear demand structure. Further suppose that all firms have identical horizontal marginal cost curves and fixed costs. First consider free entry and the comparative statics associated with fixed costs and how these determine concentration and profits in Cournot–Nash equilibrium (the 'long run'). For simplicity, start with one firm and suppose that in each period one more firm may enter. In the entry decision incumbents make the Cournot assumption that potential entrants will remain at zero output and potential entrants assume that incumbents will produce what they did before ('Sylos' postulate'). Next assume that following the entry decision, before the quantity decision, each realizes its folly if there is entry (that is, post entry, before the market game, incumbents and entrants now realize that their rivals will not hold output at the previous period's level). They now play a symmetric Cournot–Nash one period game. In this model as fixed costs are reduced from high to low, profits, on average (this is not monotone) fall.[44] Next consider any arbitrary long run equilibrium. If this is perturbed by n being decreased exogenously without an increase in fixed costs, clearly π must be greater than if the same reduction in n had been achieved because of greater fixed costs.

In terms of the expected values of C^* and π^*, the profit concentration pattern is captured in Fig. 1. The line $\pi_i(C_i)$ is the 'short run' relationship for an industry 'i' which would in the 'long run' have concentration and profits of C_i^* and π_i^*. Clearly $\pi_i(C_i)$ is one of a family of such possible curves, depending upon the long run equilibrium C^* of different industries. $\pi^*(C^*)$ is the relationship between long run concentration and long run profits in free entry equilibria as industry parameters (e.g., fixed costs) are varied. The arrows indicate how concentration and profits would move over time if the ith market were initially out of long run equilibrium.

[43] For simplicity we look only at 'pure strategies', with one firm at the entry-exit margin. (This is not a Nash equilibrium model, so it is not literally a pure strategy.) A more complete model establishing the long run relationship is in Lambson (1987).

[44] Start with profits of zero and a monopoly. Lowering fixed costs, F, raises profits until entry is induced. The profits of an incumbent can be up to three times fixed costs without inducing entry. For $P = 1 - Q$, and $MC = 0$, π^* is less than $3/4(n+1)^2$. If F falls past a critical level of $F = 1/4(n+1)^2$ entry occurs and n is incremented by one. At this critical point, when entry occurs, π^* remains strictly positive. But this simple model is not symmetric. If F is increased in some equilibrium, exit will occur at a point at which π^* becomes negative, hence the range starts at zero.

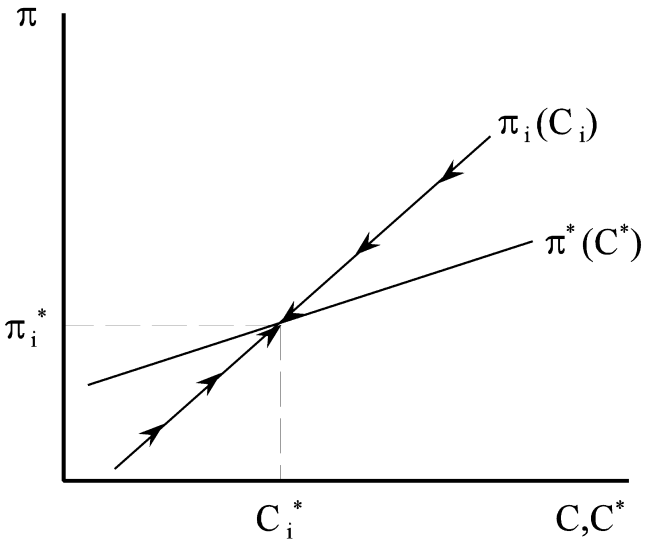

Fig. 1. Profit and concentration, short and long run.

This simple story can be varied. One alternative is limit pricing. With limit pricing, one may have the effect that when concentration is greater than what would be expected in the long run given technology, that leading firms would select to have lower profits, to slow entry. In this case the $\pi_i(C_i)$ short run relationship could even cross $\pi^*(C^*)$ from above, but it still may have a positive slope, and over time C and π should converge towards equilibrium levels.[45]

Following this description of the latent variables and their relationships within the model, we turn to the empirical implementation.

4. Empirical implementation

4.1. Data

Data are described in Appendix A. The data are constructed as an industry cross-section. This follows the usual SCP modeling approach of looking at a cross-section of industries across one business cycle. 1977–79 were a strong

[45] This assumes either the stochastic or dynamic types of models as in Masson and Shaanan (1982) or the Matthews and Mirman (1983) equilibrium model with stochastic demand. Limit pricing alone does not imply monotonicity in a variety of directions. But the general pattern of the model would be similar to that described here.

growth period, a relative downturn (slowing of growth) started in 1980 and continued into 1981.

Profits are measured as the rate of return on assets: net accounting profits plus interest on debt divided by assets averaged over 1977–81.[46] Return on assets is the strongest profit measure when explaining entry to Korean manufacturing, and hence it seems reasonable that it would be the measure most associated with structural change.[47]

Concentration is calculated as leading firm (top 3) value of shipments divided by industry value of shipments. We treat concentration in 1981 as an endogenous variable and concentration in 1977 as predetermined/exogenous.[48]

Since Korea's two major markets are only about 5 hours apart by land transportation, intra country geographic submarkets are not typically important in Korean manufacturing. But KSIC (Korean Standard Industrial Classification) data have some of the other common failings of concentration data. Concentration data are often over inclusive (including in the definition of an industry many firms which are not actually competing with each other) or under inclusive (categorizing close rivals as in two different industries). Due to these other considerations we pre-selected the sample from four- (and five)-digit industries for which, in our judgement, the concentration indices reflected competition within a relatively homogeneous industry that was not competing too closely with some other industry.[49]

A remaining problem was how to deal with international trade. During the sample period, Korea significantly protected its domestic markets. Nevertheless, there were significant imports in some industries. We used both KSIC concentration and a series which we adjusted for imports and exports. Very little changed with the adjusted data; e.g., despite some industries with significant international trade, the means of the adjusted and unadjusted concentration ratios

[46] Price-cost margins and return on equity yield similar, but weaker, results. Entry and other structural adjustments should respond to profit potential, which is captured by profits on equity or capital, rather than a measure of price-cost margins (cf., Masson and Shaanan (1982) and Schmalensee (1988)). Deflating net profits by equity presents problems when capital markets are imperfect. Industry outsiders might consider similar asset investments to incumbents, but may not consider similar debt equity ratios, especially when equity is not traded and is not at market equilibrium levels (some firms may actually have negative book equity). The opportunity cost of equity may be highly firm specific.

