Industrial Location and Protection:
The Political and Economic Geography of U.S. Nontariff Barriers

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Abstract

The debate over the relationship between the location of industry and the incidence of import barriers has been miscast. Three problems call into question the findings reported in the endogenous protection literature. First, geographic concentration is widely used as a proxy for political concentration (i.e., the spread of industry across political districts), although these two variables are conceptually and empirically distinct. Second, extant measures of geographic concentration ignore the spatial relationship among units (e.g., counties or states) in which "lumpy" industries make their home, thereby often failing to detect concentration where it exists. Third, in those few studies in which political concentration receives any direct attention at all, non-monotonic effects and interaction terms are seldom tested, despite their grounding in theories of interest group politics more generally. This article addresses all three problems. The results indicate that geographically concentrated but politically dispersed industries are the ones most likely to receive relief from imports, although a handful of very large industries benefit from being politically concentrated. The article thus reveals how to reconcile the two competing hypotheses around which one of endogenous protection theory's most enduring debates has taken shape.

One of the most enduring debates in the endogenous protection literature concerns the relationship between the location of industry and the incidence of import barriers. This debate is widely framed around two competing hypotheses: the first posits that geographically *concentrated* industries are more likely to act collectively in lobbying for protection, giving them a loud voice in trade politics; the second holds that geographically *dispersed* industries are more likely to have broad political representation (under certain electoral rules), giving them a greater number of voices in trade politics. Despite a considerable amount of empirical testing, however, the jury is still out on which of these hypotheses correctly signs one of endogenous protection theory's most salient variables. We argue that the findings in the literature are difficult to interpret, given the tendency to conflate geographic with *political* concentration, the latter measuring the spread of an industry across electoral districts. We disentangle these variables in explaining the pattern of nontariff barrier (NTB) protection for 4-digit U.S. manufacturing industries in 1990. We find that geographically concentrated but politically dispersed industries are more likely to receive relief from imports, though a handful of very large industries benefit from being politically concentrated. Both sides of the debate are thus partly right, although not for reasons that either side could explain.

In addition to letting the political concentration variable testify for itself, we create a new measure of geographic concentration. Existing studies of economic geography rely upon measures that suffer from what White (1983, 1010-1011) terms the "checkerboard problem," in that they fail to account for the spatial relationship among geographic units. Imagine, for example, that the squares on a checkerboard are parcels of land, and that industry is located only on the black squares and thus quite dispersed across the board. Now imagine a second checkerboard on which the squares are sorted by color, so that all the black squares with industry are contiguous,

as are all the red squares without industry. Surprisingly, most measures of geographic concentration cannot distinguish between these two checkerboards, even though industry is invariably more "lumpy" on the latter. By neglecting spatial relationships among the geographic units in this manner, existing studies thus fail to test the hypothesis that close physical proximity lowers the costs of organizing and monitoring an industry's efforts to "turn out the vote." Our measure corrects the checkerboard problem, permitting a more direct test of whether geographically concentrated industries are better able to overcome the collective action problem inherent in lobbying for protection.

Finally, we examine several alternative specifications of the relationship between the location of industry and the incidence of barriers to trade. Specifically, we test the hypothesis that moderate political concentration maximizes protection, as compared to lesser or greater levels of political concentration. We also consider the hypothesis that the interaction between political concentration and industry size is the key to predicting which industries are most likely to receive relief from imports (Salamon and Siegfried 1977; Snyder 1989). Studies including political concentration typically fail to include this interaction term (but see McGillivray 1997), one deemed to be important in theories of interest group politics more generally (Cameron, Epstein, and O'Halloran 1996). Our article provides the first evidence bearing on these hypotheses while simultaneously distinguishing political from geographic concentration and resolving the checkerboard problem.

2. The Literature

Endogenous protection theory has long sought to tease out the political implications of economic geography. Most of the literature begins with Olson's (1971) puzzle about collective ac-

tion. Since protection often benefits all of the firms in an industry regardless of whether they individually lobby, firms have a strong incentive to free ride on each other's efforts. The result is a suboptimal level of political activity on the part of the industry as a whole (Olson 1971, 35, 44-45). The "close group" hypothesis, as we call it, posits that transaction costs incurred in organizing and monitoring effective lobbying decline with close physical proximity, lessening the incentive for firms to free ride (Pincus 1975; Lavergne 1983; Hansen 1990; Trefler 1993).[1] Schonhardt-Bailey (1991, 38), for instance, contends that communications and transportation costs are less onerous for industries concentrated in a given region, enabling these firms to establish closer contacts and keep better tabs on each other's efforts to turn out the vote. Although these costs have surely declined in the "information age," the density of contacts among business groups is still greatest on a local scale. Indeed, because these regional clusters are more in tune with the concerns of suppliers and customers, they are better able to articulate their demands than are dispersed industries (Porter 1990, 154-9). Those who subscribe to this view thus expect a *positive* relationship between geographic concentration and import barriers.

A competing hypothesis posits that because geographically dispersed industries have broad political representation, their demands for protection are more likely to be granted (Pincus 1975; Caves 1976, 284; Esty and Caves 1983). As Rogowski (1997) explains, this "dispersed group" hypothesis obtains where the electorate votes across smaller single-member districts, but not where the electorate votes as a national constituency or where purer proportional representation

[1]This point is quite distinct from Olson's (1971) argument about group *size*, even though both variables speak to the capacity to organize and monitor collective action. Smaller groups are not necessarily more proximate, and vice-versa, a point which is not explicit in Olson (1971, see 46-47).

helps to smooth out the vote. In the United States, where this hypothesis is on solid footing, the expectation is that geographically dispersed industries are more likely to receive protection because of their greater political representation in Congress (McGillivray 1997). The dispersed group hypothesis, in contrast to the close group argument, focuses on the dynamics of representation in political institutions rather than the intensity of protectionist pressures on the part of industrial constituents. Those who subscribe to this view predict a *negative* relationship between geographic concentration and import barriers.

