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TESTING PROTECTION FOR SALE IN THE FOOD INDUSTRIES

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Abstract

This paper tests the Grossman-Helpman Protection for Sale model using panel data from U.S. food processing industries with endogenous protection, import penetration, and political campaign. The results support the key predictions of the model: organized industries are granted higher protection that decreases with import penetration and the price elasticity of imports. Furthermore, the presence of import quotas raises the level of protection substantially. The estimated weight on aggregate welfare is strikingly similar those found by Goldberg and Maggi (1999) and Gawande and Bandopadhyay (2000), implying that protection is not for sale in these industries.

Key words: trade protection, political economy, food manufacturing, lobbying, politics

JEL codes: F13, F1, L66, C52

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TESTING PROTECTION FOR SALE IN THE FOOD INDUSTRIES

Introduction

The most influential of the last wave of conceptual models of the political economy of trade policy is the "Protection for Sale" model developed by Grossman and Helpman (1994, henceforth G-H). Its main contribution is to provide micro-foundations to the behavior of policymakers and organized lobbies and crisp predictions of the determinants of the structure of trade protection. So far, however, only two studies have explicitly tested its predictions (Goldberg and Maggi, 1999, henceforth G-M; Gawande and Bandyopadhyay, 2000, henceforth G-B).

Both G-M and G-B attempt to deal with two weaknesses of their data. One is the use of coverage ratios to measure trade barrier protection. Another is the use of external information on the price elasticities of imports, taken from Shiells, Stern and Deardoff (1986). In addition, both studies use cross-section rather than panel data, which provide a picture of protection at a given point in time. [1]

This article tests the "Protection for Sale" model using panel data from the U.S. food processing industries at the 4-digit SIC level (more disaggregated data than previous studies). It also uses actual tariff rates and import-quota tariff equivalents instead of NTB coverage ratios as well as import elasticities estimated within the same model and data. Finally, this article also presents further results separating out the impact of tariff vs. import quotas to assess the impact of instrument choice on the level of protection. The results provide further support for the G-H model and the estimated welfare weights are consistent with those estimated by G-M and G-B.

The Protection for Sale Model

In the G-H model (summarized here only for exposition purposes), politicians value both the total level of political contributions and the aggregate well-being of the population. The latter can be expressed either net (excluding) or gross (including) of contributions. As in G-M, the government's objective function (U^G) is assumed to be a linear, weighted average of general welfare *(W)* (net of contributions) and contributions by lobbies ($C_i = 1,...,n$ sectors):

$$U^G = \theta W + (1-\theta)\sum_{i \in L}^{n} C_i \,, \tag{1}$$

where $\theta \in [0,1]$ is the weight given to general welfare vs. campaign contributions, L represents the set of politically organized sectors, and W includes tariffs and represents the sum of indirect utilities over all sectors, organized and unorganized. Using the concept of "truthful" contributions under the framework of Berheim and Whinston (1986), let W_i, the welfare of the organized sector i, replace C_i in equation (1) to obtain the first-order conditions with respect to tariff rates (t_i):

$$\frac{t_i}{1+t_i} = \frac{I_i - \alpha_L}{a + \alpha_L}\left[\frac{Z_i}{e_i}\right], \tag{2}$$

where t_i is an ad valorem tariff rate in industry i, I is a dummy variable equal to 1 if the industry is politically organized (0, otherwise), α_L is the proportion of the population represented by a lobby, $a = (\theta/(1-\theta))$ is the weight the government attaches to general welfare (gross of contributions) in relation to total contributions, Z_i is the ratio of domestic output to imports, and e_i is the absolute value of the price elasticity of import demand.

From (2), the G-H model yields two crisp predictions to be tested: (1) industries that are not politically organized face negative rates of protection while industries that are organized are granted protection; (2) for the protected industries, the level of protection is negatively related to the price elasticity of imports and to import penetration. The result that protection levels are inversely related to import penetration is, of course, contrary to the traditional view of trade protection (e.g., Anderson, 1980; Lee and Swagel, 1997).[2]

Empirical Model

Equation (2) provides the basis for empirical specification. Adding an error term ε_i to make the equation stochastic, the empirical analogy of equation (2) is

$$\tau_i = \frac{t_i}{1+t_i} = \delta(Z_i / e_i) + \gamma I_i (Z_i / e_i) + \varepsilon_i, \tag{3}$$

where $\delta = -\alpha_L / (a + \alpha_L)$ and $\gamma = 1/(a + \alpha_L)$. Note that according to the G-H model, it is expected that $\delta<0$, $\gamma>0$ and $\delta + \gamma > 0$. From δ and γ one can derive the weights on aggregate welfare net or gross of contributions (θ and a, respectively). Note also that there are only three explanatory variables: Z_i, e_i, and I_i.