[47] We examined entry in Korea for 1977–81 in Jeong and Masson (1991), which looked at measurement issues in Jeong and Masson (1990). We found that net entry was associated with profits, and of the measures of profits, entry was most closely associated with return on assets. Potential entrants did not appear to see this profit measure as *only* 'accounting noise' (cf., Fisher and McGowan, 1983) or only as 'superior rents' which cannot be duplicated (cf., Demsetz, 1973).

[48] In Jeong and Masson (1990) we assume recursive identification via OLS with C_{77} influencing π for 1976–81, and the subperiods of the expansion of 1976–79 and the contraction of 1980–81, where at least the latter period is clearly recursively identified. The results in the profit equation herein which use instead an instrumental variables estimation of C_{81}, via three stage least squares, are similar.

[49] The list of industries is in Jeong (1985).

differ by 7 percentage points and important variables perform similarly in the regressions. We present only the results for the unadjusted KSIC concentration here.[50]

Measurement of minimum efficient scale (MES) is based upon the average plant size at the midpoint of industry output (the Florence median).[51] This proxy has the weakness that it may not adequately reflect the cost disadvantage faced by operation at suboptimal scales.[52] Under the assumption that all plants in each industry have similar production functions and capital–labor ratios, the value added per worker can be viewed as an indicator of productivity or an inverse measure of costs. Following Caves et al. (1975) we define a 'cost-disadvantage ratio,' *CDR*. This is defined by the value added per worker in the smallest plants accounting for 50% of industry employment divided by the value added per worker in the larger plants comprising the other half of industry employment. If *CDR* is less than 1, smaller plants face a cost disadvantage. (We truncate the value of the *CDR* at unity.)

Since MES can serve as a barrier only when the cost disadvantage of small scale plants is substantial, we construct a variable which reflects interactive effects of *MES* and *CDR*. This 'corrected MES' proxy, MES^c, is used for the empirical estimation. This is constructed as $MES^c \equiv MES^*(1 - CDR)$. MES^c equals zero when *CDR* equals one, and rises as smaller firms have higher costs.

Two other potential barrier proxies were also constructed: advertising intensity and absolute capital costs, *CAP*. We use a traditional proxy for product differentiation, the advertising-sales ratio. We assume that all advertising by domestic firms can be attributed to their domestic sales: $A \equiv Adv/(VS - X)$, where *Adv* is the value of advertising by Korean firms in the industry, *VS* is Korean firms' value of shipments and *X* is their value of exports.[53]

The capital costs variable is problematic. Following convention, *CAP* is defined as $CAP \equiv MES^*$(Industry Assets). But, we do not use *CAP* as a barrier in the concentration equation (in the latent variables λ, π^* or C^*). The reason for this is explained in some detail in Jeong and Masson (1990). In that paper we estimate an

[50] We could use a variety of measures. It is not clear that imported products in an industry are identical with the exported products. When looking at competition, it is not clear that exported products would not be available domestically if prices rose. We have chosen to check for robustness of our results, and use only one measure, the KSIC directly reported concentration in domestic shipments by domestic firms.

[51] An initial question is whether the *MES* measure and the concentration measure are simply two measures of the same thing. This would appear to be more likely for a small economy in which geographic factors do not significantly affect markets. Tests that decompose concentration into its component parts and that reject this proposition for these industries are in Jeong (1985).

[52] When this disadvantage is lessened more plants may operate below the 'true' *MES*. So, to an unknown degree this is built into the Florence median.

[53] Many Korean exports did not have international brand identification; were produced under contract for a foreign branded firm which undertook its own advertising; or were sold to a trading company or an importer which undertook the advertising and sales promotion.

entry function and find that despite strong negative effects of MES^c and A on entry, CAP has no effect on entry. We retain CAP in the profit equation, as it is a significant *negative* determinant of profits. As noted earlier (Footnote 37), what we are really looking for in C^* are the determinants of steady-state concentration, which need not truly be 'entry barriers,' although it is traditional to call economies of scale and product differentiation 'barriers,' they have implications for structure beyond purely 'entry' considerations.

Finally our measure of industrial policy intervention, SUB, is equal to the ratio of government backed (subsidized) loans to total industry capital. As noted before, subsidized loans were not equally available to all firms in an industry. Only government-designated 'winners' had access to these loans. In the absence of firm level data we use industry values as our measure of policy.

Since SUB is not a 'standard' variable in *TEIO-SCP* analyses, it may be useful to describe its magnitude. The mean value of SUB was 16%, 13% for non-HICs and 26% for HICs, with Iron and Steel and Automobiles at 40 and 36%, respectively.

Trade effects are modeled in the profits and concentration equation. We use import and export intensity defined relative to the domestic market as $IMP \equiv M/(VS - X + M)$ and $EXP \equiv X/(VS - X + M)$, again for the 5 years by use of the average of the ratios.

4.2. Results

The empirical model was estimated using three-stage nonlinear least-squares for 62 Korean manufacturing industries, 1977–81. Profits (π), concentration, advertising intensity (A), imports (IMP) and exports (EXP) are instrumented by exogenous and lagged endogenous variables.[54] Separating the parts of the concentration equation into λ, π^* and C^*, the results, with t values in parentheses, are as follows:

$$\lambda = \underset{(2.62)}{0.356}*\{\pi - \pi^*\} - \underset{(1.01)}{0.002}*G \tag{7}$$

$$\pi^* = \underset{(19.95)}{6.056} - \underset{(1.26)}{0.021}*MES^c + \underset{(8.91)}{1.009}*\widehat{A} + \underset{(2.71)}{0.039}*SUB - \underset{(1.22)}{0.010}*\widehat{IMP} - \underset{(0.25)}{0.002}*\widehat{EXP} + \underset{(8.44)}{0.053}*G \tag{8}$$

$$C^* = \underset{(9.84)}{71.034} + \underset{(6.72)}{1.482}*MES^c + \underset{(5.50)}{11.809}*\widehat{A} - \underset{(6.93)}{41.082}*CONS + \underset{(2.05)}{0.401}*SUB - \underset{(0.69)}{0.096}*\widehat{EXP} + \underset{(8.02)}{0.523}*G \qquad \bar{R}^2 = 0.85 \tag{9}$$

[54] Note that the nonlinear structural equation defines additional exogenous variables for the instrument set based upon interactions between the basic exogenous variables.