How do these hypotheses stack up in light of the evidence? The empirical literature sheds surprisingly little light on how to sign the geographic concentration variable or even whether this variable merits much attention in the first place. Some evidence supports the close group hypothesis. For example, in a study of administered protection in the United States, Hansen (1990, 36) reports that industries with operations in fewer states were more likely to have the International Trade Commission rule in their favor on escape clause, anti-dumping, and countervailing duty filings between 1974 and 1985. Milner (1997, 99) similarly shows that trade barrier reductions in the North American Free Trade Agreement (NAFTA) were smaller for geographically concentrated industries. Along these same lines, Moore (1996, 23-24, 30-31) argues that the declining political influence of the U.S. steel industry in the 1990s owed largely to the increasing geographic dispersion of this industry. Finally, in a study of corporate political action committees, Grier, Munger, and Roberts (1994, 918) find that geographically concentrated industries spent considerably less on campaign contributions between 1978 and 1986, likely because their close physical proximity bolstered their ability to vote as a bloc and thus to directly influence elected officials looking for returns at the ballot box.

Other evidence favors the dispersed group hypothesis. For example, in his seminal study of the U.S. Tariff Act of 1824, Pincus (1975) finds a strongly negative relationship between geographic concentration and protection. Similarly, Ray (1981, 116-117) demonstrates that geographic dispersion significantly increased NTB protection for U.S. industries in 1970, much as Lopez and Pagoulatos (1996, 244) find in the case of 44 U.S. food and tobacco manufacturing industries in 1987. Finally, in an important study of the free trade lobby in 19th century Britain, Schonhardt-Bailey (1991) reports that geographic dispersion of export industries most certainly gave the pro-liberalization side a greater number of voices in trade politics. However, she also finds that the key to the success of the pro-liberalization side was that it had a very loud voice in cotton textiles, the nation's "core" export industry, which was, by contrast, highly geographically concentrated.

Still other studies uncover little reason to put much stock in either hypothesis. For example, Caves' (1976, 294) article on Canada's tariff policy and Trefler's (1993, 145) analysis of U.S. NTBs find a positive but insignificant relationship between geographic concentration and protection. Conversely, Salamon and Siegfried (1977, 1038) and Esty and Caves (1983, 35) show that the relationship between geographic concentration and several measures of the political influence of industry is negative but more often than not insignificant. Reflecting on his own mixed results, Lavergne (1983, 154) concludes a widely cited study by insisting that the geographic concentration variable most likely "has no true impact at all…."

Three problems make it difficult to interpret the results reported in the literature. First, each of the studies above conflates political and economic geography. This is more than a little troubling, since the close group and dispersed group hypotheses tap quite distinct aspects of industrial location. After all, an industry clustered within a given region may be dispersed across

electoral districts, just as a geographically dispersed industry may be politically concentrated. For example, the "bolts, nuts, washers, and rivets" industry (SIC 3452) is geographically concentrated in the Midwest. Yet, since it is located in a heavily populated area with accordingly small electoral districts, this industry is spread relatively evenly across 100 U.S. House constituencies. On the other extreme, "ship building and repairing" (SIC 3731) is geographically dispersed along the Atlantic, Gulf, and Pacific coastlines, but 80 percent of its national employment is concentrated in just 25 House districts.[2] These examples reveal that geographic concentration is a poor proxy for political concentration, and vice-versa. By conflating the two concepts, the literature has confused the issue.

Second, most measures of geographic concentration are plagued by White's checkerboard problem: they ignore the spatial relationship among geographic units. This undermines tests of the close group hypothesis, which after all is based on the physical proximity of group members. To illustrate what is at stake, consider the "broadwoven fabric mills, cotton" (SIC 2211) and "instruments to measure electricity" (SIC 3825) industries. The conventional Herfindahl index—which ignores spatial proximity—ranks these industries almost identically in terms of their geographic concentration, suggesting that this variable would offer little insight into any differences in their levels of protection. Over 75 percent of 1987 national employment in the broadwoven fabric mills industry (54,500 workers) is located within a 200 mile radius of Clemson, SC. Yet less than 50 percent (41,846) of the nation's workforce in the other industry lies within 1200 miles of Centralia, KS, and the rest is evenly spread up and down the coasts. Strikingly, of the two industries, only broadwoven fabric mills is protected. But the critical difference between

[2]Readers can view maps of employment in these industries at http://userwww.service.emory.edu/~erein/research/geocon-appendix.pdf.

these two industries in terms of geographic concentration cannot be detected by methods used in existing studies.

Third, where political concentration receives any attention at all, the tendency is to test only for a linear relationship between this variable and protection. However, recent work on the optimal dispersion of interest groups and electoral redistricting suggests that the relationship might instead be non-monotonic (Cameron, Epstein, and O'Halloran 1996; Rogowski 1997). Further, political concentration may interact with industry size (McGillivray 1997), since large industries might benefit from being heavily represented in a given electoral district, even if smaller industries would do better if they were more evenly dispersed across districts (Snyder 1989). We test both alternative hypotheses.

3. The Model

This section sets out the model we use to explain the incidence of NTBs across a sample of 363 4-digit U.S. manufacturing industries in 1990.[3]

[3]The sample includes all 459 4-digit manufacturing categories in the 1987 Standard Industrial Classification (SIC) list, minus missing data (due almost entirely to the trade flow and trade policy variables described below). It is publicly available at http://userwww.service.emory.edu/~erein/research/#geocon. Expansion of the sample is constrained by lack of NTB data across time, limited subnational geographic employment data for other countries, and low-quality or missing industry concordances across time and countries.

Dependent Variable

Our dependent variable is a measure of NTBs which reports the *incidence* rather than the intensity of protection. It includes only "hard core" barriers, such as binding quotas, tariff quotas, voluntary export restraints, countervailing or antidumping duties, and outright prohibitions (Anderson 1996, 3, 13). The dummy variable *NTB* is measured in 1990 and is scored 1 if at least fifty percent of the 4-digit Harmonized Commodity Description and Coding System (HS) codes matching a given 4-digit Standard Industrial Classification (SIC) code are covered by such non-tariff barriers (0 otherwise).[4]

Our measure of protection focuses exclusively on NTBs and not tariffs for two related reasons. Specifically, given the substantial limits placed on tariffs by the General Agreement on Tariffs and Trade (GATT) in this period, U.S. protection was more likely to take the form of NTBs, which are estimated to have impeded imports far more than tariffs (Marvel and Ray 1983, 190-191; Trefler 1993, 154; Lee and Swagel 1997, 374). Also, as Ray (1981, 116) has shown, whereas tariffs significantly affect NTBs, NTBs have little influence on tariff levels. Thus, in line with the majority of cross-industry studies of post-Kennedy Round trade barriers, we proceed with tariffs as a right-hand side variable (see below) and *NTB* as our dependent variable.

