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by

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EXPLAINING CROSS-COUNTRY VARIATION IN NATIONALIZATION FREQUENCIES *

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Abstract: This paper studies the nationalization frequency of developing countries during the period 1968-1979. The variables associated with the benefits of nationalization are found to exert significant, expected impacts in a binomial regression model. The costs of discouraging direct investment are dealt with in two ways. First, a semiparametric estimator is used to study unobserved heterogeneity in the binomial model. Second, a Markov model allows for dependence in nationalizations over time. The results cast new light on the pattern of nationalization across countries over time.

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I. INTRODUCTION

In contrast to portfolio investment, direct investment remains under the control of foreign investors. It is well-known that the risk of nationalization by host countries may prevent it from being undertaken.

Various studies have examined the occurrence of nationalizations across countries. Jodice (1980) explained some 60 % of the variation in natural resource nationalization 1968-1976. He argued that nationalization occurs because weak regimes capable of running firms under domestic ownership (due to high GDP and satisfactory government capacity) need scapegoats in times of crisis. Shafer (1985) related the costs of nationalization to the strength, resources and autonomy of a state. According to Burton and Inoue (1984), the sectorial pattern similarly reflects a country's economic development. Juhl (1985) supported the view that nationalization increases with a country's capacity to assume responsibility for affiliates. None of these studies are compatible with the abrupt downturn which occurred in nationalizations after 1976, however. It can be noted that this downturn occurred in all sectors, while many of the previous studies have been concerned only with individual ones. In fact, there has been no satisfactory explanation of when in time nationalizations are undertaken.

In this study, we examine the cross-country variation in the frequency of nationalizations across all sectors during the period 1968-1979. The frequency measures the time during which countries have pursued nationalizations. Special consideration is given to the costs of discouraging direct investment to other host countries which compete for direct investment. Such costs may explain why it has not been possible to explain the occurrence of nationalizations solely by looking at the characteristics of individual countries. Examining them, we argue that there are two phenomena to take into account, a clustering in countries' behaviour and/or dependence in nationalizations over time. The empirical examination raises intricate econometric problems, however. First, the annual occurrence of nationalization is a dichotomous variable from which the frequency variable is aggregated. Second, the explanatory variables are not directly or annually observable. Third, we expect an interdependence in the behaviour of countries that are close substitutes for direct investment, but this heterogeneity can not be directly observed.

To deal with these difficulties, this article firstly develops a binomial regression model. A semiparametric estimator identifies a possible unobserved

heterogeneity which may indicate clustered country behaviour. Secondly, a Markovian model takes account of the dependence between countries' successive nationalizations. The model enables estimation of the expected frequency of individual countries. This approach allows us to study the latent dynamics underlying the observed frequencies.

Section 2 presents hypotheses and variables for empirical testing. Section 3 discusses the data base. The econometric count data model and its semiparametric estimation are introduced in Section 4. In addition, the expected number of years of nationalizations is obtained from a dynamic first order Markov chain. Nonlinear least squares estimation is demonstrated to be feasible. Section 5 presents the empirical results and analyses marginal effects. The article is summarized in Section 6.

II. HYPOTHESES AND VARIABLES

Direct investment is 'traded' in a market where it is supplied by firms and demanded by host countries. Taxation and nationalization are alternative measures for host countries to appropriate gains once investments have taken place. The greater the profits that cannot be taxed, but can be retained under domestic ownership, and the greater the host country's need of earning foreign exchange in the short run, the greater the benefits of nationalization. The losses, on the other hand, are primarily of a long-run nature. Nationalization cuts off a subsidiary from its parent company, and the probable outcome is a gradual loss of capital, technology, employment opportunities, possible risk-diversification, etc. In addition, future direct investment may be discouraged.