(Note that the $\mathbf{R}^2$ applies to Eq. (1) which includes Eq. (7)–(9).)

$$\pi = \underset{(4.76)}{5.382} + \underset{(2.44)}{0.067}*\widehat{C} + \underset{(0.21)}{0.009}*MES^c + \underset{(0.27)}{0.129}*\widehat{A} - \underset{(1.01)}{0.032}*SUB - \underset{(2.41)}{0.041}*\widehat{IMP} - \underset{(0.30)}{0.005}*\widehat{EXP} - \underset{(2.71)}{0.040}*CAP + \underset{(2.71)}{0.046}*G + \underset{(1.01)}{0.002}*EFT \qquad \bar{R}^2 = 0.44 \tag{10}$$

Assuming that *SUB* is a measure of industrial policy with an errors in variables problem, this problem can be addressed by adding tax rates (which were also affected by policy) at the two-digit level to the instrumental variable set and instrumenting *SUB* (as well as the endogenous variables). This model leads to similar results which are reported in Appendix B.

The fact that most results are robust to use of instrumental variables estimation of *SUB* is noteworthy, but in econometric terms there is no conclusive interpretation. It could mean *SUB* is a proxy for the entire package of Industrial Policy instruments, all of which have an influence on industrial structure. That is, the fact that the effects of *SUB* are similar whether we use *SUB* itself or if we instrument for *SUB* (adding Tax Policy to the instrument set) may suggest that *SUB* is a proxy for Industrial Policy as a whole. An alternative interpretation is that the errors in measurement in *SUB* and the errors in measurement in the Tax Policy variable are highly correlated. Yet another closely related alternative is that policies were targeted together (hence are correlated), yet that only *SUB* (loan policy) leads to real effects on industrial structure. Hence *SUB* alone influences industry structure, but, also that the effects of all of the policy variables on industry structure are also, trivially, captured in the *SUB* variable.[55] The instrumental variables estimates add to our prior beliefs that we are estimating something more than simply the effects of loan subsidies on industrial structure and performance. But, we cannot definitively state that we have more than the effects of subsidized loans or estimates of the effects of Industrial Policy in its entirety.[56]

Our primary concern is with the latent variables: C^*, λ and especially the newly

[55] One part of industrial policy was at times to order a target (high subsidy) firm to purchase a floundering competitor; target firms were often granted import licenses for inputs not as available to competitors; target firms were at times permitted international technology agreements, not permitted to competitors. As Beason and Weinstein (1996) state this for Japan "... to the extent that Japanese industrial policy was coherent ... our targeting measures should pick up much of the impact of these [other] policies." (Their measures and tests are at an industry level, as were Japan's industrial policies.)

[56] Suppose that Industrial Policy is the vector x_1,x_2,x_3. If least-squares estimates on x_1 and estimates of x_1 using x_2 as an instrument are very similar, this does not assure that policy x_3, or even x_2, is operating in a similar vein. *SUB*, or loans, are inherently firm specific; firms differ in credit worthiness. Tax policy was (generally) industry specific. It is possible that tax relief to an industry could even lead to a greater number of firms in equilibrium. That the instrumented *SUB* remains robust indicates that subsidized loans and tax breaks went together in policy and that the net effect of the two is captured in the estimates.

defined π^*. First we look at the estimates themselves. Next we look at the effects of industrial policy and finally we examine the inter relationship between π^* and C^* and discuss their implications for the methodology.

The speed of adjustment is rising as profits deviate from the latent variable for steady-state profits, π^*. The π^* is measured independent of the π equation (except for the three stage least squares process which involves a common covariance matrix). Its value derives entirely from the concentration (adjustment) equation. It is defined as the level of profits at which it appears that the speed of structural adjustment, λ, is minimized. That is, if profits are widely divergent from long run values, we would expect structural adjustments to be rapid, whereas if profits are close to long run values, any expected structural adjustment may well be much slower.[57] Even if the economy is not close to equilibrium, as long as the deviations are not consistently one sided (e.g., short-term profits consistently inflated), actual profits and predicted profits should be similar. The mean value of π^* is 9.8%, similar to the mean of π of 9.5%, and the correlation of π and π^* is 0.69, which has a p value of 0.001. π^* is greater if either A or G is greater. *EXP* and *IMP* are both negative and insignificant in π^*. Each of these signs in π^* is the same as in the actual π equation except for that on *SUB* (which is insignificant in the π equation). As for significance, there are only three differences between the two. *SUB* and A are positive and significant in π^*, but are insignificant in π, and IMP is significant in π, but not in π^*. Greater government intervention, or at least greater government subsidies, implies greater steady-state profits. In the profit equation, *SUB* is not only insignificant, but negative (conditional upon current concentration).[58] The point elasticity of π^* at the mean values with respect to *SUB* is 0.067.[59] In all regards, this newly formed latent variable appears to strongly act as one would expect a priori if the model were well specified.

We return to discussing π^* and its relationship with C^* after each of the relevant equations has been introduced.

With fixed sunk capital and low growth there may be little scope for major changes in market shares. When growth is high, a substantial fraction of production will be produced with capital that was recently constructed. Hence there is an expectation that market growth should lead to higher adjustment speeds. Here growth is significant in π^* and hence in λ (as π^* is a subpart of λ),

[57] To the extent that π^* is not perfectly measured, in fact some concentration changes when profits are near to π^* may even be opposite in sign to the expected changes, contributing to a lower estimated λ.

[58] But *SUB* may increase current profits through greater concentration.