[4]Whether a 4-digit HS code was covered by an NTB in 1990 was determined by Anderson (1996), as contained in the files "t_us_fin.asc" and "t_us_int.asc" from Feenstra, Lipsey, and Bowen (1997). Anderson's NTB measure in turn is an aggregate computed from data at the 6-digit HS level, originally obtained from the authoritative UNCTAD Trade Information System (TRAINS) database (Feenstra, Lipsey, and Bowen 1997, 36-37). The HS-SIC concordance was obtained in file "concord.dbf" from U.S. Bureau of the Census (1994b).

Independent Variables

Geographic Concentration. We quantify geographic concentration using *GEOCON*, a decreasing function of the distance from each employee to the national "centroid," or midpoint, for a given industry. *GEOCON* is based on highly accurate estimates of county-industry employment data for 1987.[5] Specifically, denote industries as i, $i \in \{1,2,\ldots,n\}$, counties as k, $k \in \{1,2,\ldots,m\}$, and the number of jobs in industry i in county k as j_{ik}. The latitude and longitude of the employment-weighted centroid of county k is the vector $\mathbf{p}_k = \left(p_k^{lat}, p_k^{long}\right)$.[6] The national employment-weighted industry centroid, calculated from county-industry employment data, is the vector $\mathbf{c}_i = \left(c_i^{lat}, c_i^{long}\right)$, where $\mathbf{c}_i = \dfrac{\sum_{k=1}^{m} \mathbf{p}_k j_{ik}}{m \sum_{k=1}^{m} j_{ik}}$. The distance from county centroid $\mathbf{p}_k$ to national industry centroid $\mathbf{c}_i$ is designated d_{ik}, where

$$d_{ik} = 3949.99 \cdot \arccos\left(\sin(|\, c_i^{lat} \,| \arctan(1)/45) \cdot \sin(|\, p_k^{lat} \,| \arctan(1)/45) + \cos(|\, c_i^{lat} \,| \arctan(1)/45)\right.$$

[5]Official employment figures for the detailed geography and industry units used here are partially unavailable for anonymity reasons. Accordingly we are compelled to estimate county-industry employment instead, using a procedure (McGillivray 1997, 594) whose output correlates highly with nonmissing official figures ($r = 0.946$). See http://userwww.service.emory.edu/~erein/research/geocon-appendix.pdf for more information.

[6]We use 1990 population weights and county border definitions (U.S. Bureau of the Census and Consortium for International Earth Science Information Network [CIESIN] 1998) because 1987 values are unavailable.

$$\cdot \cos(|\, p_k^{lat} \,| \arctan(1)/45) \cdot \cos\left((|\, c_i^{long} \,| \arctan(1)/45) - (|\, p_k^{long} \,| \arctan(1)/45)\right).^{7}$$

Geographic concentration can then be expressed as follows:

$$GEOCON_i = \frac{\sum_{k=1}^{m} f(d_{ik})\, j_{ik}}{m \sum_{k=1}^{m} j_{ik}}, \text{ where } f(d_{ik}) = \mathrm{e}^{-d/s}.^{8}$$

Several characteristics of *GEOCON* merit attention. First, this measure explicitly recognizes the spatial relationship among geographic units, not just the distribution of their internal characteristics, thus correcting White's checkerboard problem. Second, *GEOCON* is calculated from much less aggregated geographical units (counties versus states) and industry definitions (4-digit instead of 3-digit) than are most other studies' measures (Krugman 1991, 57-58). Third, *GEOCON* contains no missing industry data for each of the component geographical units, an important source of bias in other studies (Krugman 1991, 57). For these reasons, especially the

[7]We thank John Blodgett, CIESIN, for this distance expression.

[8]In our case, $s = 631.43$, or the mean distance from county centroid to national (non-industry-specific) centroid, chosen arbitrarily to scale the index so that extreme distances do not receive undue weight. The use of the exponent of negative distance, and not linear distance, makes *GEOCON* a measure of concentration rather than dispersion, and is suggested by White (1983, 1013). However, the results reported below are all substantively identical if *GEOCON* is alternatively calculated with $f(d_{ik}) = d_{ik}$. Hawaii and Alaska are excluded in all calculations for this variable, although, as it turns out, our results are not at all sensitive to their inclusion.

first, *GEOCON* is relatively uncorrelated with standard Gini- and Herfindahl-based measures, instead constituting a distinct—and, we argue, superior—concept of geographic concentration.[9]

Political Concentration. The variable *POLCON* measures the concentration of an industry's employment across electoral districts rather than economic geography. It also differs from *GEOCON* in that it is based solely on the internal characteristics of districts and not on the spatial relationships among them. The political geography used in constructing *POLCON* is the

[9]The Herfindahl index of geographic concentration is simply the sum of the squares of the county shares of national employment in that industry (Pearce 1992, 184). The Gini coefficient is $G_i = 1 + \frac{1}{m} - \frac{2}{m\sum_{k=1}^{m} j_{ik}}\left(\sum_{k=1}^{m} r_{ik} j_{ik}\right)$, where r_{ik} is the rank of county *k*'s employment when the counties are sorted in decreasing order of jobs (Pearce 1992, 172). The correlation of *GEOCON* with geographic concentration indexes using Herfindahl, Gini, and Krugman's (1991, 55-56) alternative Gini formulas, respectively, is a mere 0.311, 0.263, and 0.245 ($N = 453$). We should note that *GEOCON* does, however, fail to discriminate properly between highly dispersed industries and ones concentrated in only a few very distant locations. White's (1983, 1012, equation 4) alternative measure is superior to *GEOCON* on this score, but it is prohibitively expensive to compute in our case. For a random sample of 17 industries, though, the correlation between White's measure and *GEOCON* (using the exponent of negative distance) is $r = 0.871$ ($r = 0.978$ if both are computed using linear distance instead). In practice, then, few industries in our dataset exhibit the one kind of geographic concentration that *GEOCON* only weakly detects. For more information, see http://userwww.service.emory.edu/~erein/research/geocon-appendix.pdf.