In a world of incomplete information, countries' past behaviour is likely to influence the estimated risk of future nationalizations through a signalling effect. A country which nationalizes may inflict a damage to its reputation, and discourage direct investment in the future (Eaton and Gersovitz, 1984). Since the late 1970s countries have nationalized foreign firms selectively, however. Investments are discouraged only if the risk of nationalization for the individual firm outweighs the expected profits. The greater the stock of investment in a country, or the greater the amount of investment which may be attracted by a country, the greater the potential loss from nationalization in the form of foregone investment. In addition, the amount of investment discouraged by nationalization hinges on what alternative opportunities are available for firms. This, in turn, is influenced by what behaviour is expected

by other potential host countries that may serve as alternative locations for a project. As discussed in Andersson (1991) this may give rise to an interdependency in the behaviour of countries. The greater the number of competing countries that nationalize, the smaller the discouraging effect on the flow of direct investment for an individual country that nationalizes, and the smaller the captured rent necessary to make nationalization pay. The fewer competing countries that nationalize, the larger the discouraging effect and the larger the captured rent required for nationalization to pay.

In this situation, it is far from straightforward how to represent the costs of discouraging direct investment through nationalizations. However, one should expect a clustering — grouping in countries' behaviour. The problem is that we can not observe which countries are close substitutes as location for direct investment and we do not know in advance how many groups to look for. Moreover, it is likely to take time before a reputation can be revived. A country can be expected to discourage more direct investment when it starts nationalizing than when it continues to do so. This creates a dependence in a country's successive nationalizations in time.

Below, we analyse the occurrence of nationalizations across countries as well as over time in 1968-1979. This period includes the historical peak of the policy, as well as its beginning downturn after 1976. The number of years 1968-1979 in which a country nationalized is the dependent variable. This number, termed the *frequency* of nationalization, is discrete and ranges from 0 to maximally 12. For estimation, we will apply both a binomial regression and a regression based on a Markov chain.

In practice, it is not possible to directly observe the profitability of nationalization relative to taxation or the discouragement of direct investment.[1] Instead, we examine factors that can be expected to be associated with them. Influences which are associated with the benefits, i.e. the profitability of nationalization relative to taxation, should not be affected by the dependency over time. Influences associated with the costs of discouraging direct investment should, however. Some variables are related both to the benefits of taxation and to the discouragement of investment. The implications for nationalization may, as seen below, go different ways. The definitions of explanatory variables and descriptive statistics are given in Table 1. The rationale for their inclusion is as follows for each variable:

x_1 : *The stock of direct investment* measures both the amount of investment which is available for nationalization, and that which may be dis-

couraged by it. There should be either a negative or a positive impact on nationalization, depending on which effect is stronger.

x_2 : *The growth rate* is positively related to a country's ability to attract new investment. A negative impact on nationalization is expected for two reasons. The higher the rate of growth the better the prospects for tax revenue by the host country, and the greater the amount of investment which risks to be discouraged by nationalization.

x_3 : *The size of the economy (GDP)* is a proxy variable for the degree of capital mobility between an economy and the rest of the world. With a larger economy, investment is less easily discouraged by nationalization. Thus, we expect a positive impact on nationalization to the extent that the disincentive effect is important.[2]

x_4 : *The income level (GDP/c)* has previously been viewed as an indicator of a country's capacity to run nationalized firms under domestic ownership, which suggests a positive impact. However, the income level also reflects a country's ability to gain from direct investment under foreign ownership, which may account for a negative impact. Moreover, GDP/c is positively related to the capacity to attract new investment, and thereby the discouraging effect. This suggests a negative impact if the discouraging effect is strong.

x_5 : *The export commodity concentration* indicates the vulnerability of a country's external position and the need of short-term foreign exchange earnings. A positive impact is expected. A dummy variable is created taking the value 1 if the share of fuels, minerals and metals in total merchandise exports exceeded 80 % in 1970 or 1980, otherwise zero. The dummy reflects that a high concentration is likely to exert an impact, while variation at a low level should not matter.

x_6 : *The tax rate* is negatively related to the benefits of nationalization. As we cannot observe the specific tax levied on foreign firms, we use the average tax pressure in the economy as a proxy.