[59] The direct effect of *SUB* on π^* is small, but simulation with $SUB = 0$ (in both π^* and C^*) and assuming that an industry's *SUB* had no effect on its domestic growth, G, indicates that *SUB* is responsible for slightly over a quarter of net long run profits (net of interest on debt using current leverage ratios). With $SUB = 0$ the net profit rate falls from 1.93 to 1.56%. (Given high Korean leverage ratios, profits on equity are about five times this level.)

but the linear growth term in λ is insignificant and its effect is small. The fact that G is significant in π^* means that λ is rising in G if $\pi < \pi^*$, because greater G will mean a greater π^* and hence a greater deviation of profits from steady-state levels. If the linear term is considered to be zero, the converse holds if $\pi > \pi^*$. Nonetheless, the observed values of λ for Korea are much higher than for any studies of concentration adjustment for mature economies. The annual structural adjustment rate is estimated at 6.44%. In related methodologies (generally estimating λ as a parameter rather than a latent variable) applied to mature economies, estimates of λ are in the range of 0.3–2.3% per annum.[60]

Growth does not provide the reason for this greater adjustment speed. Growth is high; mean growth was 17.8%, with a minimum and maximum of 2.3 and 34.0% in our sample. But if the direct effects of growth were the entire explanation for greater λ values, one should expect it to be significant in the linear part of λ. Our a priori modeling assumption was that more rapid structural adjustment also should occur when the difference between π and π^* is greater. The average λ would be about zero (the point estimate is small, negative, and insignificant) if π were equal to π^*. During this period of rapid industrial transition there could be more significant deviations from long run expected market structures, leading to substantially greater λ's than in the more mature economies. Korean concentration levels were changing over time at a much greater pace than in more mature economies. For example, in the Geroski et al. (1987) United States data for concentration changes over 5 years, the mean of ΔC was -0.021% with a standard deviation of 4.67 over a range of $[-17,11]$ (these values were not reported in that paper). The comparable figures in this data set over 4 years (recall λ is reported at the 1-year rate) were a mean of -0.80%, but a substantially larger standard deviation of 9.73 and the range of $[-18.9,28.5]$ is substantially larger, due primarily to a much larger maximum increase. It appears that the value of λ is high in great part due to greater deviations from steady-state profit levels, again as predicted.

C^* also appears to be a priori reasonable. The means of actual C and estimated

[60] Geroski and Masson (1987) cite numerous studies of market adjustments, all of which imply slow structural adjustment rates, far less than half of those found herein. (Levy (1987) finds 'fast' adjustment in the sense of adjustment of profits *conditional upon structure*.) Rosenbaum (1993) also finds slow structural adjustment. The exception is Geroski and Pomroy (1990), using a noncomparable panel methodology. Using their linear functional forms, a fixed effect in concentration can be estimated as a fixed effect in a concentration change, ΔC, equation. Doing this, they find full adjustment in 5 years. But if there are market specific adjustment speeds (i.e., ΔC) and their linear form is not 'true', then their fixed effect may reflect complete adjustment to the market specific adjustment speed of concentration change, rather than adjustment to the level of concentration. (For example, if there is a market specific adjustment speed, the fixed effect in ΔC will capture this and overstate the estimated adjustment rate, $\Delta C/C$, under the maintained hypothesis.)

Our methodology models industry specific adjustment speeds (industry specific λ's) by making them a function of $(\pi - \pi^*)$ and G, and finds considerable variation in the predicted values across industries, as does Geroski et al. (1987).

C^* are 57.7 and 52.9%, and their correlation is 0.76.[61] Advertising intensity (A) is a positive determinant of C^*, whereas the consumer goods dummy is negative and also significant. Mean advertising ratios for consumer goods industries were about 2%. With the coefficient on the consumer goods dummy almost four times that on A, the mean consumer goods industry appears to have a C^* of 41%, whereas the mean for producer goods is 64%. The growth variable has a negative effect on C^*: in a rapidly growing industry (as almost all of ours are), the expected steady-state concentration is lower than in a stagnant market. As in other work, a very significant determinant of steady-state concentration is the proxy for minimum efficient scale. Recalling the definition of $MES^c = MES(1 - CDR)$, and looking at the mean of CDR of 0.55, the implied point estimate of the coefficient on MES is only about 0.8. If one takes the measure of MES at the median plant size as a good measure of MES, there are two ways to evaluate the influence of MES on concentration. One might expect that as MES rises the long run three firm concentration should rise by three times as much, i.e., that the point estimate on MES should be close to 3.[62] The other way of looking at the influence of MES is to look at actual levels of $3*MES$ and contrast this with three firm concentration. Looking at our data for MES and concentration, we find the mean concentration was 58% and three times MES was 24%. The sign and significance on MES^c suggest that it is acting as a proxy for scale effects. It is hard, on this evidence alone, to say whether Korean industrial policy has led to higher concentration than efficiency would dictate. To assess this, we turn to evaluating the effects of SUB on λ, π^* and C^*.

It appears that industrial policy raised both C^* and π^*, and that for some industries it raised λ. Our first question is whether industrial policy led to the same outcome as would come from unfettered market forces. Is the Invisible Hand significantly altered? By simulation we can verify that SUB raises C^*. Not only is SUB statistically significant, but its point estimate suggests an economically substantial effect. When simulating C^* at mean values we find C^* equals 53%, whereas if we instead assume that SUB were 0, then the value of C^* is only 45%.[63] For the 15 target HICs in our sample, our estimates suggest that SUB raised C^* by

[61] Simulation of C^* for $SUB = 0$ involves simulation not only of the direct effect of SUB on C^* but also the indirect effects through changes in the endogenous variables affected by SUB which are in turn determining C^* $\{A,IMP,EXP\}$.

[62] There are reasons to question the Florence median as a measure of MES. It may be correlated with MES, yet not be a good absolute measure, especially for an economy in transition from traditional to modern technologies.

[63] Mean C in 1977 was 58.5%, falling to 57.7% in 1981. The point elasticity of C^* with respect to SUB is 0.12. Although SUB raises C^*, it may lower C for some period of time: if SUB raises λ for an industry with C^* less than C, concentration will fall more rapidly towards C^* in that industry. In footnote 13 we show how much of Taiwanese growth was manifested in firm size, how much in firm numbers. As a crude comparison, we applied these Taiwanese ratios to Korean market growth and find that these rates would have led 1977 C to fall to 28% by 1981.