House district in the 102nd Congress.[10] *POLCON* is a Herfindahl index of district employment for a given industry. Specifically, $POLCON_i = \sum_h \left(j_{ih} \Big/ \sum_h j_{ih} \right)^2$, where j_{ih} is the number of jobs in industry *i* in House district *h*. To get j_{ih}, we started with the county-industry employment estimates (j_{ik}) used for *GEOCON* and matched counties to House districts using area allocation ratios.[11]

Control Variables

Industrial Concentration. The variable *INDCON* measures the concentration of domestic market share across firms in a given industry. Specifically, *INDCON* is a Herfindahl index of the dollar value of the 1987 domestic shipments of the industry's 50 largest companies.[12] The relationship between *INDCON* and protection is widely debated. The more familiar hypothesis holds that because industrial concentration means a small number of significant firms, higher

[10]To the extent that legislators factored their constituencies' preferences into their decision-making on trade policy in 1990, they presumably were most concerned about the constituencies which they were aiming to win in the 1990 primary and general elections, which were 102nd Congress districts.

[11]Source: U.S. Bureau of the Census and CIESIN (1998). *POLCON* could alternatively be calculated using Senate districts (i.e., states) instead of House districts, or with a Gini instead of a Herfindahl index (see note 9). As it turns out, however, with no such variant of *POLCON* do our results differ substantively from those presented.

[12]This original Herfindahl index is divided by one thousand for ease of presentation of results. Source: U.S. Bureau of the Census (1998).

values on this variable imply lower transactions costs and greater rents to be had from import relief, such that *INDCON* should be positively related to *NTB* (Marvel and Ray 1983; Hansen 1990; Trefler 1993, 141; Grier, Munger, and Roberts 1994; Lopez and Pagoulatos 1996, 239). The lesser known hypothesis holds, on the contrary, that industrial concentration attracts the attention of regulators bent on increasing competition, or brands the industry as undeserving of import relief because of existing rents, such that *INDCON* should be negatively related to *NTB* (Salamon and Siegfried 1977, 1038; Ray 1981, 108, 116; Esty and Caves 1983, 30). The evidence has not consistently supported either hypothesis, more often than not revealing an insignificant relationship between industrial concentration and protection (Caves 1976, 286-287; Hansen 1990, 35-36). This may be partly because industrial concentration is often used as a proxy for geographic and political concentration. Our interest lies in whether industrial concentration exerts a more transparent effect when explicitly controlling for those other concentration variables.

Industry Size. The variable *SIZE* is national employment by industry in 1989, in tens of thousands.[13] The political influence of an industry is widely predicted to increase with its size because greater employment means more votes, thus improving the odds that an industry's demands for protection will be heard by officials vying for (re)election (Milner 1988, 259-260; Hansen 1990, 35; Lee and Swagel 1997, 378-379; but see Esty and Caves 1983; Trefler 1993, 145). Alternatively, *SIZE* might be negatively related to protection, reducing the workforce's ability to mobilize collectively or by raising the industry's profile in the eye's of consumers who oppose protection (Caves 1976, 284; Salamon and Siegfried 1977, 1032).

[13]U.S. Bureau of the Census (1997), file "asm_i2.dbf" (variable *emp*).

Trade Position. We gauge an industry's trade position with the variable *IMPEXP*, the ratio of import penetration to export dependence, based on 1989 data.[14] *IMPEXP* taps the extent to which an industry is threatened more by import penetration than it gains through exports. Higher values of *IMPEXP* are thus predicted to increase the likelihood of protection.

Hourly Wage. *WAGEHOUR* measures the average hourly wage of production workers by industry in 1989.[15] High wage industries are those with the greatest productivity and thus comparative advantage, so *WAGEHOUR* is likely to be negatively related to *NTB* (Lee and Swagel 1997, 378-379).

Tariff. The variable *TARIFF* is the trade-weighted average nominal tariff in 1990 for all 4-digit HS lines matching a given 4-digit SIC industry.[16] Many studies report that existing tariff levels are positively related to NTBs, implying that these are *complementary* forms of protection (Ray 1981; Marvel and Ray 1983, 195-196; Lee and Swagel 1997, 379). Other studies find,

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[14]No industry in our sample has zero export dependence, so *IMPEXP* is defined for all cases. See McGillivray (1997, 597) for a similar specification. The central results of the article are no different if import penetration and export dependence together are substituted for *IMPEXP* in the models reported in Table 1. Import penetration is imports (for domestic consumption only) over imports plus domestic shipments. Export dependence is exports (of domestic production only) over exports plus domestic shipments. Shipments data are from U.S. Bureau of the Census (1997), file "asm_i2.dbf" (variable *value*). Imports data are from U.S. Bureau of the Census (1994b), file "imp_comm.dbf" (variable *val_con_89*). Exports data from U.S. Bureau of the Census (1994a), file "exp_comm.dbf" (variable *value_89*).

[15]U.S. Bureau of the Census (1997), file "asm_i2.dbf" (variables *wages* and *hours*).

[16]For the source, see note 4 above.

however, that prior tariffs are negatively related to NTBs, suggesting that these are instead *substitute* forms of protection (Mansfield and Busch 1995). Evidence favoring either hypothesis is important in evaluating whether NTBs are "old wine in new bottles" or a new threat to trade liberalization.

Descriptive statistics on all of the variables are reported in Table 1.[17]

We estimate the following probit model:

$$\Pr(NTB_i = 1) = F(ß_0 + ß_1 GEOCON_i + ß_2 INDCON_i + ß_3 POLCON_i + ß_4 SIZE_i$$

$$+ ß_5 TARIFF_i + ß_6 IMPEXP_i + ß_7 WAGEHOUR_i + \overbrace{ß_8 POLCON_i^2}^{\text{Model II}} + \overbrace{ß_9 SIZE_i * POLCON_i}^{\text{Model III}}),$$

where $i \in [1,2,\ldots,459]$ (industries) and $F(\cdot)$ is the cumulative standard normal distribution.[18] All right hand side variables, except *TARIFF*, are measured at least one year before 1990 to avoid simultaneity. The expected effect of *GEOCON* and *IMPEXP* on *NTB* is positive; of *WAGEHOUR*, negative; and of *INDCON*, *SIZE*, and *TARIFF*, either positive or negative. In Models I-III, we include all those variables while varying the specification of the effect of *POLCON* on *NTB*. Model I tests for the positive monotonic relationship between *POLCON* and *NTB* that is widely hypothesized in the literature. Model II adds the square of *POLCON* to permit a non-monotonic (i.e., $\cap$-shaped) relationship, as posited in the literature on interest group

[17]Notable bivariate correlations are as follows: *GEOCON* with *POLCON*, $r = 0.344$ ($N = 363$), with *INDCON*, 0.139, with *IMPEXP*, 0.030, and with *SIZE*, -0.102; *POLCON* with *INDCON*, 0.479, with *SIZE*, -0.190, and with *IMPEXP*, -0.009; *INDCON* with *SIZE*, -0.023, and with *IMPEXP*, -0.040; *SIZE* with *IMPEXP*, -0.023.

