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National champions and corruption: some unpleasant interventionist arithmetic.

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CICLO DE SEMINARIOS 1996

Día: Martes 7 de mayo

9:00 hs.

National Champions and Corruption: Some Unpleasant Interventionist Arithmetic*

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February 26, 1996

Abstract

We present a hold-up model of investment where active industrial policy promotes both corruption and investment. Since corruption deters investment, the effect of industrial policy on investment is lower than when corruption is absent. We find evidence suggesting that corruption is indeed higher in countries pursuing active industrial policies. Policy implications are illustrated by decomposing the total effect of industrial policy into a positive, direct effect, and a negative, corruption-induced effect. In the presence of corruption, the total effect of industrial policy on investment ranges between 84% and 56% of the direct impact. The magnitude of these corrections suggests that corruption considerations should not be absent from cost-benefit analyses of industrial policies.

One of the major debates today is about whether or not active industrial policy plays a substantial role in promoting economic growth. The case in favour of active industrial policy uses arguments that range from the traditional notions of externalities and learning curves to more colourful ideas about the benefits of supporting investment in high value added sectors using sophisticated technologies. A popular argument brandished is that investment can be heavily promoted through active industrial policies, with the experience of Japan and Korea usually cited as evidence. The case against active industrial policy points out the lack of convincing empirical evidence on the benefits of industrial policy and the lack of agreement on practical issues such as the criteria to use in the process of picking the companies to be favoured, sometimes called "national champions". In policy debates, advocates of active industrial policy argue that it is one of the main ways to improve a country's competitiveness, a term sometimes used to capture both simple productivity measures and the ability to compete in the global economy. While the academic community is becoming increasingly suspicious of interventionist policies in general and of the concept of competitiveness in particular (see especially Krugman (1994a,b), policy makers find the rhetoric of its advocates quite compelling. In this paper we take a different approach. We do not query with the idea of competitiveness, nor with the fact that it may be a good thing and that to achieve it a country needs to follow interventionist economic policies such as an active industrial policy. Instead, we take the need for active industrial policy as given and investigate wether some of its side effects compromise the achievement of its goals. Our aim is to examine whether the possible benefits of interventionist industrial policies such as the promotion of investment or the support of R&D must be qualified down in the presence of corruption.

In a nutshell, the theoretical argument is that active industrial policy transfers rents to firms in favoured sectors. Bureaucrats with control rights over those firms can create mechanisms to extract some of those rents through bribes. Since corruption is known to have a negative effect on investment and growth, the total effect of industrial policy on investment can be decomposed into two effects: a positive direct effect and a negative indirect effect through corruption. The same could be true for the effect of industrial policy on R&D spending. Empirically, we find that the magnitude of the qualification is quite high.

One example of the interactions between active industrial policy and corruption is provided by the

US$37 billion South Korean Yulgok defence-procurement program.[1] The program represented one third of government spending during the 1970's and 1980's. At the heart of the program were two policies that gave an extraordinary amount of discretion to government procurement officials. The first was the familiar request for secrecy in military procurement. The second was active industrial policy encouraging technology transfers to local companies that would later take on the supply of military equipment to the South Korean army.[2] As these companies were progressing down their "learning curves", they were enjoying rents that the South Korean military shared through bribes. Indeed, corruption allegations lead to an investigation that ended in 1993, when Lee Chun Ku, a former defence minister, was convicted on accepting a US$370,000 bribe for arranging a tear gas contract. A second former defence minister was convicted on accepting a kickback on a submarine contract. During 1993, the investigations led to no less than 39 generals being sacked, reprimanded or thrown in jail.

The structure of the paper is as follows. Section I presents a simple model to illustrate the interactions between industrial policy, corruption and investment. The effect of industrial policy on investment can be decomposed into a direct positive effect and an indirect negative effect operating through higher incentives for corruption. If the total effect is negative, industrial policy actually deters investment and, if corruption affects welfare only through investment, a tax may called for, a result that can be called Anti-Pigouvian. If the effect is positive but lower than the direct effect, industrial policy must be more aggressive to achieve the same goals once corruption is taken into account and Super-Pigouvian subsidies may be the optimal policy response to correct an investment shortage. In section II we present our data. Given the scarcity of hard data for a wide cross-section of countries, we use mostly subjective indices on industrial policy and corruption. The use of this type of data can be defended by emphasizing its commercial use by fee-paying investors, so that an argument of revealed preference can be made in its favour.[3]

Section III presents our empirical results. The main finding of the paper is that those variables that

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[1] Reported in *The Economist*, January 29, 1994.

[2] A case in point was the selection of French Mistral missiles rather than American Stinger missiles, simply on the grounds that the French manufacturers were willing to pass on to Korean companies guidance and warhead technology.

[3] Of course, investors complement this type of data with country reports.

we use to measure how active is industrial policy are indeed associated with higher levels of corruption. In a regression of the level of corruption on a standard set of controls and our indicator of industrial policy, the coefficient on industrial policy is positive and significant. This result holds both in our cross-section and panel estimates, and is robust to the use of corruption indexes from different sources, alternative indicators of industrial policy, and the use of robust regression techniques. We also examine whether our results are biased by the possible endogeneity of industrial policy. We use TSLS techniques to identify exogenous effects of industrial policy on corruption and find that our results remain essentially unchanged.

In Section IV, we analyze the impact of industrial policy in two areas that industrial policy activists consider important for the economy's competitiveness: investment and R&D. We use empirical estimates to decompose the total effect of industrial policy into a positive, direct effect, and a negative, corruption-induced effect. In the presence of corruption, the total effect of industrial policy on investment ranges between 84% and 56% of the direct impact. If the only harmful effect of corruption operates through an adverse effect on investment, the optimal industrial policy seems to be of the Super-Pigouvian type. That is, where in a corruption-free environment industrial policy should be 1 peso, in a corrupt economy it should be between 1.19 and 1.79 pesos. In the more general case, where corruption has other deleterious effects, maybe because of moral considerations or through its effect on fairness, the existence of corruption may lead to lower optimal industrial subsidies. Though our results should be taken with care due to the narrowness of our data set, the magnitude of these corrections suggests that the consideration of corruption should not be absent from cost-benefit analyses of industrial policies. Section V summarizes the main results and concludes.