12 percentage points, from 59 to 71%, whereas for the less targeted subsample, its effect was to raise C^* by 5 percentage points, from 41 to 46%.[64] Our results support the qualitative evidence that suggested industrial policy in Korea led to significantly higher concentration than would have been expected from the Invisible Hand alone.[65]

Another interesting question is whether Industrial Policy led to a Speeding or Slowing of the Invisible Hand. The answer to this question appears to be ''The policies accelerated some adjustments and slowed others''. The mean value of the estimated λ for all industries is 6.44% per annum. Simulation, supposing that *SUB* were 0, reduces the estimate of λ to 5.04%. About half, 33 of 62 industries, had greater simulated λ's due to the effects of *SUB*. Adding *SUB* to the linear part of λ, to check for a direct effect, led only to insignificance.

Before looking specifically at long run profits as estimated from the structural adjustment equation, we first examine the profit equation which generates the short run relationship of profits conditional upon present industry structure.

The profit equation is similar to that in Jeong and Masson (1990, 1991). The selected industries and time periods are similar, although here we have *SUB* as a regressor and use three-stage least-squares for endogenous 1981 concentration rather than assuming recursive identification from 1977 concentration. In the earlier work we verified that the entry barrier proxies appear to reflect entry deterrence. We also argue that in an explosively growing economy like Korea there should be little limit pricing. The barrier effects which reduced entry in the entry equation were consistent with no limit pricing in the profit equation both in the earlier work and here.[66] Both growth and concentration are strong positive determinants of profits.

The effects of concentration on profits are of particular interest, as during this phase of industrial policy Korea openly encouraged domestic market power to finance investment in exports. The loan subsidies do not seem to have much direct effect on the current (short-term) profit rate, conditional upon concentration; the coefficient is small, negative and insignificant. This does not imply a lack of success in raising profits, however. Suppose that the effects of industrial policy were to have raised short run concentration by eight percentage points (the

[64] Note that although ΔC for these industries was lower, as growth expands the market given a technology (MES), C^* falls, and the target HICs had substantial growth.

[65] Alternatively, one may see this not as verification, but as replication of a known outcome. As such, this provides quantification and support for the validity of the modeling technique as a whole, as it accurately captures that outcome.

[66] The rapid growth and technical change in Korea leads one to expect that limit pricing would be unlikely. In a rapidly growing economy the likelihood that capital structure in 1 year would be sufficiently greater in another to deter any potential entrant seems nil. The theories of limit pricing such as Milgrom and Roberts (1982) or Matthews and Mirman (1983) that model firms as signaling superior cost structures (or other unobservables) to potential entrants would also seem irrelevant in such a rapidly changing environment. Learning-by-doing strategies may be relevant.

predicted long run effect). Then the net effect of *SUB* on gross profits (even if *SUB* did not raise *G*) would be about 0.5 percentage points. This is about a quarter of ***net*** profits.[67] This is similar in value to the estimated effect of *SUB* in π^* as well.

Given the possible interpretation that the concentration—profits link may simply reflect superiority, not market power per se, we briefly note two additional factors. First, if superiority cannot be copied in a reasonably short time, then one should not see the rapid convergence of *C* to *C** as π deviates from π^* nor the entry response to higher profit rates noted in Jeong and Masson (1990, 1991).[68] Second, statistical evidence of market power in Korea also is found from an entirely different methodology. Yang and Hwang (1994) study exchange rate pass-through. For 1976–1990 they find that domestic and export prices of Korean firms respond significantly differently. Export prices appear competitive, responding to changes in foreign prices and exchange rates. Domestic prices follow the market power pattern of responding significantly to input prices, but insignificantly to the major factors determining export prices. They conclude ‘‘. . . that the degree of price discrimination is also substantial’’. Third, our more recent work (Jakubson et al., 2002) examines a panel of Line-of-Business data for Korea over 1987 to 1995 and finds that concentration is strongly positive in explaining price cost margins after controlling for firm share and regardless of whether we include industry fixed effects. Additionally, this work finds that the domestic to export price ratio is 1.10 at low concentration, and is a rising and statistically significant function of concentration.

This establishes the short run relationship between concentration and profits. We turn now to the long run. As noted above, the means of π and π^* are 9.5 and 9.8%, and their correlation is 0.69. π^* is a latent variable for profits estimated from a structural adjustment equation, not directly from a profit equation. It is the profit rate at which measured adjustment rates in concentration are minimized. That this measure yields such plausible profit estimates validates modeling these industries by using a first-order adjustment process with our nonlinear formulation of λ. The structural adjustment equation yields estimates of both long run profits and concentration. For both model validation and for economic interpretation, it is relevant to see if the relationship between these two also appears to be reasonable.

Regressing π^* on *C** yields:

$$\pi^* = \underset{(19.58)}{9.16} + \underset{(1.45)}{0.012}{*}C^* \qquad \bar{R}^2 = 0.03 \tag{11}$$

[67] Due to high leverage, net profits on assets are 1.93%. Our dependent variable, gross profits (profits plus interest) on assets averaged 9.50% and net profits on net worth are 9.55%.

[68] Shorter-term superiority or first mover advantage is consistent with these results. In a highly dynamic economy, such as Korea’s which was at this time playing ‘catch up’ technologically, long-term superiority advantages might be less likely than in a more mature economy. Note, this is essentially the same intuition as the expectation of no limit pricing in Korea which was offered in Footnote 66.

The slope is positive and its t value is significant at the 10% level, using a one-tailed test, as there is an apriori sign expected.[69] (This t value is only suggestive of 'significance,' because (11) is not a classical regression model.) The slope of the long run relationship between concentration and profits appears to be much lower than that of the short run relationship demonstrated above. This relationship is as illustrated in Fig. 1, and appears to be reasonable, especially as we have argued above that limit pricing would not be likely in such an explosively growing economy. Concentration greater than what would be determined by technology and subsidies leads to higher profits and entry (or the relative expansion of firms outside of the top three). Similarly, concentration that is low relative to predicted values leads to low profits and increased dominance of market leaders.

It is important to consider the relevance of these results to the *TEIO-SCP* models versus the criticisms that mismeasurement of accounting profits may be leading to spurious profit–concentration correlations (cf., Fisher and McGowan, 1983) or that non-duplicable superiority rents associated with firm shares may lead to spurious profit–concentration correlations. Consider the former. It might be posited that there is some systematic mismeasurement. But what we find is not only concentration affecting profits, but profits affecting the speed of structural adjustment as a priori hypothesized *TEIO-SCP* modeling would suggest it should be. It is hard to rationalize a measurement problem that causes high rates of concentration adjustment for both high and low profit rates with a measurement problem which is monotone in concentration and profits. Similarly, the concentration adjustments themselves suggest a pattern of at best transitory advantages for leading firms.