Recent work has underscored the necessity of endogenizing import penetration (the inverse of Z_i) in the determination of trade barriers (Trefler, 1993; Lee and Swagel, 1997). We use a modified Armington model, both to endogenize import penetration and to estimate the price elasticity of imports (Reinert and Roland-Holst, 1992; Blonigen and Wilson, 1999):

$$\ln\left(\frac{1}{Z_i}\right) = \ln\left(\frac{M_i}{X_i}\right) = \beta_0 + \ln\left(\frac{P_{di}}{P_{mi}}\right)[\beta_1 + \beta_2 \ln t] + \sum_{i=3}^{n} \beta_i \ln V_i + u_i , \qquad (4)$$

where P_{di} / P_{mi} is the domestic to import price ratio, t is a trend variable and V_i represents other variable shifters, β_i's are parameters to be estimated, and u_i is an error term. The price elasticity of import demand (in positive values) is given by $e_i = [\beta_1 + \beta_2 \ln t]$. Thus, the right hand side variables in this equation consist of the domestic to import price ratio, a trend variable shifter, and the annual rate of change of the industry value of shipments, which represents a proxy to the business cycle (Field and Pagoulatos, 1998). Finally, in this article, political organization is taken as given. Several attempts to endogenize I_i failed to provide additional information or improve the results.[3]

The Data

Annual time series data (1978-92) from 34 food processing industries at the 4-digit 1972 SIC level were used to operationalize the empirical model. Due to data availability limitation constraints, the 1972 (instead of the 1987) SIC definitions were used. Data translation tables were used for the cases where only the 1987 SIC or USITC data were available. Finally, a handful of industries were excluded due to missing data on import prices.

The values of imports at the 4-digit SIC level were taken from Feenstra (1996). Average tariff rates were computed by dividing total duties collected by CIF import values from a tape supplied by the US International Trade Commission (1978-90) and its website (dataweb.usitc.gov) for 1991-92. Tariff-rate equivalents were used for industries protected by import quotas (sugar, meat packing, and the dairy industries). The tariff-rate equivalents were taken from two reports of the U.S. International Trade Commission (1990a, 1990b) and a U.S. Department of Agriculture (1994) report.[4]

The variable Z_i was computed by dividing the value of domestic output by the value of imports deflated by their respective (output and import) price indexes. The NBER data-base on manufacturing productivity by Barstelman and Gray (1996) provided the values of domestic output and associated output price indexes.

Data on import prices at the 4-digit SIC level are not readily available. However, the FAO website and Foreign Agricultural Trade (USDA, various years) databases provided data on quantity and price for most processed agricultural products. Import price indexes were constructed by aggregating products by SIC definitions and by weighting available quantity and price values.[5]

Following G-M, the political action committee (PAC) campaign contributions to congressional candidates were used to construct the political organization variable I_i by assigning PAC contributions to 4-digit SIC codes. The PAC data came from four reports of the U.S. Federal Election Commission (1978-94) encompassing election cycles. Then the ratios of contributions over total food-industry contributions were calculated for the 1978-92 period and sorted in an ascending order. The variable I_i took a value of zero for the first (lowest) quartile of observations to represent unorganized sectors/years combinations and took a value of 1 for the remaining observations.

Once all the data were operational, equations (3) and (4) were estimated simultaneously using nonlinear 3SLS and the SHAZAM 7.0 software. Note that import penetration is endogeneous and e_i is an explanatory variable in the tariff equation. The estimation was first carried out at the single industry level in order to obtain estimates of the price elasticity of demand for each industry. Then equation (3) is re-estimated with pooled data including import elasticity estimates. An extended model includes a dummy variable for industries protected by import quotas to assess the impact of policy instrument choice on the level of protection.