I. A SIMPLE MODEL AND EMPIRICAL STRATEGY

A standard rationale for active industrial policy is based on the difficulties in appropriating the full returns of some investment expenditures, resulting in insufficient incentives for their production under laissez faire.[4] To model this idea, we assume that investment in cost reducing activities, e, involves

[4] This argument has recently attracted the attention of international economists, both theoretically and empirically. The main findings seem to be that it is very difficult to identify the industries where such positive externalities are present, and that even in successful cases, the payoff to active industrial policy is likely to be very modest. See, for example, Baldwin and Krugman (1987), Krugman (1987) and the chapter on industrial policy in Krugman and Obstfeld (1991).

the production of knowledge and takes place before actual production takes place. Thus, in the first period, firms must incur a sunk cost by hiring scientists to undertake research and development at a wage cost w, the cost per unit of investment. In the second period, production is undertaken at cost $c(.)$. Then, investment is given by the solution to the following problem solved by each of the n firms (with n large) in the economy

$$Max_e \qquad -we + \delta\,[\theta - c(e)], \tag{1}$$

where θ are the firm's revenues, δ is the discount factor and the properties of the cost function include $c'<0$ and $c''>0$. The privately optimal investment is given by

$$-w - \delta\, c'(e^*) = 0. \tag{2}$$

Assume that this type of investment has some other role unaccounted for by the private firms, such as contributing to society's stock of knowledge. Then, a subsidy must be provided to align social and private objectives. In practice, countries use a combination of industrial policies, such as procurement preferences and fiscal privileges, to achieve this goal. We assume that a subsidy equal to λ is paid in the second period for every scientist hired by the firm in the first period. Under this subsidy, the firm's investment decision is given by

$$-w + \delta\,[-c'(e^{FB}) + \lambda] = 0, \tag{3}$$

which, in the absence of corruption, achieves the first best.

There are a number of ways of introducing corruption into this set up. An interesting possibility is that the corrupt official operates only when the firms enter commercial operations in the second period. We assume that firms are under the influence of a bureaucrat who can introduce regulations that can effectively confiscate their entire second period profits. This is an example of a hold-up problem where the party behaving opportunistically is legally related to the firm, rather than through the market as in the traditional hold-up literature (e.g. Williamson (1975) and Klein *et al.* (1978)).[5] It is worth

[5] This is a form of corruption rather understudied in the corruption literature. The classic study of the economics of corruption is Rose-Ackerman (1978).

emphasizing that even if there was no industrial policy, the existence of second period appropriable rents would give rise to a similar hold-up problem. In fact the existence of corruption would provide a justification for countries to engage in active industrial policy in order to correct distortions introduced by this type of hold-up problem.

We assume that the bureaucrat is paid a fixed wage (normalized to zero), so that in effect we abstain from analysing the interaction of the bureaucrat's incentive contract and the size of the subsidies.[6] Alternatively, we could interpret the figure of the regulator as that of a mafia organisation. We also ignore issues of secrecy and risk aversion, both for the firm and for the bureaucrat, but dealing with them explicitly would not change our results. Assume that there is one regulator deciding how many firms to ask for bribes in the second period.[7] There is a chance q of being detected and fined an amount $f(g)$, where g is the proportion of firms asked for bribes and we have $f'>0$ and $f''>0$. After suitable normalization, the problem of the regulator is to set g to maximize his expected income

$$Max_g \qquad (1-q)\, g\, [\theta - c(e) + \lambda e] - q f(g), \tag{4}$$

The first order condition is

$$(1-q)\, [\theta - c(e) + \lambda e] - q f_g' = 0. \tag{5}$$

From the point of view of the firms, g is the probability of bribe demands occurring. Then the firm's investment decision is the result of solving

[6] For an analysis of the role of wage incentives to deter corruption see Besley and McLaren (1993). Note that the omniscient planner should realize that by raising the level of subsidies to the national champions it is rising the incentive for lower rank bureaucrats to ask for bribes, and thus should adjust the bureaucrat's incentive scheme. For related issues, see the literature started by Hart (1983), specially Schmidt (1994). Nickell (1993) is a recent empirical effort along these lines.

[7] Alternatively, we could interpret the figure of the regulator as a cartel of bribe-takers. Italy's corruption scandal revealed that *all* the members of Naples City Council were involved in a scheme that ran an organized network to collect kickbacks originated in the construction of a stadium for the World Soccer Championship of 1990. Payments to council members ranged between 5 and 200 million lire ($3,300 to $133,000). See, for example, *La Nacion*, March 24, 1993.

$$Max_e \qquad -we + \delta(1-g)[\theta - c(e) + \lambda e], \tag{6}$$

such that

$$g = Argmax\ (1-q)\, g\, [\theta - c(e) + \lambda e] - q f(g). \tag{7}$$

It is clear now that it is the existence of rents, and not only of rents associated with industrial policy, that invites corruption. The set up makes it clear that, even if we assume there is no industrial policy, the existence of corruption may provide a new rationale for state intervention. By introducing the risk of expropriation in the second period, corruption of the regulator in the industry reduces investment so that industrial policy may be called for to correct it.

The first order condition is now

$$-w + \delta(1-g)[-c'(e) + \lambda] - \frac{dg}{de}\delta\pi = 0, \tag{8}$$

where $\pi = \theta - c(e) + \lambda e$. The total effect of industrial policy on investment is obtained using the implicit function theorem to obtain

$$\frac{de}{d\lambda} = -\frac{(1-g) - \frac{dg}{d\lambda}(-c_e' + \lambda) - \frac{dg}{de}e - \frac{d^2 g}{de\,d\lambda}\pi}{-c_{ee}''(1-g) - 2\frac{dg}{de}(-c_e' + \lambda) - \frac{d^2 g}{de^2}\pi}. \tag{9}$$

This expression has indeterminate sign. We know that the effect of industrial policy on investment has to be lower when one allows for the fact that industrial policy brings about corruption, which in turn acts to reduce investment. The reason is that industrial policy can only increase corruption, and corruption acts like a tax on second period profits (in other words, the expression above must be lower than *1/c''*). When corruption is an issue, it is conceivable that corruption could be affected to such an extent that any direct beneficial effects of industrial policy on investment would be completely offset by the associated increase in corruption induced by more industrial policy.