5. Recent events

Since we first wrote, the financial crisis in East Asia hit Korea amongst others. A natural question, and one which a reviewer asked, is whether the subsidized policy loans for Korean firms can be seen as a culprit in this late 1997 crisis. Although we cannot cover every aspect of the crisis in detail, we can provide some explanation.

By the late 1990s the loan subsidy policies had long been phased out. In 1985 Korea significantly reduced its 'hands on' approach to influencing private firm decisions; by the early 1990s, industrial policy subsidies were essentially gone. Financial markets were also liberalized, especially in the early to mid 1990s to gain OECD membership. In particular short-term foreign borrowing was de-

[69] This was one of the few substantial changes that occurred by endogenizing *IMP* and *EXP*; if these are treated as exogenous, the slope is 0.022 with a t value of 2.76 and $\bar{\mathbf{R}}^2 = 0.14$.

regulated in 1996. Following this, merchant banks significantly expanded short-term overseas borrowing at the lower interests rates available outside of Korea.

Korean firms were highly leveraged. The Debt to Equity ratios pre crisis were about 300%, double those in the US. Importantly, unlike the US, most Korean debt was in the form of short-term bank loans; loans of 1 year duration financing long-term capital investment.

The Korean growth rates in manufacturing were strong in the mid 1990s, about 10% per annum, exports grew at 16% in 1994 and 31% in 1995; firm investment in long-term projects appeared to make great sense; the Korean reliance on short-term loans was problematic. Appreciation of the Korean Won relative to the Japanese Yen and a sharp drop in semiconductor prices created a macro shock to Korean exports in 1996. With this shock, the triggering events came from the massive investment expansions by KIA in autos and Hanbo in Steel. The auto industry, had excess capacity following entry by Samsung, expansions by Daewoo and KIA along with the Japanese devaluation, led to poor profit performance; the steel industry remained profitable, but Hanbo's 500% expansion in investment in a new technology followed by the downturn left it without the immediate sales to pay its short-term debts. As these two failed, their banks needed liquidity to pay their own short-term foreign loans, calling in the credit of other firms. The resulting devaluation of the Won (by almost 50%) due to slowing growth and financial troubles should lead to greater exports in a frictionless model, but it made the liquidity problem of short-term foreign currency denominated loans more severe for the banks, leading them to call in their domestic loans to firms. In the end, however, none of the pre-crisis foreign loans were defaulted but several Korean firms were illiquid.

The general consensus is that the financial liberalization without adequate supervision, along with inexperience with short-term foreign borrowing, played a major role in the collapse; as firms and banks ran into trouble paying their loans, they were downgraded in the international markets, tightening the availability of external finance. The problems were financial, rather than inherent in the real economy.[70,71]

What happened? What was the 'inexperience'? If one looks to the theory of 'Soft Budget Constraints' [SBCs], first developed by Kornai (1980), firms may feel that government loans for investments may not need to be paid back if

[70] It is perhaps noteworthy that in 1999 and 2000, Hyundai automobile was making record profits, including the profits it was making in its division which purchased the failed KIA. Samsung Autos was purchased by Renault, and is also profitable. The problems were more of a financial 'run' due to short-term loans being called rather than inherently bad investments. (To some extent, profits may be the consequence of loan forgiveness, but these industries appear to be flourishing.)

[71] Many have written that the crisis was in the financial sector, not the real sector, and was not due to strong policy intervention, but to financial deregulation without adequate supervision. See Corsetti et al. (1998), Masahiro (1998), Radelet and Sachs (1998), Krugman (1998), Stiglitz (1999), Wade (1998) and Chang et al. (1998).

investment outcomes are poor, creating a moral hazard problem. As extended by Dewatripont and Maskin (1995), a single lender may lend more when a loan is about to default; greater investment may save part (or all) of the initial loan plus the new loan for payback. Thus with a unitary lender, there may still be SBCs. But, as they point out, if there are numerous lenders to a firm (or bank), a firm approaching default may not receive additional loans. Any one lender, by providing more funds, may simply be assuring that other lenders will receive payment on their loans, and the new loan may in fact not be paid at all, if earlier loans have seniority in discharge.[72]

Prior to the liberalization of the 1990s, most Korean firms had a 'main bank' holding the majority of their debt; large Chaebols were required to use a main bank. What appears to be true is that the SBCs of the pre mid 1990s functioned adequately in a system in which highly leveraged firms used almost exclusively short-term debt to finance long-term projects. Banks, government or private, would have incentives to extend further credit during downturns or until projects came to fruition. Such short-term debt structures, however, cannot function well without SBCs. The debt structures, the high leverage and the predominant use of short-term debt, failed to be stable once there were more sources of funds for firms and/or for banks to secure loanable funds.

The earlier policies had led firms to believe that were they successful in exports and employment expansion, then they would still face SBCs from the government via the banks; they would be bailed out if they were in trouble. The Koreans borrowed an expression from China, ''A big horse never dies''. This expectation may have been correct for individual illiquid firms in 1997 were it not for the fact that the crisis quickly spread through the economy; the government could not bail out enough firms (and the IMF would not have financed a bail out).

This is essentially the story as told by Krugman (1998). He blames under-regulation of financial intermediaries which ''believed they would be protected from risk'', creating a moral hazard problem for the banks; and the firms with a similar moral hazard problem. He states that this ''moral hazard/asset bubble view seems a strong contender for a leading role'' in the crisis.

Another alleged culprit was the Chaebol structure of many firms in Korea. The expansions of the Chaebols were financed by the earlier pick the winners policies. Chaebol firms provided loan guarantees for other member firms of the same Chaebol. In the crisis, the guarantees had to be invoked and often, because of the crisis, there was inadequate liquidity from the other units, causing the illiquidity to spread across firms in a Chaebol. Indeed, part of the current policy is to reduce 'cross-debt guarantees'. This policy seems to be ignoring the endogeneity of loans in a capital market equilibrium.