Empirical Results

Table 1 presents the estimates for price elasticity of imports for each industry, obtained via the joint estimation of equations (4) and (5). Table 2 presents the welfare weight parameters for single industries while Table 3 presents the pooled results for all industries in the sample.

Note that the estimated import price elasticities vary with time $(\hat{e}_i = \hat{\beta}_1 + \hat{\beta}_2 \ln t)$ and that only their mean values are presented in Table 1. Only four out of 34 industry coefficients did not have the expected sign.[6] The results for those four industries are not presented and they were also excluded from the pooled estimation. Of the 30 industries that have the expected sign, 23 mean elasticity coefficients (77%) were statistically significant at the 95% level. Thus, the results appear plausible in terms of the signs and magnitudes of the price elasticities of import demand.

Table 2 shows the parameter estimates for δ and γ for each industry. Since the estimated δ is generally negative while the estimated γ is positive, the results confirm expectations. Among the organized industries, it is of interest to assess the weight the government attaches to aggregate welfare (θ) compared to campaign contributions ($1-\theta$). Two tests of the welfare weight were conducted. The first test hypothesized that the government does not care about welfare. In 93% of the cases, the null hypothesis that $\theta = 0$ was rejected at the 95% level. The second test, which hypothesized that the government is a pure welfare maximizer (θ = 1), yielded mixed results. The null hypothesis was rejected in 40% of the industries.

The results from the pooled data of 30 food industries are summarized in Table 3. A second version of the model included a dummy variable indicating the presence of a non-tariff barrier (i.e., an import quota). As Lopez and Pagoulatos (1996) found, the use of import quotas might result in higher levels of protection, as their use may be more politically expedient than the more transparent tariff rates.

All coefficients are statistically significant at the 95% level. The results also coincide with the predictions of the G-H model, i.e. $\delta<0$, $\gamma>0$ and $\delta+\gamma>0$, meaning that organized sectors receive protection and unorganized sectors are taxed. G-M found weak support for the latter results with respect to unorganized sectors. Clearly, protection positively varies with (Z_i / e_i) in the organized sectors. These results provide further support for the fundamental predictions of the G-H model beyond the single-industry results.

From the above parameter estimates, the implied weight (θ) that the government attaches to aggregate welfare is 0.9987, quite close to the one found by G-M for the U.S. manufacturing sector (0.986) and the one that can be imputed from G-B's results (0.9997).[7] It is remarkable that all these three studies yield quite similar weights on net aggregate welfare vs. campaign contributions, suggesting that protection is not for sale.

The null hypothesis that the government does not care about aggregate welfare $(\theta = 0)$ was rejected at the 5% level. An alternative test (H_0: θ = 1), suggesting that the government is uninfluenced by campaign contributions, was also rejected at the 5% level. Judging from the magnitude of the welfare weight, the government mostly cares about general welfare in setting commercial policy. Judging from the hypotheses tests, the government is sensitive to both aggregate welfare and campaign contributions.

The relative weight placed on aggregate welfare is rather large ($a = 776$) but lower than the one found by G-B for the whole manufacturing sector (3175). As rightly observed by G-B, high values of a imply that the relative weight placed on gross aggregate welfare versus the weight placed on campaign contributions is close. However, a high value of a is a necessary but not a sufficient condition for such a conclusion.[8]

When the basic G-H model is augmented with the import quota dummy variable, the parameter estimates δ and γ display the same coefficient signs, though somewhat lower in magnitude. The welfare weights continue to be significantly different from 0 and θ significantly different from 1 at the 95% level. Thus, the results continue to support the G-H model predictions. The quota-dummy coefficient is statistically significant, indicating policymakers' bias towards raising the level of protection where an import quota is in place.[9] More specifically, given that other conditions remain the same, the government will increase trade protection by 80% when using an import quota in lieu of a tariff.

Summary and Conclusions

This article tests the predictions of the Protection for Sale model for the structure of protection in the U.S. food processing industries using more direct measures of tariff rates and more disaggregated data than previous work, namely the studies by Goldberg and Maggi (1999) and Gawande and Bandyopadhyay (2000). In addition, the price elasticity of imports is determined within the same model and (panel) data.