[18]To limit collinearity in Models II and III without affecting the estimates for the other variables, we "centered" *POLCON* by subtracting 0.0921 (its 95th percentile value).

politics more generally (see Cameron, Epstein, and O'Halloran 1996). In Model III, we test for an interaction between *POLCON* and *SIZE*, enabling us to evaluate whether the electoral clout of industries concentrated in relatively few political districts varies with the number of votes their workforces represent (Snyder 1989).

4. Results

The results for Models I-III are reported in Table 1.[19] Overall, the models perform quite well. The pseudo R^2s range between 0.44 and 0.46. Tests reveal no problems with collinearity.[20] Heteroskedasticity tests are borderline positive in Models I and III and positive in Model II, so in Table 1 we report robust standard errors, which are consistent even under heteroskedasticity.[21]

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[19]These models were estimated with the *probit, robust* command in Stata 5.0. Model specification tests also drew on the *hetprob* and *reg* procedures.

[20]Specifically, OLS regression of each independent variable on all the others yields R^2 values that average 0.221, 0.259, and 0.282 for the three models, respectively, and which for no variable are greater than 0.506. ("Max collinearity R^2" in Table 1 lists the maximum such R^2 for the variables in the respective model.). Of all the variables, *POLCON*, *INDCON*, and *WAGEHOUR* exhibit the greatest collinearity, and (with one exception noted below) the estimates for these variables are quite stable to the inclusion or exclusion of the others.

[21]A heteroskedastic probit model with variance function conditioned on all independent variables reveals borderline or significant heteroskedasticity in *GEOCON* and *IMPEXP*. (Wald tests of the hypothesis that these two variables' variance coefficients equal zero yield $p = 0.064$, $p = 0.015$, and $p = 0.060$, respectively, for Models I-III, while failing to reject the hypothesis that the variance coefficients of the other variables are jointly equal to zero.). Re-estimated models with

[insert Table 1 about here]

The article's first objective was to disentangle political from geographic concentration. The dividends to doing so are clear, although Table 1 reveals that the relationship between *POLCON* and *NTB* is not as straightforward as the literature might have it. Take Model I, in which *POLCON* is tested by itself. Here, the variable is negatively signed in keeping with the dispersion hypothesis, but the coefficient is insignificant. In Model II, which includes *POLCON* as well as $POLCON^2$, there is no evidence of a $\cap$-shaped effect: both coefficients are insignificant. In Model III, which includes an interaction between *POLCON* and *SIZE*, we find not only a positive and highly statistically significant relationship between this interaction term and *NTB* ($p < 0.01$), but also a strongly negative coefficient on *POLCON* by itself ($p < 0.05$). This finding lends support for the dispersion hypothesis, qualified by the result for *POLCON*SIZE*, in that political concentration is not as detrimental for larger industries as it is for smaller ones. Notice further that the relationships we observe in Models I-III are insensitive to alternative measures of *POLCON*.[22]

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variance functions conditioned only on these two variables do not undermine the statistically significant results reported in Table 1 for *GEOCON*.

[22]In particular, we calculated Herfindahl and Gini indexes using both Senate (state) and House district units. All such variants of *POLCON* yield insignificant results in Models I and II and positive and significant interactions with *SIZE* in Model III. It is also worth noting that the *POLCON* results are reasonably robust to alterations in the coding of the dependent variable. That is, if we use a continuous version of *NTB* instead of the dummy variable (and use OLS), or if we make the threshold for the *NTB* dummy 0, 10, 20, 25, 30, 40, 90, or 100 percent instead of 50 percent, the findings from Models I-III remain unchanged.

Consider the substantive significance of *POLCON*. In general, it has a modest effect on NTBs, except in the case of a handful of unusually large industries. Figure 1 depicts the (Model III) predicted probability that $NTB = 1$, holding all other variables at their means, as *POLCON* and *SIZE* vary from their 10th percentile to 90th percentile values in the sample. Over this range, *POLCON* can change the probability of an NTB by only 2.2 percent when *SIZE* is at its mean, and *SIZE*, 9.8 percent.[23] Both *POLCON* and *SIZE* have skewed distributions, which complicates the interpretation of these results.[24] To facilitate interpretation we can calculate "tipping values" for both *POLCON* and *SIZE*, beyond which the marginal effect of the other variable is positive.[25] Increases in *SIZE* decrease NTBs for political concentration values up to 0.076, which amounts to 93% of the industries in the sample. Increases in *POLCON* decrease NTBs for industries with

[23]Over *POLCON*'s entire range, with mean *SIZE*, the maximum change in the probability that $NTB = 1$ is 27.3 percent; similarly, for *SIZE*, the figure is 12.8 percent.

[24]For example, 95 percent of the sample industries have a value of *POLCON* less than 0.088 and have less than $135{,}200$ employees. Yet the mean values for the cases in the top five percentiles for each variable are 0.173 and $238{,}611$, respectively.

[25]For tipping value $POLCON^*$, set $\hat{ß}_4 SIZE + \hat{ß}_9 SIZE * POLCON^* = 0$, so that $POLCON^* = -\hat{ß}_4 / \hat{ß}_9$. For tipping value $SIZE^*$, set $\hat{ß}_3 POLCON + \hat{ß}_9 SIZE^* * POLCON = 0$, so that $SIZE^* = -\hat{ß}_3 / \hat{ß}_9$. Taking the fitted values of the betas from Table 1 (and removing the "centering" from *POLCON*), $POLCON^* = 0.076$ and $SIZE^* = 2.7$, or 26,996 employees. The reader should be cautioned that these specific tipping values have meaning only in the context of this particular sample (1989 employment data). Whether these tipping points are stable across time, for instance, is a question that this study does not address.

up to 26,996 employees, which includes 59% of the industries in the sample. Only three of the 363 industries have values of both variables above these tipping points, and in only these cases do the variables together have a net positive predicted impact on NTBs.[26]

To sum up, these results suggest that most industries are better off when dispersed across electoral districts, although the benefits of political dispersion decline to nonexistence for moderate-sized and larger industries. Indeed, a handful of extremely sizable industries stand to benefit from greater political concentration. In addition, larger size reduces the prospects for protection in most industries, *ceteris paribus*.