[72] A well functioning bankruptcy system could remedy this, but negotiations about seniority of payment typically take time and may fail, especially if many of the lenders are abroad.

For simplicity, we exposit a two-firm Chaebol model.[73] Suppose that the world is composed of many identical firms in all respects other than Chaebol affiliation. First suppose that they all carry identical debt levels and that the probability of illiquidity for each firm is drawn from an i.i.d. process and is denoted ρ. Partition this into independent firms and pairings of Chaebol firms, where a Chaebol (group) is simply a loan cosigning agreement; two Chaebol members agree to pay each others' loans in the case that the other firm becomes illiquid, assuming that the cosigner is not also illiquid. In this case, the probability that an independent firm will default on a loan is ρ, whereas the probability that a Chaebol firm will default is ρ^2. For instance, if $\rho = 0.01$ for an independent firm, the probability of default for our simplified Chaebol is 0.001. The relative risk of loaning to an independent firm can be defined as $\mathbf{R} = \rho/\rho^2 = 1/\rho$. In normal times, the probability of failure to repay loans for a Chaebol firm is always smaller than its own liquidity risk. Again, at a simple level, suppose that the crisis simply raises the probability of firm insolvency from 0.01 to 0.20; **R** then decreases significantly; from 100 to 5, a significant increase in relative risk of default for a Chaebol firm.

Then consider the implications for endogenous leverage. Suppose that banks will lend to the same probability of bankruptcy for Chaebol and non-Chaebol firms. If a crisis is considered possible, but unlikely, leverage will be greater for Chaebol firms than for non-Chaebol firms. Furthermore, the probability of bankruptcy for Chaebol firms will be lower during 'normal' times, but higher in 'crisis' times.[74]

Undoubtedly, there was more going on than this in leverage and bankruptcy in Korea, but the intuition above appears to be robust to reality. In our assessment, the newly created relatively unsupervised and sudden availability of overseas short-term loans to banks and firms in 1996 coupled with high leverage and short-term debt structures which were not compatible with the new realities of the credit markets, is what made the entire system vulnerable.

6. Conclusions

In this paper we develop a structural adjustment model with innovations in the methodology. In particular, we examine the rates of structural adjustment as firm profits deviate from their long run levels. We define these long run levels as a latent variable, and derive long run profits from data capturing the speed of structural adjustment. We verify that the relationship between our long run profits

[73] Borrowed from Masson et al. (2002).

[74] The model for a competitive credit market is shown in Masson et al. (2002); the mechanism which leads to a lower bankruptcy incidence for Chaebol firms in normal times is the realization that they are riskier in abnormal times.

variable and observed profits are what are expected a priori following the traditional SCP model. As we note, the superior firm and the accounting bias hypotheses would not predict these findings. This does not deny that there are superiority effects or accounting biases, but it does imply that the SCP model discovers strong artifacts in the data that are not generated by these hypotheses.

These results also suggest that adjustment models which ignore potential variability across industries in terms of adjustment speeds, may miss some important information and are likely to be seriously misspecified.

On a substantive basis, we also provide some insight into the take-off period industrial policies used in Korea. We econometrically find that industrial policy during this period raised concentration, something posited in the press and in many academic papers, but something which had heretofore been on the level of assertion, rather than based on statistical evidence.

It is worthy to note that the substantive results lend credence to the new methodology. For example, the model finds that the a priori hypotheses of many leading economists about Korean industrial policy are supported by this model. This suggests that our model captures more than the simple SCP predictions about structure. This in turn lends credence to the methodology employed.

Acknowledgements

We would like to acknowledge econometric tips from George Jakubson; useful comments from Henry Wan, Paul Geroski, and Andrew Dick; research assistance from Dong Gung Kim, Yun Jeong Choi and Ramsey Shehadeh; and financial assistance from The Asia Research Fund. Anonymous reviewers have led both to clearer exposition and a richer set of endogenous variables, including the benefit of a tighter fit when following their priors.

Appendix A. Data

The data set employed in this study consists of 62 Korean manufacturing industries of which 32 are consumer goods and 30 are producer goods. The selection of these industries was determined primarily by the principle that the KSIC industry classifications must closely reflect the microeconomic concept of a market. Consequently, we exclude too broadly, too narrowly or vaguely defined industries. Our sample of industries includes 48 four-digit and 14 five-digit Korean Standard Industrial Classification (KSIC) industries. Although five-digit KSIC industries are more narrowly defined than four-digit industries, most data are available only at the four-digit level. Therefore, where data were available and four-digit industries included products which were not close substitutes, we used

five-digit data. The mean concentration of the five-digit industries in the sample was 52%, and the overall sample mean was 58%.

We used three-firm concentration ratios measured by the value of shipments in 1977 and 1981. These data were provided by the Korea Development Institute and the National Bureau of Statistics, Economic Planning Board. For a few four-digit industries, concentration ratios were approximated by use of a shipments-weighted average of the five-digit components. (If the five-digit industries were too heterogeneous in concentration, the industry was dropped.)

SUB data were provided by the Bank of Korea (Korea's central bank) and Korea Development Bank. Some *SUB* data were published in the *Financial Statement Analysis* (The Bank of Korea) each year and supplementary data were from the unpublished sources from the Banks. We included the loans officially designated as policy loans, foreign loans and other government controlled low-interest loans.

The exports and imports data come from the Korean Department of Customs Administration, *Statistical Yearbook of Foreign Trade*, 1978–80, and the Bank of Korea, *Input–Output Tables*, 1975–80. Since the classifications of the trade data are different from the KSIC, we reclassified the trade data according to the KSIC industry definitions. Both variables are defined as the simple average of the ratios of the 5 years, 1976–1980.

MES is derived from manufacturing census data, for each year and then averaged for 1976–80. π, *G*, *A*, *CAP* and all other variables are derived using data from the above, augmented by data from the Bank of Korea, *Financial Statement Analysis*. For some industries we also use the *Financial Analysis* published by the Korea Development Bank as a supplementary source. Each of these was averaged across years as well; e.g., the profit rate on capital is computed separately for each year, then averaged for the 5 years, 1977–1981.

Lagged variables are 3-year averages derived from the same sources as above, in some cases from earlier editions.