The empirical results for both single industries and pooled data strongly support the key predictions of the G-H model with regard to the structure of trade protection. Organized sectors are granted protection while unorganized sectors suffer negative protection (the latter found only weakly in Goldberg and Maggi's study). Unequivocally, protection is negatively related to import penetration and the price elasticity of import demand within the organized sectors.

From the pooled results, the parameter estimate for θ is close to its upper limit (around 0.998) and is between the one found by Goldberg and Maggi (0.986) and the one imputed from Gawande and Bandyopadyay (0.9997), indicating that the government places a heavier weight on aggregate welfare net of contributions vis-à-vis campaign contributions. The parameter estimate for a is large (between 776 and 2006) and in the same range as the one presented by Gawande and Bandyopadhyay (3,175).

The results from all three studies still beg the question raised by G-B as to why empirically the G-H model yields such high weights on aggregate welfare, suggesting that protection is not for sale. A particular assumption that is at odds with empirical observation is the one on "truthful contributions" which implies that industries render all welfare gains from trade as campaign contributions. For example, trade policy benefits to the U.S. food industries have been estimated at approximately $32.9 billion in 1987 (Lopez and Pagoulatos, 1994) while these industries contributed only $8.2 million to congressional candidates in the 1987-88 election cycle. Industry welfare gains were, therefore, about 4,000 larger than campaign contributions.

Footnotes

[1]G-M present several specifications to correct for heteroscedasticity for their NTB coverage ratios. G-B focus instead on error-corrections for the import price elasticities. While G-M use cross-section data for the manufacturing sector at the 3-digit SIC level, G-B use 4-digit SIC data for 1983.

[2]Likewise, Trefler (1993) finds that the growth of import penetration leads to higher levels of protection. Grossman and Helpman argue that this and other similar results are due to ignoring the price elasticity of imports and point out the lack of theoretical underpinning guiding those results.

[3]The specification of the discrete variable for political organization is given below. To endogenize that variable, an additional equation was specified based on the work of Mitra (1999), Grier (1991) and others who emphasize industrial concentration, capital stock, geographic dispersion, and employment characteristics. Because of the failure to improve and in some cases the deterioration of the results of interest for the sample at hand, political organization is taken as exogeneously determined. A related issue for estimation involving a single industry is that the political organization variable is often constant ($I_i = 0$ or $I_i = 1$) during the time span considered, collapsing the estimation in (3) to one parameter (δ or $\delta + \gamma$).

[4]We are grateful to Frederick Nelson of USDA's Economic Research Service for providing updated data on tariff-rate equivalents of import quotas.

[5]We are grateful to professors Elena Lopez and Emilio Pagoulatos for furnishing their import price indexes for the 1972-87 period. These price indexes were extrapolated adopting their methodology (Lopez and Pagoulatos, 2001).

[6]The exceptions are Condensed and Evaporated Milk (SIC 2023), Cane Sugar Refining (2062), Bottled & Canned Soft Drinks (2086), and Flavor Syrup Extracts (2087).

[7]From the G-H model, the government's objective function is $G = C + aW$, which is equivalent to $\tilde{G} = a_1 C + a_2 (W - C) = (a_1 - a_2)C + a_2 W$ with $a = a_2 /(a_1 - a_2)$ provided that $a_1 > a_2$. This is the interpretation followed by G-B. Since a is unbounded but homogeneous of degree zero with respect to the scale of a_1 and a_2, a sensible assumption is to follow G-M and normalize a_1=1 and let $a_2 = \theta$ provided that $1 > \theta$ (a restatement of $a_1 > a_2$). Thus, $\theta = a/(1+a)$ is used to calculate the weight to be compared to G-M.

[8]Following the notation in footnote 7, if $a_1 = a_2 + \varepsilon$, then $a_1 - a_2$ is quite small relative to a_2, leading to a large relative weight a as G-B found. This is equivalent to saying that $1-\theta$ is small. The upper limit of a is not bounded and large values of a could be taken, as G-B did, as evidence of nearly equal importance of campaign contributions vs. aggregate welfare gross of (including) campaign contributions. However, campaign contributions appear in both terms whose weight we are trying to assess. Using the term a makes it confusing to test pure aggregate welfare maximization on the part of the government (a rejection of any kind of protection for sale). Thus, θ is taken as the reference weight to test the protection for sale hypothesis.