[insert Figure 1 about here]

The article's second objective was to test the close group hypothesis more fully by using a measure of geographic concentration that solves the checkerboard problem. The relationship between *GEOCON* and *NTB* is positive and highly statistically significant ($p < 0.001$) across all three models, offering a ringing endorsement of the close group hypothesis.[27] This is impressive, given that these models already control for industry size, industrial concentration, and concen-

[26]NTBs are observed in just two of those three industries. It is worth noting that in those two cases *INDCON* takes on values well below average; hence the observed interactive effect of size and political concentration is not an artifact of industrial concentration.

[27]The strongly positive results for *GEOCON* hold up even if we modify the coding of the dependent variable to use a 0, 10, 20, 25, 30, 40, 50, 60, 70, 75, or 80 percent threshold instead of the 50 percent default for *NTB*, and even if we make *NTB* a continuous variable instead of a dummy (and use OLS).

tration across political geography.[28] The measure of geographic concentration we use makes all the difference: conventional indexes are insignificant when substituted for *GEOCON*, revealing the critical importance of correcting the checkerboard problem.[29] Also, *GEOCON*'s effect and significance in Models I-III does not change if the geographic units upon which it is based are states instead of counties. That is to say, 74 times more aggregation—with its consequent potential for bias—still does not smooth over the substantively important variation in *GEOCON* (Ellison and Glaeser 1997, 910-914).

GEOCON's effect on NTBs is substantively as well as statistically significant. Specifically, holding the other variables at their means in Model III, *GEOCON* can increase the probability of an NTB by up to 40 percent, making protection likely when it otherwise would be virtually im-

[28]It should be noted that, for Models I-III, adding controls for variables such as the following has *no effect* on the estimates for *GEOCON* (nor are such controls statistically significant themselves): (a) the 1987 number of firms in the industry (U.S. Bureau of the Census 1998); (b) the 1989 value of total shipments by the industry (U.S. Bureau of the Census 1997); or (c) whether the industry's products can be categorized as final or intermediate goods (Anderson 1996; Feenstra, Lipsey, and Bowen 1997, 36-37). In addition, the effect of *GEOCON* is not conditioned on industry size. For instance, if we interact *GEOCON* (centered to reduce collinearity) with *SIZE* in Model III, the coefficient of the interaction term is positive but not significant (one-tailed $p = 0.236$).

[29]In particular, Gini and Herfindahl indexes, as well as Krugman's (1991, 55-56) measure, all calculated using both state- and county-level data, yield mostly positive but wholly insignificant estimates in Models II and III (although a few of these alternatives cross the significance threshold in Model I).

possible.[30] This result is all the more striking given that the evidence bearing on geographic concentration has been so ambiguous to date. In addition, given *POLCON*'s very modest substantive effect, it appears that political geography is not nearly as important as simple economic geography in the politics of protection.

The evidence bearing on the control variables is also interesting. The strongly positive coefficient on *TARIFF* ($p < 0.01$) indicates that those industries already protected by tariffs are the ones most likely to receive NTBs, implying that these measures are complements. *INDCON* has a negative but statistically insignificant influence on NTBs in all three models. Like so much of the literature, we find that market share concentration has little bearing on endogenous sources of protection. Finally, both of the comparative advantage variables, *IMPEXP* and *WAGEHOUR*, carry the predicted sign, and each is statistically significant ($p < 0.05$) across all three models. Those industries that stand to lose more from imports than they gain from exports, and those which employ lower-skill labor, are the ones most likely to receive NTBs in this sample of U.S. manufacturing industries, controlling for the effects of political and geographic concentration.

[30]In comparison, holding all other variables at their sample means, the maximum predicted increase in the probability of *NTB* due to *TARIFF* over its sample range is 81.8 percent; due to *WAGEHOUR*, -14.4 percent; due to *IMPEXP*, 59.5 percent (if we exclude a single very high outlier value of that variable). If we only count variation from each variable's 10th percentile to 90th percentile values in the sample, the figures are *GEOCON*, 10.8%; *TARIFF*, 16.0%; *WAGEHOUR*, -8.2%; and *IMPEXP*, 1.5%.

5. Implications

The article began by setting out competing predictions about the relationship between industrial location and import barriers. The question is whether close physical proximity helps an industry secure protection by increasing its ability to act collectively, or whether it instead parochializes the industry, squandering votes on a suboptimal number of electoral districts. Our findings reconcile these competing claims. Surprisingly, both the close group and dispersed group hypotheses get part of the story right, although not for reasons they would identify.

The explanation is as follows. First, studies of endogenous protection should disentangle political from economic geography. Strikingly, if we conflate the two concepts and regress NTBs on only *POLCON*, as prior studies do, *POLCON* takes on a positive coefficient and remains insignificant. Only when geographic concentration is included separately does *POLCON*'s true empirical significance reveal itself. Second, measures of geographic concentration must account for the spatial relationships among the units. Existing measures, all of which fail to do this, yield insignificant results when substituted for *GEOCON*. This is why prior studies have typically reported ambiguous findings on geographic concentration and why the results here are unusually powerful.

How should the findings for political concentration be interpreted? We contend that the dispersion hypothesis is substantially correct. Most industries are better off with employment dispersed across as many electoral districts as possible (while maintaining high geographic concentration). Too much political concentration results in "converting the saved" in Congress, squandering the industry's voting power where it is not needed to sway the hearts and minds of elected officials (Magee, Brock, and Young 1989, 97-99). This jibes with the so-called "defense industry strategy," whereby contractors locate plants around the country to buy votes in support of up-

coming contracts. The twist here is that a few very large industries stand to benefit from concentrating in fewer districts than would be optimal for small industries. Industries employing an enormous workforce can dominate the agenda of their elected representatives while not detracting from their influence in other districts (since they are larger than average), constituting a winning coalition or an effective veto player (Snyder 1989).[31]

Yet this mechanism only works for a handful of extremely large industries. The surprising and more general implication is that having a larger workforce reduces an industry's influence. In our view, this strongly supports the Olsonian argument that larger groups have greater difficulty acting collectively. Size may also engender consumer opposition to protection (Caves 1976, 284; Salamon and Siegfried 1977, 1032). It could be, of course, that an industry grows large precisely because it is efficient and competitive and therefore not desirous of protection. However, larger industries disproportionately compete more against imports than they export, casting doubt on this argument.[32] Swaying votes in Congress is therefore more a matter of solving collective action problems than of boasting a lot of potential votes *per se*. In other words, how well a group is able to organize, rather than its sheer size, is what counts.