This simple theoretical set up can be extended to allow for the possibility that policy makers anticipate the effect industrial policy on corruption when deciding on the optimal amount of industrial policy. Assume the welfare objective of the government can be described by

$$Max_{\lambda} \quad W = H(e) - G(g), \tag{10}$$

where *H(.)* is the function indicating all the welfare costs and benefits of investment, including any knowledge spillovers unaccounted for in the private calculations of firms. The function *G(.)* summarises all other welfare costs of corrupt activities that do not affect investment. These may include issues such as distributional distortions, allocation of talent to the wrong activities, lack of social mobility, fairness and moral considerations induced by the presence of corruption in society. The first order condition is

$$\frac{dH}{de}\left(\frac{\partial e}{\partial \lambda} + \frac{\partial e}{\partial g}\frac{\partial g}{\partial \lambda}\right) - \frac{dG}{dg}\frac{\partial g}{\partial \lambda} = 0, \tag{11}$$

where the first term captures the effect of industrial policy on welfare that operate through investment and the second term captures effect of industrial policy on the costs of corruption other than those operating through investment considerations. It is useful to assume initially that $G(.)=0$ for all g, that is to ignore any corruption effects on welfare that do not operate through lower investment incentives. We can then summarise the previous discussion in the following two remarks.

REMARK 1 (SUPER-PIGOUVIAN INDUSTRIAL POLICY): *If $de/d\lambda>0$, the optimal industrial policy with-corruption is higher than the optimal industrial policy when there is no corruption*

A way of providing the intuition for the Super-Pigouvian result is to reflect on the situation faced by a man who is walking down the street on a cold night and finds a drunken beggar. Assume he is moved enough to give him a dollar for a hot meal. If we are in a Super-Pigouvian world, the beggar should be able to convince his benefactor that, because of his drinking problem, he will destine only a fraction of the dollar, say 50 cents, for food, the rest being allocated to booze expenditures. If the man really wants to give the beggar one dollar worth of hot food, he must give him 2 pesos. In short, just as providing food for a beggar may be more expensive when he also has an alcohol problem, so will the objective of promoting investment prove more expensive to achieve in a corrupt environment.

REMARK 2 (ANTI-PIGOUVIAN INDUSTRIAL POLICY): *If $de/d\lambda<0$, the optimal industrial policy with-corruption involves a tax.*

It helps to state the above condition under functional forms $f(g)=fg^2$ and $c(e)=A-\ln e$. We can rewrite (9) as

$$\frac{de}{d\lambda} = \frac{1 - \dfrac{(1-q)}{qf}(\theta - A + \ln e + 2\lambda e + 1)}{\dfrac{1}{e^2}\left[1 - \dfrac{(1-q)}{qf}(\theta - A + \ln e + \lambda e)\right] + \dfrac{(1-q)}{qf}\left(\dfrac{1}{e} + \lambda\right)^2}. \tag{12}$$

Then $de/d\lambda<0$ if the numerator is negative. Inspection of this expression provides some intuition for these results. For example, the optimal industrial policy is more likely to be of the Anti-Pigouvian variety and to involve a tax the lower is the probability of detection of corrupt bureaucrats, q, the lower is the fine for malfeasance, f, and the higher are the rents of the firm in the second period.[8]

For the more general case, where $G(.)\neq 0$ and there are other, perhaps more obvious and direct costs of corruption, the optimal industrial policy in the presence of corruption may be lower than we would otherwise have even when $de/d\lambda>0$. In the example of the pauper, it is equivalent to assume that alcoholism has other problems besides reducing the amount of money devoted to food expenditure, such as the promotion of crime. We expect this to be the more realistic case.

Empirical Strategy

To summarise, the object of this paper is to estimate the extent to which investment is stimulated by industrial policy, after deducting any detrimental effects of corruption. In other words, we decompose the total effect of industrial policy on investment, λ, into a direct positive effect and a negative effect operating indirectly through higher incentives for corruption

[8] For example, if $w=0.01$, $q=0.5$, $\theta=1$, $A=0$, $\delta=0.95$, $f=0.5$ and the wage subsidy is 50 percent ($\lambda=0.005$), we have that $g=0.5$ and investment, profits and expected graft income are positive and $de/d\lambda<0$.

$$\frac{de}{d\lambda} = \frac{\partial e}{\partial \lambda} + \frac{\partial e}{\partial g}\frac{\partial g}{\partial \lambda}. \qquad (13)$$

We must first investigate the relationship between industrial policy and corruption as suggested by equation (7). Our goal is to estimate an equation of the following general form

$$CORR_i = \beta_0 + \beta_1 GDP_i + \beta_2 SCHOOL_i + \beta_3 POL_i + \beta_4 SECUR + \beta_5 OPEN + \beta_6 \lambda_i + \varepsilon_i$$

where the subscripts refer to country *i*, CORR is our measure of corruption and λ_i is the intensity of industrial policy in country *i*. We control for the level of development (as measured by the level of income per capita (GDP) and the average years of total schooling (SCHOOL)) as there is a presumption that in more educated countries with better information flows the costs of corruption will be better understood and will be socially condemned accordingly. We also control for the extent of political rights in the country (POL) to proxy for political competition. Though aspects of crime prevention policies are extremely difficult to capture in a corruption context, especially when doing cross-country comparisons, we include a variable measuring the extent to which there is general crime prevention (against property and the person) in the country (SECUR), as in the literature started by Becker (1968). In a previous paper, Ades and Di Tella (1994), we found that the extent to which domestic firms are subject to foreign competition is a significant determinant of the level of corruption, so we include the amount of imports over gross domestic product (OPEN) among our controls.