III. DATA

It is difficult to obtain consistent data on nationalizations, i.e. involuntary seizure of equity. Rather than developing a new data base we use the most comprehensive one available, based on a systematic scanning of secondary sources by Kobrin (1980). The unit of analysis is an act, which is defined as the taking of any number of firms in a single industry in a single country in a

TABLE 1

Variable definitions and descriptive statistics (n=56)

Variable	Definition	Mean	Median	Standard Deviation
x_1	Direct Investment (Stock, 1974)	857	345	1445
x_2	Average Growth (1970-1979)	4.5	4.7	2.5
x_3	GDP (Size, 1974)	13273	3510	23956
x_4	GDP/Capita (1979)	1369	770	2327
x_5	Export Commodity Concentration (Low/High)	.21	0	.41
x_6	Tax Rate (Per Cent of GDP)	16.7	16.3	6.5
y	Frequency	2.5	2.0	2.1

given year. It is questionable to quantify nationalizations on the basis of the number of acts or firms taken, since the seriousness of 'offenses' varies. This 'seriousness' is affected by tacit compensation which can not be observed. However, the data allows us to register whether nationalizations occur or do not occur at a given point in time.

Our sample includes 67 observations, which are all developing countries with a stock of direct investment that amounts to at least 60 million USD on average 1972-1974, according to UNCTC (1983). Eleven countries with missing values had to be excluded, reducing the number of observations to 56. The lower limit is used to avoid inclusion of countries where nationalization was ruled out due to a lack of targets. Together the countries excluded were hosts for less than 2 % of the total stock of direct investment in developing countries.[3] A list of the included countries is found in Table 3.

Definitions and descriptive measures for the explanatory variables are given in Table 1. The measures relate either to an average level, to a change during the sample period or, for variables that have been at a fairly constant

level, to individual years. The reason is that usage of annual observations on explanatory variables would exclude many countries for which data could not be found. Moreover, it would require a specification of how firms and countries form expectations of each other's behaviour. This is beyond the scope of this paper, but has been addressed in Andersson and Brännäs (1990).

IV. MODELS AND ESTIMATION

In this section we introduce the binomial and Markov models as well as the applied estimators. The former model is based on the assumption that a country's nationalizations are independent over time, while allowing for clustering of countries' behaviour. The latter model is based on a first order Markov chain, which takes account of the possible dependence over time in the policy of each country.

IV.1. Binomial Model

Assume that nationalization in each year is a Bernoulli distributed random variable. Given independence between years, the resulting variable, the number of years of nationalization out of 12 possible, is binomially distributed. A binomial regression model sets the probability of nationalization p equal to a distribution function, guaranteeing that the estimated probability remains in the permissable range. With a logistic distribution function, the Bernoulli probabilities of nationalization or not each year form a logit model. The probability of nationalization for the ith country ($i = 1, \ldots, N$) is $p_i = 1/(1 + \exp(x_i\beta))$, where x is the k-vector of explanatory variables, and β is the vector of unknown parameters to be estimated.

It turns out, that the variance of the number of years of nationalization is larger than the mean (cf. Table 1), while it is expected to be smaller with the binomial distribution. This means that there is 'overdispersion', or unobserved heterogeneity, which should be taken into account. It can arise due to, e.g., omitted, proxy or error contaminated variables, or random parameters (e.g., Brännäs and Rosenqvist, 1988). Treating the unobserved heterogeneity as a random variable θ (with an unknown distribution function) we write the probability for a given θ as $p_i = 1/(1 + \exp(x_i\beta + \theta))$.

Dunn et al. (1987) suggest a semiparametric estimator to a related type of model. The unknown parameter vector β and the shape of the unknown continuous distribution function are estimated jointly. The latter is estimated by a discrete distribution function. The points of increase are mass points (θ_j)

and the increments (q_j) are probabilities corresponding to each mass point. The model is estimated without a constant term so that the mass points can be interpreted as constant terms. It is possible to predict which constant term is the most likely one for each country by logistic discrimination, see below. From general theory it is known that the number of mass points (Q) is finite (Simar, 1976; Lindsay, 1983). Empirical experience with this estimation procedure suggests that Q usually is quite small.