How should the geographic concentration result be interpreted? We believe this finding constitutes unwavering support for the close group hypothesis. Of course, the exact mechanisms by

[31]McGillivray (1997, 601-602) finds in contrast that large, politically *dispersed* industries exhibit more protection than large, concentrated ones. Our results may differ due to the separate inclusion of geographic concentration. However, we do not wish to make too much of our differences with McGillivray on this point, since in both cases the interaction effect findings are tentative, driven by only a handful of industries (as noted above).

[32]See note 17.

which spatial proximity generates political influence can only be inferred from our evidence, since we do not directly observe the causal process but only the result (i.e., protection). We believe geographic concentration has several critical instrumental effects, however. For instance, close physical proximity enables face-to-face communication, the most effective means of information exchange. It provides a basis for dense social networks which promote the sharing of knowledge and, as a result, collective action (e.g., Galaskiewicz 1985). And it may bolster the formation of a common identity in the process. For these reasons, geographic concentration also means that workers and managers in different plants face lower transaction costs in organizing for the purpose of turning out the vote. They should thus be more able to monitor the political efforts of others in their industry and to sanction undercontributors. The result is a greater ability to convert protectionist preferences into policy. The empirical association we find supports this argument, which can only be validated, moreover, by correcting the checkerboard problem.

Our claims about the instrumental effects of geographic concentration resonate with a variety of studies having little to do with trade protection. For example, Tilly (1973) argues that physical closeness among members of a group makes collective action more likely. Mizruchi and Koenig (1991) demonstrate that geographic proximity increases the chance that firms in an industry will cooperate to make campaign contributions. And Caldeira and Patterson (1987, 968-969) establish that a factor as simple as the physical proximity of members' seats in a legislature increases those members' political friendship and thereby joint action—even when controlling for initial levels of friendship. Such studies lend support to a close group interpretation of this article's findings about *GEOCON*.

Nevertheless, we are obliged to consider alternative explanations for the demonstrated association between geographic concentration and protection. One could argue, for example, that

geographically concentrated industries disproportionately receive protection because they might be less competitive, not because of the spatial proximity of their firms and workers. Or one might argue that protection itself causes concentration, rather than the other way around. Neither argument is borne out by the evidence. The data in our sample indicate that geographically concentrated industries are *not* less competitive.[33] More generally, economic theory and evidence suggest strongly that industries exhibiting geographic concentration are capitalizing on economies of scale, which makes them *better*, not worse, trade performers (Porter 1990; Hanson 1998). And while geographic concentration is certainly affected by market size (and hence protection), a number of studies have demonstrated that reductions, not increases, in protection raise geographic concentration (see Amiti 1998).[34] Hence there is no reason why geographically concentrated industries would *ceteris paribus* prefer greater protection.

Another competing explanation is that assets of productive factors may be more specific for geographically concentrated industries (Shafer 1994, 39-45; Moore 1996, 24). For example, getting a local job may be more difficult for an unemployed worker in a region dominated by

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[33]*GEOCON* is not significantly correlated with *IMPEXP*, plain import dependence, or *WAGEHOUR* ($r = 0.030$, $r = -0.057$, and $r = -0.033$, respectively, with no $p < 0.280$; $N = 363$).

[34]It is true that our study, as a single cross-section, does not by itself eliminate the possibility that many of these NTBs were in place for a long time before 1990, possibly preceding (if not causing) the geographic concentration with which they are associated. However, as Krugman (1991, 60-63) argues, the localization of industry is path-dependent and "sticky," and U.S. industries in particular were, if anything, more concentrated during the formation of these NTBs, not less (Kim 1995), which is consistent with our explanation, and not the alternative.

single manufacturer. If so, then asset specificity, and not *GEOCON*'s effect on transaction costs impeding collective action, could explain our results. Since we lack a good measure of asset specificity, we are unable to empirically reject this alternative interpretation. However, we find this argument theoretically less compelling than the close group hypothesis. In particular, just because an industry is geographically concentrated does not mean that it is the only game in town.[35] The vast majority of geographically concentrated U.S. manufacturing industries are centered in the same area, the industrial heartland from Missouri through Ohio.[36] Indeed, economists have theorized that labor market pooling contributes substantially to industrial localization (Krugman 1991, 38-43). Far from making assets more specific, geographic concentration may thus increase the ease with which one productive factor is put to another use. In this sense, we submit that the close group hypothesis provides a better explanation of the observed relationship between geographic concentration and protection.

Another implication of our findings concerns industrial concentration. Following Olson's (1971) group size claim, an industry with fewer important firms may exhibit greater collective action and, hence, protection, but this is an entirely different argument from the close group and dispersed group hypotheses. The literature has too often used industrial concentration as a proxy for geographic and political concentration, despite the fact that *INDCON* is not highly correlated with *GEOCON* and only moderately with *POLCON*. More telling still, if we do not include

[35]*GEOCON*'s correlation with the number of firms in an industry is negative but very low ($r = -0.116$, $N = 453$). *GEOCON* likewise exhibits little relationship with industrial concentration ($r = 0.132$, $N = 443$).

[36]The national industry centroids of the top third of all industries sorted by geographical concentration are only an average of 310 miles from each other.

POLCON in our regressions, *INDCON* becomes statistically significant, a sign of the pitfalls inherent in substituting one for the other. When variables appropriate to each separate concept are included in a single model, industrial concentration washes out, consistent with some prior studies (Caves 1976, 286-287; Hansen 1990, 35-36). Apparently the problem of cooperation among larger numbers of firms is dominated by the greater difficulty of encouraging cooperation among physically dispersed actors—even if many of those actors are tied to one or a few firms.

In addition to shedding new light on an old debate, our findings raise some new questions for further research. First, the formation and articulation of protectionist preferences among workers and managers, levels of unionization, representation through peak associations, lobbying, and voter turnout may well vary with geographic concentration, offering telling insights into the political activities of industry with respect to trade policy. While our paper can only hint at these issues, it points the way for future research on the political effects of geographic concentration.