We are mainly interested in the sign and magnitude of β_6, the marginal effect of industrial policy on corruption. Once we obtain our estimates for β_6, we decompose the effects of industrial policies on investment and R&D spending as in equation (13). We also present estimates of β_6 that are free from simultaneity bias using TSLS techniques. This is important both because the optimal industrial policy may be chosen taking into account the problems of corruption as suggested in the theoretical section, and because of the traditional concerns that industrial policy reflects the extent to which policy makers are captured by interest groups through corruption, as suggested in the rent seeking literature.

II. THE DATA

Our main source of data is the *World Competitiveness Report (WCR)*, a publication of the EMF Foundation in Geneva. Its use in economics is not new (e.g. De Long and Summers (1991)) though its use as a source of corruption and industrial policy data is. It consists of yearly surveys conducted amongst top managers and economic leaders in the surveyed countries. The size of the surveys varies every year: 1800 in 1989, 1384 in 1990, 3272 in 1991 and 2160 in 1992. It is not usually considered a study advocating laissez faire (see De Long and Summers (1991) and Krugman's review of the *WCR* for *The Economist* on April 29th 1995), so that, if anything, this source of data has a bias in favour of active industrial policies.

Countries use a large set of different instruments in performing active industrial policy, such as grants, tax concessions, soft loans, preferential procurement policies and export credit facilities. One of the most widely used instruments of industrial policy across countries is preferential procurement on domestic companies by local governments. As suggested in the introduction, military procurement is one activity where national security arguments lead to procurement from selected national companies. Another example is the European support to aircraft manufacturing by Airbus.[9] This support takes the form of subsidies ($1.5 billion in 1974 dollars in Baldwin and Krugman (1987) estimation) and preferential procurement by the national airlines.[10] We use two indices of industrial policy from the *WCR* survey section. A procurement index (PROCUR) that measures *"the extent to which public procurement is open to foreign bidders"*, and a fiscal index (FISCAL) that measures *"the extent to which there is equal fiscal treatment to all enterprises."* Both indices are measured on a scale from 0 to 100, with 100 taken to mean that the country in question has a public procurement policy completely closed to foreign companies and a fiscal policy that treats enterprises in the most unequal way.

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[9] Military procurement, is one of the main supporters of R&D in the United States, as reported by Rogerson (1994). The Airbus project has a precedent in the joint development by the British and the French of a supersonic aircraft, the Concorde, that was only bought by the state-owned airlines of both countries.

[10] The French government *"has used its influence over demand to provide privileged markets, for example by requiring the state-run phone company to buy its telecommunications and computer equipment from French firms. And in a few cases, notably aircraft, extensive government subsidies have been used to promote industries that are regarded as the key ones."* (Krugman and Obstfeld (1991), pp. 275).

We also use "harder" indicators of industrial policy where available. One such indicator is monetary subsidies to private and public enterprises (SUBSID89), compiled by the *WCR* from national accounts.[11] The latest year with a reasonable sample size is 1989. Another indicator that we use is support to manufacturing (in subsidies) as a percentage of sectoral GDP (SUPPM87), reported in Ford and Suyker (1990). Unfortunately the latest year reported is 1987 and for only 16 countries.

Our corruption data come from two different sources. The first corruption index (CORRWCR) that we use comes from the *WCR,* where the definition used is *"the extent to which improper practices (such as bribing or corruption) prevail in the public sphere."* Countries are graded in a 0 to 100 scale, with 100 taken to mean maximum corruption.[12] The second source of corruption data we use was assembled by Peter Neumann (1994) and his collaborators at *Impulse*, a German business publication.[13] Neumann's strategy consisted in interviewing people with business experience in each of the countries included in the study, especially concentrating on German exporters who normally had business in the countries concerned. On average, 10 individuals were interviewed per country (the minimum number was three) with a guarantee of confidentiality on their identities. This index (CORRGEX) indicates the proportion of the total number of deals that involved corrupt payments. The correlation coefficient of this index with the corruption indicator of the WCR is 0.89.[14]

We completed our data set with per capita GDP, imports as % of GDP, gross domestic investment as % of GDP and general government consumption as % of GDP for 1989-92 from the corresponding

[11] Leonard and Van Audenrode (1993) report that, between 1975 and 1981, 75 percent of investment in Belgium benefitted from public subsidies.

[12] In fact, the *WCR* reports their indexes in a way such that 0 is the best possible grade, implying the most open procurement policies and the less unequal fiscal treatment. We redefined the indexes to make the empirical results easier to follow. Unfortunately, as with all the survey data from the WCR, the exact phrasing of the corruption question changes slightly from year to year. Thus in 1989 the question was *"extent to which the country prevents corruption"* and in 1990 was *"extent to which government regulations prevent improper practices in the public sphere"* and in 1991 and 1992 was *"improper practices (such as bribing and corruption) prevail in the public sphere"*.

[13] We thank Frederick Galtung at Transparency International for referring us to Neumann's work.

[14] The correlation coefficient of the WCR corruption indicator with the corruption index produced for the 1980's by *Business International* used in Ades and Di Tella (1994) and Mauro (1995) is 0.84.

issues of the *World Development Report*.[15] Data on political rights is from Gastil (1990-93) and schooling data for 1990 from the 1993 issue of the *Human Development Report*. We also collected an index on general law enforcement in each country (SECUR) from the *WCR*, defined as the extent to which *"there is confidence that property and the person are adequately protected."*

For our regression exploring the allocation of talent, we collected data on personnel involved on R&D nationwide for 1989 from the *WCR* (source *UNESCO*). We take this variable as a proxy for R&D spending in the country. The list of the countries included in the data set are shown in Appendix I, while the definitions of all the variables used are in Appendix II.

Description of the data

In Table 1 we show means, standard deviations, maxima and minima for the variables used in our regressions. Readings are for the four year average between 1989 and 1992, except for the corruption index from the German exporters which is for 1993, schooling which is for 1990, R&D personnel which is for 1989, data for subsidies to public and private enterprises which is for 1989, and support to manufacturing which is for 1987.