The density function to be used for estimation is for the ith country written in the form of a finite mixture model with logistic probabilities $Pr(y_i) = \sum_{j=1}^{Q} q_j \; Pr(y_i|\theta_j)$. Here, y_i is the frequency of nationalization and $Pr(y_i|\theta_j)$ is the conditional binomial density function.

The log-likelihood function,

$$\ell = \sum_{i=1}^{N} \ln \sum_{j=1}^{Q} q_j \; \frac{\lambda_{ij}^{12-y_i}}{(1+\lambda_{ij})^{12}} \tag{1}$$

where $\lambda_{ij} = \exp(x_i\beta + \theta_j)$, is maximized with respect to β, the probabilities q_j, the mass points θ_j, and the number Q.

To estimate Q we use a theoretically motivated criterion function due to, e.g., Lindsay (1983). This function $D(\theta) = \sum_{i=1}^{N}\{Pr(y_i|\theta)/Pr(y_i)\} - N$ is evaluated for all $\theta \in \Xi$. Here, the denominator is evaluated at estimates $\tilde{\beta}$, $\tilde{\theta}_j$, $\tilde{q}_j$ and $Pr(y_i|\theta)$ at $\tilde{\beta}$. Lindsay (1983) provides conditions on the range and potential gaps of Ξ. The estimates $(\tilde{\beta}', \tilde{\theta}', \tilde{q}', Q)$ that maximize the likelihood function globally have the property that $D(\tilde{\theta}_j) = 0$ and $D(\theta) < 0$ for other values on θ. It can be noted that neglect of unobserved random heterogeneity, when such prevails, generally leads to an inconsistent estimator. The $D(\theta)$ function can be seen as one means of testing the model specification for unobserved random heterogeneity.[4]

The log-likelihood function (1) is maximized (routine AMOEBA, Press et al., 1986). With Q treated as fixed, the covariance matrix is calculated using the Berndt et al. (1976) algorithm. To estimate the value of Q and to ascertain that the obtained solution is indeed a global maximum, the $D(\theta)$ function is evaluated.

The probability that a given country is associated with a particular mass point or constant term $j (j = 1, \ldots, Q)$ is obtained by the Bayes rule as $d_j = Pr(j|y_i) = q_j Pr(y_i|j)/Pr(y_i)$. The d_j is a logistic discrimination probability.

IV.2. Markov Model

Given that nationalizations cause reputation effects, which gradually diminish over time, the occurrence of the policy should not be independently distributed. For variables related to the benefits of nationalization, this should not pose any problem. The disincentive effects, related to the costs of discouraging future investment, may not be properly captured unless the dependence over time is taken into consideration, however. To account for dependence in a country's nationalization decisions over time we assume that the dynamics arises as a first order Markov chain. As will be demonstrated below, this is a natural extension to the binomial model.

Again, there are two states; nationalize (state 1) and not nationalize (state 0). The probability vector p_t has two corresponding elements p_{1t} and p_{0t}. By the Markov property (e.g., Bhat, 1972, ch. 3) the probability of the present state vector depends only on the state vector in the previous period. Collecting the conditional probabilities into a transition matrix we obtain

$$P = \begin{pmatrix} 1 - p_{10} & p_{10} \\ 1 - p_{11} & p_{11} \end{pmatrix}.$$

Here, p_{10} is the conditional probability of a transition to state 0 given that state 1 was occupied in the previous period and p_{11} for a transition to state 1. We may write $p_t = p_{t-1}P$. It follows from the time invariant P that $p_t = p_0 P^t$. As $t \to \infty$ there will be a steady state probability vector $\pi' = (\pi_0, \pi_1)$ under certain conditions on P.