[9]As in G-M and G-B, this article does not address the problem of policy instrument choice (tariff vs. quota). In previous estimations, the quota dummy variable was introduced in alternative ways such as a slope shifter (of Z_i/e_i) or as a weight shifter.

The results presented in Table 3 are more plausible. One fact that hampered endogeneous estimation of the quota dummy was the sparcity of data, as import quotas were used in only a handful of industries. According to the Chicago School, policy instrument choices are driven by efficiency considerations, as in the use of quantitative restrictions for commodities that have a relatively low elasticity of demand (vs. supply elasticity), as argued by Gardner (1987). This is certainly the case in sugar and dairy products in the sample, both of which are protected primarily through import quotas.

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Table 1. Parameter Estimates for Import Elasticities

SIC	β_1	T-value	β_2	T-value	Mean Elasticity (e_i)	T-value
2011 Meat Packing Plants	0.5886	6.793	-0.1287	3.786	0.3492	3.4714 ***
2013 Sausage & Prepared Meats	0.4583	3.661	-0.0327	1.984	0.3975	15.543 ***
2016 Poultry Dressing Plants	0.7016	0.958	0.0845	0.874	0.8587	12.995 ***
2017 Poultry & Egg Processing	1.1354	11.890	0.1124	1.427	1.3445	15.294 ***
2021 Creamery Butter	1.7121	10.258	-0.5068	7.899	0.7694	1.941 ***
2022 Cheese, Natural and Processed	0.8480	2.443	0.1850	6.731	1.1920	8.242 ***
2026 Fluid Milk	0.7513	2.738	-0.1042	1.621	0.5574	6.839 ***
2032 Canned Specialties	2.1309	6.776	0.4199	4.348	2.9118	8.869 ***
2033 Canned Fruits & Vegetables	2.3506	5.105	-0.6992	3.984	1.050	1.921 **
2034 Dried & Dehydrated Fruits & Vegetables	1.2118	2.862	-0.2453	3.209	0.7556	3.940 ***
2035 Pickled Sauces & Salad Dressing	-11.307	6.660	7.0116	7.451	1.7342	0.316
2037 Frozen Specialties	7.2622	8.154	-3.2271	7.215	1.260	0.499
2041 Flour & Grain Mill Products	0.3353	1.835	-0.0508	1.902	0.2408	6.062 ***
2043 Cereal Preparations	3.7768	8.110	-1.3864	8.304	1.1982	1.105
2044 Rice Milling	-0.0258	0.071	1.7786	14.461	3.2823	2.360 ***
2046 Wet Corn Milling	2.0744	4.116	0.2654	2.927	2.5681	12.372 ***
2048 Prepared Feeds	0.7818	10.003	0.3059	10.268	1.3507	5.647 ***
2051 Bread & Bakery Products	83.317	1.288	-41.009	1.304	7.0423	0.220
2061 Raw Cane Sugar	1.0217	26.333	-0.0774	4.834	0.8777	14.503 ***

Table 1. (Continued)

SIC	β_1	T-value	β_2	T-value	Mean Elasticity (e_i)	T-value
2065 Candy & Confectionery Products	0.7938	7.647	0.3382	5.065	1.4228	5.380 ***
2066 Chocolate & Cocoa Products	0.6055	4.260	-0.2195	4.055	0.1972	1.149
2067 Chewing Gum	0.6543	2.746	-0.1524	2.507	0.3708	3.111 ***
2074 Cottonseed Oil Mills	0.2860	0.724	0.3899	6.687	1.0112	3.3167 ***
2076 Vegetable Oil Mills	-0.0187	0.305	0.3277	6.005	0.5908	2.306 ***
2082 Malt Liquors	-1.4105	3.098	0.7886	3.102	0.0562	0.091
2084 Wine & Brandy Spirits	1.0299	8.162	0.0961	5.097	1.2087	16.079 ***
2085 Distilled Liquor Except Brandy	1.3427	13.837	0.0248	0.899	1.3888	71.624 ***
2091 Canned & Cured Seafood	7.7746	9.314	-2.0165	6.761	4.024	2.552 ***
2095 Roasted Coffee Processors	0.3997	5.045	0.1630	5.907	0.7028	5.515 ***
2098 Macaroni & Spaghetti	-2.6537	0.500	1.808	0.498	0.7082	0.501