III. THE EMPIRICAL EVIDENCE

Cross-Section Evidence

Table 2 shows our basic cross-sectional evidence on the relationship between industrial policy and corruption. The largest sample we could assemble contains 32 observations. Regression (1) presents our standard set of controls: per capita GDP, average years of total schooling, the Gastil index of political rights, the security index and the degree of openness in the economy. The first two variables are included to capture the level of development in the country. The Gastil index and the security index are included to capture basic enforcement of laws through political competition and effectiveness of general law enforcement. We include openness to control for the effect that political and natural

[15] The 1989 observation of GDP per capita for Indonesia was extrapolated from the 1990 observation, assuming a similar growth rate of PPP adjusted GDP to that for 1990-91.

barriers to trade have on corruption.[16] We also control for heteroscedasticity so that standard errors in parenthesis are White-corrected.

In regression (1), neither income per capita or the Gastil index of political rights significantly affect the level of corruption. On the other hand, the level of schooling, the degree of openness, and the security index affect corruption negatively and significantly. One standard deviation increase in the average years of total schooling in the population over 25 reduces the corruption index CORRWCR by 7.52 points, over one third standard deviation of this index. A one standard deviation increase in the security index also reduces the corruption index by one third of a standard deviation of the corruption index. Finally, when openness increases by a standard deviation, corruption falls by 7.6 points, slightly over 36% of a standard deviation in the corruption index.[17]

Regression (2) introduces the procurement index (PROCUR) to our list of regressors. This variable measures the degree to which government procurement policies are geared towards promoting the national champions, which may be expected to enjoy rents in excess over their free market equilibrium values. The coefficient is significant and positive and indicates that a one standard deviation increase in the extent of preferential procurement practices by the government is associated with an increase in CORRWCR of 7 points, or one third of a standard deviation. Thus, the evidence shows that active industrial policy is correlated with higher levels of corruption in our cross-section of 32 countries. The inclusion of regional dummies (for the OECD and Latin America) in regression (3) does not affect this conclusion. The OECD dummy is insignificant but the one for Latin America (Mexico and Brazil) is negative, large and highly significant.

Regressions (4) and (5) use the degree to which the country provides uneven fiscal treatments to enterprises as a proxy for active industrial policy. The coefficient on this index has the expected

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[16] Although these variables are likely to be correlated, their inclusion gives us some confidence that the coefficient on PROCUR will not be capturing issues related to the level of development in the countries involved.

[17] We also run regressions substituting OPEN for the indicators presented in Leamer (1988). He uses an empirical Hecksher-Ohlin model with nine factors of production to estimate trade intensity ratios for 53 countries. He then uses the residuals to proxy for trade barriers. The coefficient on PROCUR is significant and of similar size to that in regression (2), both when the "unscaled" (homoscedastic) and when the "scaled" (heteroscedastic) data are used. The coefficient on the Leamer indicator is insignificant when the "unscaled" data is used. The drawback is that these indicators are produced only for the year 1982 and the number of observations drops to 27.

positive sign, and is highly significant. A one standard deviation increase in FISCAL is associated with an increase in corruption of 11.5 points, just over 55% of a standard deviation. The size and significance of this coefficient are almost unchanged when the Latin American and OECD dummies are included in regression (5).

Panel Evidence

In Table 3 we present the results that we obtained after pooling all the yearly observations for the four years in our sample. Simple pooling may introduce a downward bias in the standard errors of the regression if there is correlation among residuals of the same cross-section units. We tackle this problem in regressions (6) and (7) by allowing for correlation across periods in the shocks to corruption and estimating the stacked set of regressions using country-specific random effects. This methodology ensures that a country's levels of corruption in 1989, 1990, 1991 and 1992 are not treated as independent observations.[18] The coefficient on PROCUR that we obtain is again positive and significant, though its magnitude is somewhat smaller (and the standard error slightly larger) to the one obtained when we simply pool the data. Regression (7) allows intercepts to be different for each year. The coefficient of PROCUR is positive and similar in size to the one obtained in regression (6), though less precisely estimated. A one standard deviation increase in PROCUR increases corruption by 0.12 of a standard deviation.

In regressions (8) and (9) we reproduce the last two regressions but now use FISCAL as our index of industrial policy. In both regressions, FISCAL enters positively and significantly as a determinant of corruption. The size of the coefficient is slightly lower than the ones we obtained for the cross-section regressions. A one standard deviation increase in FISCAL in regression (9) increases corruption by about 0.32 of a standard deviation.

[18] Another way to correct this is by controlling for fixed effects. This has the considerable advantage of controlling for time-invariant omitted variables. The problem is that we are using a rather short panel with institutional variables that tend to have little time-series variations for the time span considered. The strategy we use is to adopt a very general specification to try to include as much of observed heterogeneity as possible. The results controlling for country fixed effects are mixed: the coefficient on FISCAL retains its size and significance while that on PROCUR is lower and insignificant.

Robustness

The first four regressions in Table 4 analyze the robustness of the results that we obtained. The first two regressions substitute the "soft" indicators of industrial policy based on executive surveys for indicators based on "hard" data from national accounts. The problem with the use of these indicators, besides capturing only instruments of industrial policy that are easy to quantify such as subsidies, is readily apparent from the two regressions we present: the number of observations in regression (10) falls to 24, while that for regression (11) falls to only 16. Regression (10) uses subsidies to private and public enterprises as % of GDP for 1989 (SUBSID89), the last year for which there was a relatively large sample size. Regression (11) uses support to manufacturing as % of sectoral GDP (SUPPM87), presented in Ford and Suyker (1990). Note that the variable measuring political competition, POL, is dropped as all 16 countries in our sample have the same value (1 standing for total freedom). The coefficients on both regressions are positive and significant, indicating that high subsidies or support for manufacturing are associated with higher levels of corruption.

A potential concern is that both our corruption indicator and our industrial policy indicator come from the same source, the WCR, and thus may not be completely independent. The previous two regressions avoided this problem by substituting the industrial policy indicator. In regressions (12) and (13), we show that our results also hold when we use an alternative measure of corruption from Neumann (1994). In regression (12) we regress the proportion of total deals made in a country that involve corrupt payments (as measured by the German exporters corruption index (CORRGEX)) on our basic regression using PROCUR as our indicator of industrial policy. Since CORRGEX was obtained in 1993, we use the latest available observation for each variable, 1992, except schooling that corresponds to 1990. Our measure for industrial policy is still significantly associated with corruption as measured by CORRGEX. A one standard deviation increase in PROCUR increases the German exporters measure of corruption by 0.14 standard deviations, about one half of the impact observed in the cross section regressions using the WCR measure of corruption. Regression (13) shows that similar results hold when FISCAL is used to proxy for industrial policy. The coefficient on FISCAL is positive and significant. A one standard deviation increase in our indicator of industrial policy is associated with an increase in corruption of over one fifth of a standard deviation in the corruption measure of the German exporters.