Second, how does industrial location affect protection in countries with electoral systems that differ from the single-member districts characteristic of the United States (McGillivray 1997; Rogowski 1997)? Recall that electoral institutions only reflect the *political* component of industrial location. Our findings indicate that economic geography matters much more. Geographic concentration can be expected to increase protection regardless of electoral rules. Indeed, others have found some initial support for this hypothesis (Milner 1988, 260). Comparative studies equipped with measures of both political and geographic concentration may provide invaluable insights along these lines. Particularly encouraging is our finding that geographic concentration need not be measured using very fine units of analysis, since state-level data produces much the same answer as county-level data. Those with more limited sub-national data in hand should thus not be deterred by concerns about aggregation bias.

Third, will the increasing geographic concentration of industry in Western Europe and North America reshape trade politics among the advanced industrial states (Rogowski 1997)? The new trade theory suggests that increasing returns to scale drive more international trade, but increasing returns also foster geographic concentration (Krugman 1991). The question is thus whether greater concentration will offset the gains from further trade integration that might otherwise be achieved.

6. Conclusion

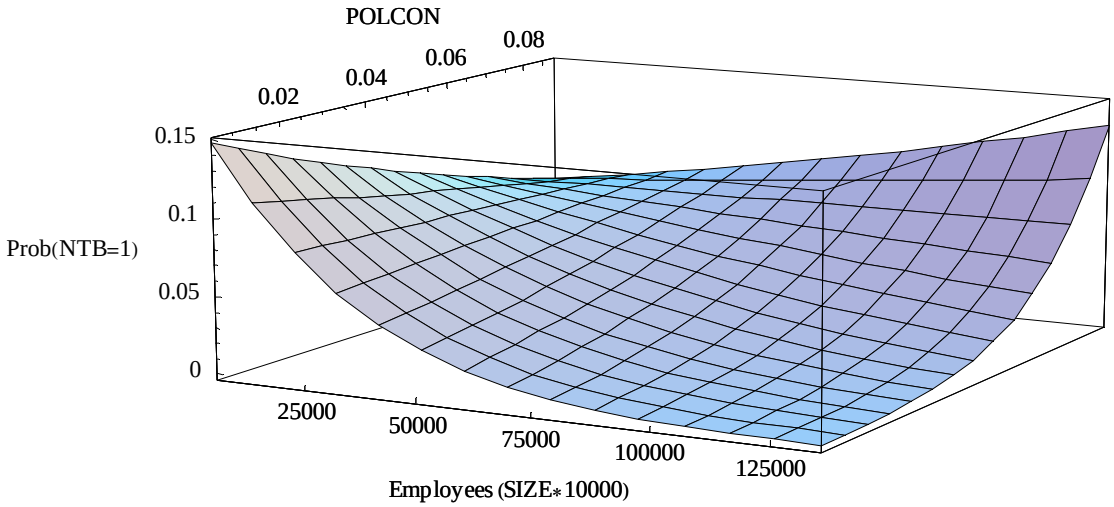
Three problems cast doubt on the findings reported in the endogenous protection literature. First, geographic concentration is widely taken as a proxy for political concentration, although these two variables hardly work in lockstep. Second, measures of geographic concentration typically ignore the spatial relationship among the units (i.e., counties or states), and thus fail to account for the proximity of regions home to lumpy industries. Third, in those few studies in which political concentration receives any direct attention at all, non-monotonic effects and interaction terms are seldom tested, despite their grounding in theories of interest group politics more generally. We correct all three problems and find that geographically concentrated but politically dispersed industries are the ones most likely to receive relief from imports, although very large industries benefit from being politically concentrated. The article thus reveals how to reconcile the two competing hypotheses around which one of endogenous protection theory's most enduring debates has taken shape.

Table 1. Estimates of Three Probit Models of NTBs (US, 4-Digit SIC Industries, 1990)

$\text{Prob}(NTB_i = 1)$	**Model I** Monotonic in *POLCON*	**Model II** Non-monotonic in *POLCON*	**Model III** *POLCON* interacts with *SIZE*	Mean ± SD, Min–Max 0.110±0.314, 0–1
Constant	-3.181* (0.811)	-3.042** (0.944)	-2.970** (0.800)	—
$GEOCON_i$	4.733** (1.118)	4.425** (1.123)	4.117** (1.063)	0.438±0.108, 0.194–0.790
$INDCON_i$	-0.468 (0.264)	-0.514 (0.270)	-0.348 (0.244)	0.704±0.629, 0.004–2.894
$POLCON_i$	-2.147 (3.243)	0.050 (4.242)	-6.820* (3.167)	0.029±0.041, 0.003–0.351
$POLCON_i^2$	—	-19.490 (22.240)	—	0.003±0.010, 0.000–0.124
$SIZE_i$	0.022 (0.015)	0.025 (0.015)	0.041* (0.019)	4.096±5.782, 0.070–43.090
$POLCON_i*SIZE_i$	—	—	2.526** (0.811)	0.076±0.117, 0.002–1.387
$TARIFF_i$	13.798** (3.344)	13.812** (3.390)	13.828** (3.386)	0.052±0.040, 0–0.244
$IMPEXP_i$	0.031* (0.016)	0.030* (0.016)	0.031* (0.016)	4.29±26.16, 0.01–486.85
$WAGEHOUR_i$	-0.112* (0.061)	-0.105* (0.060)	-0.119* (0.061)	10.578±2.804, 4.957–17.870
No. of observations	363	363	363	—
LL (restricted)	-125.931	-125.931	-125.931	—
LL (unrestricted)	-70.398	-70.149	-68.408	—
% correctly pred.	94.2	93.9	93.7	—
Pseudo-R^2	0.441	0.443	0.457	—
Max collinearity R^2	0.400	0.506	0.455	—

Robust SEs in parentheses. * denotes $p < 0.05$, ** $p < 0.01$. 2-tailed *p* for *INDCON*, *TARIFF*, *POLCON*, *SIZE*, and *POLCON*SIZE*; 1-tailed *p* for all others. Descriptive statistics do not incorporate the centering for *POLCON* used in Models II-III.

Figure 1. Impact of Political Concentration (*POLCON*) on Predicted Probability of NTBs, Conditional on Industry Employment (*SIZE*).



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