Table 2. Welfare Weight Parameter Estimates: Results for Single Industries

SIC	δ	T-value	γ	T-value	θ	s.e.	a	s.e.
2011 Meat Packing Plants	-0.000176	1.536	0.0000339	0.549	0.99997 ***	0.0000618	29499	53758
2013 Sausage & Prepared Meats	-0.0000957	3.459						
2016 Poultry Dressing Plants	0.0000124	0.855						
2017 Poultry & Egg Processing	-0.00000204	1.834						
2021 Creamery Butter	-0.000301	0.706	0.000355	2.928	0.99964 ***	0.000121	2814.5 ***	961.49
2022 Cheese, Natural and Processed	-0.00473	0551	0.0115	3.005	0.98856 ***	0.00379	86.39 ***	28.908
2026 Fluid Milk	0.0436	0.826	-0.183	0.911	1.0178 ***	0.019	-57.166	59.901
2032 Canned Specialties	0.000049	1.486						
2033 Canned Fruits & Vegetables	-0.0148	2.677	-0.00073	0.054	1.0007 ***	0.0137	-1347.8	24861
2034 Dried & Dehydrated Fruits & Veg.	-0.000398	2.114						
2035 Pickled Sauces & Salad Dressing	-0.0000073	0.098						
2037 Frozen Specialties	-0.13697	-1.161	0.13333	1.1277	0.86618 ***	0.11864	6.473	6.625
2041 Flour & Grain Mill Products	0.000335	0.656	-0.000504	1.113	1.0005 ***	0.000453	-1984.1	1781.8
2043 Cereal Preparations	0.00000359	1.242						
2044 Rice Milling	0.00000037	0.070						
2046 Wet Corn Milling	-0.0015051	2.645						
2048 Prepared Feeds	0.000128	6.503						

Table 2. (Continued)

SIC	δ	T-value	γ	T-value	θ	s.e.	a	s.e.
2051 Bread & Bakery Products	0.001039	1.724						
2061 Raw Cane Sugar	-1.6172	2.682	1.9618	3.067	-0.45903	0.45419	-0.3146	0.2134
2065 Candy & Confectionery Products	-0.000617	4.939	0.0000826	1.029	0.99992 ***	0.000080	12102	11764
2066 Chocolate & Cocoa Products	-0.0000074	0.108						
2067 Chewing Gum	0.0000396	1.563						
2074 Cottonseed Oil Mills	-0.000136	0.696						
2076 Vegetable Oil Mills	-0.00196	0.302						
2082 Malt Liquors	-0.000379	2.579	0.000383	2.498	0.99962 ***	0.000153	2608.1 ***	1044.6
2084 Wine & Brandy Spirits	-0.00138	1.432	-0.00417	6.199	1.0042 ***	0.000676	-239.67	38.487
2085 Distilled Liquor Except Brandy	0.00727	2.933	-0.00739	3.611	1.0074 ***	0.00207	-136.22	37.812
2091 Canned & Cured Seafood	-0.02668	4.783						
2095 Roasted Coffee Processors	-0.0000079	3.589						
2098 Macaroni & Spaghetti	-0.000072	0.422						

Table 3. Pooled Estimation Results

Variable	Coefficient	Basic Model	Ext. Model	G-M	G-B
$\frac{Z_{it}}{e_{it}}$	δ	-0.00445261 (0.0001768)	-0.00019678 (0.00008456)	-0.009 (0.0040)	-0.000309 (0.000153)
$\frac{Z_{it}}{e_{it}} * I_{it}$	γ	0.0012888 (0.0004627)	0.0004985 (0.0002089)	0.0106 (0.0077)	0.0003151 (0.000157)
Weight Net of Contrib.	θ	0.99871 (0.00046195)	0.9995 (0.00020875)	0.986 (0.005)	0.9997[a]
Weight Gross of Contrib.	a	775.58 (278.59)	2005.6 (840.54)	71.429[a]	3,175
Quota Dummy			0.80171 (0.082557)		

Notes: Standard errors are in parentheses. The superscript "a" indicates that the number was derived from the authors' published results.The G-M result presented is the one for μ=1 (no multiple of the coverage ratio if it is between zero and one). The coefficient θ only changed to 0.984 and 0.981 for μ=2 and 3, respectively.