We also performed some auxiliary tests to check the robustness of our results. We first repeated the regressions presented using robust regression techniques to see if our results are driven by the presence of any gross outlier.[19] Both the size and significance of the coefficients on PROCUR and FISCAL remained very much like those using standard OLS techniques. This was true both in regressions using CORRWCR and regressions using CORRGEX as our dependent variable.

We also perform a variant of Leamer's extreme-bounds analysis suggested by Levine and Renelt (1992) to test the robustness of coefficient estimates to alterations in the conditioning set of information. The possibility for this type of analysis is restricted due to the narrow set of potential variables to be included in the conditioning set, the fact that there are no previous studies on which to decide which subset of variables should always be included and which are of potential interest and by obvious concerns about multicollinearity. Still, using GDP and POL as our I-variables (the subset of variables that should always be included in the regression) and SCHOOL, SECUR and OPEN as our Z-variables (the subset of variables that could potentially be included) we find that the coefficient on PROCUR (the variable of interest) can be considered "robust" in the sense of Levine and Renelt. The extreme low bound is never below 0.5 and the extreme high bound is never above 0.78, with the t statistics never below 2.99.

Simultaneity Bias

In this section, we examine whether our results are biased by the possible endogeneity of our measures of industrial policy. As we suggested in the theory section, rational policy makers may adjust industrial policy in the presence of corruption. A further rationale for simultaneity bias is the traditional concern raised by the rent seeking literature that policy makers may be captured by interest groups. Following this literature, it is possible to argue that corrupt politicians devise industrial policies to obtain bribes from the companies they pick as "national champions".[20]

We address this issues in the last two regressions of Table 4. In regression (14), we instrument PROCUR using the average of the procurement policies of the neighbouring countries of the country

[19] These results are available upon request. The particular method used starts by estimating a standard OLS regression and excludes any gross outlier. Then it proceeds iteratively: it performs a regression, calculates case weights based on absolute residuals, and regresses again using those weights. Iterations stop when the maximum change in weights drops below a pre-specified tolerance level.

[20] See, for example, Bhagwati (1982) and Tullock (1967).

in question. In other words, we use the average level of industrial policy in Germany's neighbours to instrument for Germany's level of industrial policy. The rhetoric of competitiveness is plagued with arguments favouring industrial policy because the country's rivals are following it. We therefore instrument for the level of industrial policy in a country using these regional averages. The identifying assumption is that these regional averages only affect corruption through their effect on the domestic levels of industrial policy. In regression (14) we find that the coefficient on PROCUR is still positive and significant after it is instrumented with the neighbours industrial policies. The magnitude of the coefficient on PROCUR is almost 64% larger than the OLS estimate (regression (2)). In regression (15) we add the average procurement policy of the country's trading partners, weighted by that country's share of total imports to our list of instruments. This captures another dimension of rivalry beyond that implied by geographical proximity, and echoes the rhetoric of competitiveness in assuming that industrial policies of a country's main trading partners should be counteracted by similar industrial policies at home. The coefficient on PROCUR remains positive and significant after we add this new instrument, and its size is 13% larger than the one obtained by OLS.[21]

IV. HOW EFFECTIVE IS INDUSTRIAL POLICY?

The main result of this paper, that industrial policy fosters corruption, has implications for how effective will industrial policy be in achieving its objectives. The question is: will industrial policy's side-effects (like corruption) jeopardize its main goals? A natural starting point is investment. Casual observation of the high investment shares of South East Asian economies has led many observers to believe that this is a result of their higher reliance on active industrial policies. Similar arguments apply to the allocation of expenditures to R&D, which has traditionally been quite high in these countries considering their stage of development.

We investigate in this section whether industrial policies have been effective in inducing higher investment and R&D spending in our sample of 32 countries. In regression (16) in Table 5, we present

[21] We also run regressions using a measure of corruption in the *private* sector produced by Neumann. The measure estimates the kickback as a percentage of price paid to the procurement officer of a private firm in country *i* buying machinery from Germany. We find that corruption of officials in private firms is positively associated with industrial policy. It is more useful to address issues of simultaneity raised by rent seeking concerns rather than of rational policy makers anticipating corruption costs.

an investment regression of a general form similar to that presented in Barro (1991). Though looking at aggregate investment may leave out reallocation of investment from sectors without spillovers to sectors with them that is often the focus of industrial policies, the results are illustrative. We control for initial GDP (insignificant), political instability (positive and significant) and for schooling and government consumption (both enter negatively and significant).[22] Both dummies included, for Latin America and the OECD, are negative and significant. PROCUR enters positively and significantly with a coefficient equal to 0.263 (s.e. 0.058), indicating that in our sample high investment and active industrial policies are positively and significantly associated. The negative and significant coefficient on our WCR corruption index indicates that corruption reduces investment.[23]

We now recall the basic empirical result of this paper, that shows that industrial policy fosters corruption. The magnitude of this effect ranges from a high value of 0.574 in regression (2) to a low value of 0.21 in regression (7). We can then decompose the total effect of industrial policy on investment into a direct, positive, effect, and an indirect, negative effect operating through increased corruption. Using the coefficients from regressions (2) and (7) and that of regression (16), we show the results of this decomposition in Table 6. We find the total effect of industrial policy on investment once corruption is taken into account is only 56% of the direct effect of industrial policy on investment using the coefficient in (2) and 84% using the coefficient in (7). Using the coefficient estimates from the TSLS regressions the total effect can be as little as 28% of the direct effect. These decompositions are shown in Table 6.