Appendix B. Instrumental variable estimation of SUB

Again, in response to a reviewer, we examine whether there is evidence for the proposition that the effects of industrial policy in general are being captured by the *SUB* variable. As noted in text, there is no definitive answer to this question, but if the 'correct' variable is 'Policy' and we have two measures of Policy, each incomplete, one can use instrumental variables to reduce the errors in variables biases associated with using only one measure. It is to this that we turn now.

Tax incentives were another industrial policy used by the Korean government. While most firms in Korea paid corporate income taxes of about 45%, some target firms, within some HICs, paid special rates around 32%. Income tax incentives

have been measured for all of our sample at a more aggregate level by Choi and Kwack (1990). We used their estimates as instruments for *SUB*. The level of aggregation for the tax variable is high. We have 62 industries. All of these 62 industries involve only 12 different two-digit industry tax rates from their data. (These definitions are very close to KSIC two-digit definitions.) Since there may be great policy variability within two-digit industries, and individual four- (or five)-digit target industries may account for a small proportion of a two-digit industry, these data are less than ideal. Further, there is a perception that subsidized loans were more important policy instruments than were the tax instruments. But to check for robustness of the proxy for Industrial Policy, an instrumental variable approach to errors in variables, despite the greater presumed (aggregation) errors in the tax variable, is worthy of analysis. The results, which were quite close to those without the instrumentation, are presented below:

$$\lambda = \underset{(2.48)}{0.229}*\{\pi - \pi^*\} - \underset{(0.95)}{0.002}*G \tag{B.1}$$

$$\pi^* = \underset{(14.71)}{6.429} - \underset{(1.54)}{0.035}*MES^c + \underset{(11.40)}{1.345}*\widehat{A} + \underset{(2.89)}{0.061}*\widehat{SUB} - \underset{(1.89)}{0.015}*\widehat{IMP} - \underset{(0.03)}{0.002}*\widehat{EXP} + \underset{(5.92)}{0.041}*G \tag{B.2}$$

$$C^* = \underset{(4.54)}{53.241} + \underset{(7.08)}{1.835}*MES^c + \underset{(1.50)}{6.698}*\widehat{A} - \underset{(2.09)}{21.692}*CONS + \underset{(2.05)}{0.839}*\widehat{SUB} - \underset{(0.003)}{0.001}*\widehat{EXP} + \underset{(5.32)}{0.489}*G \qquad \overline{R}^2 = 0.86 \tag{B.3}$$

$$\pi = \underset{(4.19)}{5.051} + \underset{(2.47)}{0.067}*\widehat{C} + \underset{(0.34)}{0.014}*MES^c + \underset{(0.31)}{0.151}*\widehat{A} - \underset{(0.33)}{0.015}*\widehat{SUB} - \underset{(2.40)}{0.041}*\widehat{IMP} - \underset{(0.07)}{0.001}*\widehat{EXP} - \underset{(2.78)}{0.043}*CAP + \underset{(2.52)}{0.044}*G + \underset{(0.87)}{0.002}*EFT$$

$$\overline{R}^2 = 0.43 \tag{B.4}$$

Some individual coefficients vary from those in text, but the basic pattern is similar in terms of magnitudes and significance. The biggest coefficient differences are in C^*, but predicted C^* (at the means of all variables) is changed very little from 52.9 in text to 51.7 here. The effect of *SUB* on C^* is 8 percentage points in text (45% if *SUB* equals 0), here it is larger at 12 percentage points (40 with *SUB* equal to 0). This is consistent with footnote 31, suggesting that the total effects of all policy instruments on C^* exceed those of simply modeling *SUB* as a proxy for all of policy, but any firm conclusions in this regard are not possible. Estimated π^* rises from 9.8 to 10.0%; the effects of *SUB* on this rises from 0.59 to 0.96%; and λ goes from 6.44% in text to 5.74%. All of which are essentially telling the same story as in text.

Appendix C. Imports and exports

Our initial estimates were based on treating *IMP* and *EXP* as exogenous, feeling that exogenous industry differences would be substantial relative to any endogenous variation. But, capturing the exogenous variation via use of predetermined variables (e.g., IMP_{t-1}, EXP_{t-1}) we have followed the advice of reviewers and endogenized IMP_t and EXP_t. We focus the text analysis on the model of industrial structure and profits. The structural equations for these trade variables are as follows:

$$EXP_t = \underset{(0.45)}{2.199} - \underset{(2.07)}{0.111}*\widehat{C} + \underset{(2.31)}{5.411}*CONS + \underset{(1.91)}{0.257}*SUB + \underset{(11.75)}{0.766}*EXP_{t-1} + \underset{(2.96)}{0.090}*G + \underset{(1.77)}{0.019}*EFT \qquad \bar{R}^2 = 0.73 \tag{C.1}$$

$$IMP_t = \underset{(0.01)}{0.447} + \underset{(2.00)}{0.217}*\widehat{C} - \underset{(0.72)}{0.664}*\hat{\pi} - \underset{(2.84)}{0.646}*MES^c - \underset{(1.12)}{3.188}*CONS + \underset{(15.25)}{0.902}*IMP_{t-1} + \underset{(1.54)}{0.055}*G + \underset{(0.32)}{0.004}*EFT \qquad \bar{R}^2 = 0.80 \tag{C.2}$$

Over our sample there was export intensity and import intensity growth over time, with mean $EXP_t = 18.8$, up from 14.8 for EXP_{t-1}, and $IMP_t = 15.8$, up from 13.1.

For *IMP*, its implied steady-state value is *IMP** equal to 32.8, but adjustment to this value is at an annual rate of only 1.9%. This may reflect the impact of import controls.

Greater *SUB* means greater exports, as would be expected from the policy goals. Point estimates evaluated at means suggest steady-state $EXP^* = 31.8$ with an implied convergence rate of 4.3% per annum. Were $SUB = 0$, *EXP** is only 14.5 (essentially no different from EXP_{t-1}).

Probing these relationships is beyond the scope of this paper. An appropriate test in our mind would involve a longer time period for the export expansion, additional control variables pertaining to international demand, a finer analysis of the elements of *SUB* (some loans are explicitly tied to export promotion), a fuller model of adjustment speeds (letting them vary across industry characteristics), and complete modeling of industry specific import controls and changes in these over time.

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