We similarly decompose the total effect of industrial policy on R&D spending, as proxied by total personnel involved in R&D activities. In regression (17) in Table 5 we include as controls some of the basic determinants of the allocation of talent, as suggested by Murphy *et al.* (1991). We also include our measure of industrial policy, and note that the coefficient of 0.149 (s.e. 0.051) is positive and significant. We note that corruption is negatively associated with R&D spending, perhaps because

[22] The result on political instability is the opposite to that found by Barro (1991), and is due to the sample of countries chosen, mainly consisting of mature democracies with low investment rates and unstable emerging economies with very high investment rates, such as Thailand or Korea. The sign of the schooling coefficient may be capturing some convergence effects.

[23] This finding is consistent with Mauro (1995), who shows that corruption has a negative and significant effect on private investment for a larger cross-section of 67 countries using corruption data from *Business International*.

the ablest people switch occupations to activities where corruption will supplement their income or because corruption simply drives technically oriented people out of the country altogether (brain drain). The coefficient of corruption is -0.13 (s.e 0.039). Using the coefficients on PROCUR from regression (2) and from regression (7), we can estimate the total effect of industrial policy on R&D to range between 0.074 and 0.122, that is between just under 50% and 82% of the direct effect. Using the coefficient estimates from the TSLS regressions the total effect can be as little as 18% of the direct effect.

V. CONCLUDING REMARKS

The paper presents an empirical analysis of corruption and industrial policy. We find that a substantial part of the benefits of industrial policies are lost when the interaction with corruption is considered.

We use subjective data on corruption and two commonly used instruments of industrial policy (procurement preferences to "national champions" and unequal fiscal treatment to enterprises), and find evidence suggesting that corruption is higher in countries pursuing active industrial policy. We show that our results hold when we use other "harder" measures of industrial policy, such as industrial subsidies as a share in GDP, and when we correct the possibility of a simultaneity bias using TSLS techniques.

Though our results should be interpreted with caution as they stem from a relatively narrow data base, they form, however, an additional warning of the dangers associated with enthusiastically pursuing interventionist industrial policies without prior research on its full effects in the presence of corruption. We illustrate these dangers by decomposing the total effect of industrial policy on investment and R&D spending. In the presence of corruption, we find that the total effect of industrial policy on investment ranges between 84 and 56 % of the direct impact. The total effect on R&D spending ranges between 82 and 50 % of the direct effect. These findings suggest that it is more expensive to achieve such objectives using active industrial policies in economies where corruption is widespread than in corruption free environments. If corruption affects welfare only through its deleterious effect on investment, it seems that the optimal subsidy is larger in the presence of corruption, a case we call Super-Pigouvian. In the more general case where corruption has other negative effects besides reducing investment, the optimal policy response to the existence of corruption may well imply lower subsidies.

While we focus on the effects of active industrial policy, the argument could be extended to apply to other interventionist policies that have the effect of transferring rents and potentially induce corruption. The magnitude of the corrections estimated in this paper suggest that the consideration of corruption should not be absent from cost-benefit analyses of market intervention.

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Appendix I: Sample of 32 countries

Hong Kong, India, Japan, Korea, Malaysia, Singapore, Thailand, Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, Canada, Mexico, United States, Brazil, Australia, New Zealand, Indonesia, Hungary.

Appendix II: Definition of the Variables

CORRWCR: Corruption index from the *World Competitiveness Report* (*WCR*), extent to which improper practices (such as bribing and corruption) prevail in the public sector.

CORRGEX: Corruption index form the German exporters, total proportion of deals involving kickbacks, from Neumann (1994).

GDP: Real per capita GDP, from the *World Development Report* (*WDR*).

POL: Gastil index of political rights, 1 stands for total freedom.

SCHOOL: Average years of total schooling in 1990 in the population over 25, from the *Human Development Report*.

OPEN: Share of imports in GDP, *WDR*.

SECUR: Security Index, extent to which there is full confidence among people that their person and their property are adequately protected, *WCR*.

PROCUR: Procurement index, openness of public sector procurement to foreign competitors, *WCR*.

FISCAL: Index of fiscal treatment to enterprises, extent to which there is equitable fiscal treatment of all enterprises under the law, *WCR*.

SUBSID89: Subsidies to public and private enterprises as % of GDP in 1989, from national accounts.

SUPPM87: Support to manufacturing, subsidies as % of sectoral GDP in 1987, from Ford and Suyker (1990).

INVESTM: Gross domestic investment as % of GDP, *WDR*.

GOVCONS: Government general consumption as % of GDP, *WDR*.

REVOL: Number of revolutions and coups per year 1960-1985, Barro (1991).

R&DPERS: Research & development personnel nationwide in 1989, full time work equivalent, *UNESCO*.

TABLE 1
Summary Statistics

Variable	Obs	Mean	Std. Dev	Minimum	Maximum
CORRWCR	32	41.20	20.89	9.36	76.82
GDP, 000 of US$	32	12.78	5.82	1.12	21.83
POL	32	1.84	1.37	1	5.75
SCHOOL	32	8.47	3.14	2.4	12.3
SECUR	32	67.47	14.79	32.13	91.35
OPEN	32	0.35	0.35	0.057	1.68
PROCUR	32	38.55	12.19	11.22	57.34
FISCAL	32	39.89	10.50	16.03	60.16
CORRGEX	32	2.50	3.48	0	10
INVESTM	31	24.41	6.42	15.5	38
GOVCONS	31	15.71	4.82	8	27
REVOL	31	0.08	0.13	0	0.48
R&DPERS	31	6.79	4.16	0.28	14.30
SUBSID89	24	3.02	2.24	0.22	9.37
SUPPM87	16	4.41	3.64	0.10	15.50

NOTE: All variables are averages of their 1989 to 1992 observations, except SUBSID89, R&DPERS and SUPPM87, which correspond to the 1989, 1989 and 1987 observations respectively, and REVOL which is the average of the period 1960-85.

TABLE 2

Corruption Regressions, Dependent Variable: CORRWCR Average 1989-92

	(1)	(2)	(3)	(4)	(5)
Intercept	111.58 (11.69)	85.69 (11.42)	93.70 (15.28)	23.57 (16.62)	45.33 (19.90)
GDP	-0.094 (0.746)	-0.231 (0.625)	0.117 (0.631)	0.570 (0.476)	1.064 (0.442)
POL	1.189 (1.423)	0.124 (1.461)	1.033 (1.341)	3.671 (1.091)	2.073 (1.595)
SCHOOL	-3.779 (1.274)	-3.926 (1.050)	-4.625 (0.988)	-2.855 (0.809)	-3.673 (0.882)
SECUR	-0.471 (0.162)	-0.400 (0.136)	-0.533 (0.128)	-0.169 (0.149)	-0.257 (0.161)
OPEN	-21.65 (6.926)	-10.47 (7.134)	-12.95 (8.023)	-13.04 (6.533)	-19.08 (6.886)
PROCUR		0.574 (0.146)	0.620 (0.170)		
FISCAL				1.096 (0.188)	1.021 (0.173)
OECD			1.268 (6.512)		-9.131 (4.880)
LAAMER			-16.74 (5.261)		-14.412 (5.068)
Number of Observations	32	32	32	32	32
Adjusted R^2	0.72	0.81	0.83	0.82	0.83

NOTE: All variables are averages of their 1989 to 1992 observations.

TABLE 3

Corruption Regressions, Dependent Variable: CORRWCR

	(6) Country Random Effects	(7) Country Random and Time Fixed Effects	(8) Country Random Effects	(9) Country Random and Time Fixed Effects
Intercept	88.54 (11.20)		53.61 (13.89)	
1989 Fixed Effect		58.92 (8.127)		35.57 (10.05)
1990 Fixed Effect		55.58 (7.918)		36.42 (9.150)
1991 Fixed Effect		51.79 (7.047)		30.70 (8.882)
1992 Fixed Effect		53.78 (6.635)		32.47 (8.622)
GDP	-0.794 (0.522)	-0.258 (0.629)	-0.488 (0.492)	-0.013 (0.585)
POL	2.215 (1.633)	2.840 (1.682)	2.721 (1.523)	3.380 (1.570)
SCHOOL	-2.540 (1.166)	-2.983 (1.212)	-2.045 (1.083)	-2.388 (1.136)
SECUR	-0.341 (0.103)	-0.469 (0.138)	-0.223 (0.099)	-0.343 (0.127)
OPEN	-15.88 (7.109)	-17.36 (7.241)	-12.52 (6.603)	-13.41 (6.72)
PROCUR	0.228 (0.107)	0.210 (0.113)		
FISCAL			0.640 (0.145)	0.641 (0.156)
Number of Observations	128	128	128	128
Adjusted R^2	0.31	0.31	0.41	0.40

NOTE: Regressions (6) and (8) control for country random effects, while regressions (7) and (9) control for country random and year fixed effects.

TABLE 4
Corruption Regressions

Dependent Variable	CORR WCR	CORR WCR	CORR GEX	CORR GEX	CORR WCR	CORR WCR
	(10)	(11)	(12)	(13)	(14) TSLS	(15) TSLS
Intercept	120.26 (13.36)	70.63 (21.28)	9.122 (2.039)	4.410 (3.734)	68.95 (18.59)	82.25 (16.23)
GDP	1.591 (0.668)	3.231 (0.907)	-0.180 (0.106)	-0.138 (0.092)	-0.319 (0.684)	-0.249 (0.625)
POL	-1.819 (2.613)		0.618 (0.354)	1.012 (0.362)	-0.565 (2.187)	-0.018 (1.987)
SCHOOL	-7.360 (1.196)	-5.981 (1.392)	-0.372 (0.207)	-0.230 (0.243)	-4.020 (1.237)	-3.945 (1.130)
SECUR	-0.455 (0.213)	-0.524 (0.216)	-0.045 (0.019)	-0.030 (0.018)	-0.354 (0.160)	-0.390 (0.146)
OPEN	-39.27 (10.39)	-9.973 (19.60)	-1.856 (1.053)	-2.148 (1.009)	-3.237 (9.388)	-8.983 (8.301)
PROCUR			0.039 (0.017)		0.944 (0.319)	0.650 (0.270)
FISCAL				0.069 (0.034)		
SUBSID89	2.824 (1.174)					
SUPPM87		3.195 (0.920)				
Number of Observations	24	16	32	32	32	32
Adjusted R^2	0.67	0.77	0.78	0.79	0.77	0.81

NOTE: The dependent variable is the WCR corruption measure except regressions (12) and (13) where it is the german exporters measure of corruption. All variables are averages of their 1989 to 1992 observations, except regressions (12) and (13) where they are for 1992. In regressions (14) and (15), the country's procurement policy is treated as endogenous. In regression (14) we use the neighbours procurement policy as an instrument, while in regression (15) we add the procurement policy of the trading partners weighted by the respective import shares.

TABLE 5
Investment and R&D Personnel Regressions

Dependent Variable:	INVESTM	R&DPERS
	(16)	(17)
Intercept	41.19 (3.970)	12.88 (6.872)
GDP 1989	0.126 (0.221)	0.143 (0.111)
REVOL	17.32 (7.564)	
INVESTM		-0.192 (0.107)
POL		-1.126 (0.597)
SCHOOL	-0.901 (0.338)	0.425 (0.229)
GOVCONS	-0.641 (0.132)	-0.236 (0.150)
PROCUR	0.263 (0.058)	0.149 (0.051)
CORRWCR	-0.201 (0.043)	-0.130 (0.039)
OECD	-4.485 (2.038)	-1.660 (1.902)
LAAMER	-10.58 (3.123)	-2.763 (2.004)
Number of Observations	31	31
Adjusted R^2	0.76	0.66

NOTE: In regression (16) the number of observations drops to 31 due to missing data on Revolutions and Coups for Hungary. In regression (17) the number of observations drops to 31 due to missing data on R & D Personnel for Hong Kong. All variables in regression (17) are for 1989.

TABLE 6

Estimated Effect of Industrial Policy

Estimated Effect of Industrial Policy	On Investment	On R&D Personnel
Direct	0.263	0.149
Corruption Induced	[-0.115, -0.042]	[-0.075, -0.027]
Total Effect	[0.148, 0.221]	[0.074, 0.122]