The initial state is taken to be the first available year, i.e. 1968. We observe the total number of visits to state 1. Under the Markov assumption the expected number of visits in the nationalization state in the remaining 11 years (cf. Bhat, 1972, ch. 3) is

$$\mu_{11}^{(11)} = \frac{11 p_{10}}{1 + p_{10} - p_{11}} + \frac{(1 - p_{11})(p_{11} - p_{10})[1 - (p_{11} - p_{10})^{11}]}{(1 + p_{10} - p_{11})^2}. \tag{2}$$

A related expression $\mu_{01}^{(11)}$ is available for the initial state 0.

Note that in the binomial regression based on independence over time the probability of nationalization is constant and takes the logit form $1/(1 + \exp(x\beta))$. Let this correspond to the steady state probability π_1. We have

$$\pi_1 = \frac{p_{10}}{1 - p_{11} + p_{10}} = \frac{1}{1 + e^{x\beta}} \tag{3}$$

and $\pi_0 = 1 - \pi_1$. Using this relation between π_1 and the transition probabilities, the expected frequency in (2) can be rephrased in terms of logit probabilities. This makes it possible to estimate the impact of explanatory variables when dependence between years is taken into account. After some algebraic manipulation of (2) and $\mu_{01}^{(11)}$, the expected frequency (for given initial state $z_0 = 1$ when a country nationalized in 1968, and $z_0 = 0$ otherwise) is given as

$$\mu = \pi_1\{11 + [1 - (1 - \frac{p_{10}}{\pi_1})^{11}]\frac{\pi_1}{p_{10}}\,[z_0\frac{\pi_0}{\pi_1}(1 - \frac{p_{10}}{\pi_1}) - (1 - z_0)(1 - p_{10})\,]\}. \quad (4)$$

This expression can be used for nonlinear least squares estimation of β and p_{10}, which is assumed to be constant.[5,6] We may estimate an individual $p_{11,i}$ as $1 + \hat{p}_{10} - \hat{p}_{10}/\hat{\pi}_{1i}$ by solving (3).

V. RESULTS

The parameter estimates for both model types are presented in Table 2. For the binomial model, the proposed estimation procedure indicates that $Q = 2$ is the appropriate number of mass points, see below. A negative parameter estimate implies that the corresponding variable has a positive impact on the probability of nationalization. The table also includes elasticities on the probability of nationalization, or on the expected number of years of nationalization, for the binomial model.

The $D(\theta)$ function is shown in Figure 1. Two ($Q = 2$) mass points are enough to produce a global maximum of the likelihood function. The two mass points, at $\theta_1 = 0.4$ and $\theta_2 = -1.5$, correspond to a low and a high probability to nationalize respectively. Both the parameter estimates and the associated standard errors are mostly greater for the greater Q value.

Generally, the parameter estimates for the Markov model are smaller in absolute size than for the binomial model. The conditional probability p_{10} of exiting the nationalization state given nationalization in the previous period is not large but significantly different from zero. It follows that there is a large probability $(1 - p_{10})$ of staying in the no nationalization state once it is entered. The reported t-values for the Markov model are based on the F matrix (see fotnote 6) and are underestimated. It should be noted that the conditioning number of F is only 0.005, indicating an almost singular F. Adding a small constant to the diagonal elements of F increases substantially the conditioning number and the t-values.

TABLE 2

Estimation results (t-values in parentheses, for x_2, $\ln x_3$, x_5 and x_6 the appropriate tests are one-sided) and elasticities

	Binomial		
Variable	$Q = 2$	Elasticities	Markov
$\ln x_1$	-.451	.31	-.170
	(1.89)		(1.18)
x_2	.181	-.56	.102
	(2.23)		(1.92)
$\ln x_3$	.031	-.02	-.098
	(.16)		(.78)
$\ln x_4$	.349	-.24	.191
	(1.18)		(1.47)
x_5	-.916	-	-.497
	(1.93)		(1.63)
x_6	.065	-.75	.001
	(1.48)		(.27)
θ_1	.416		.911
θ_2	-1.514		-
q_1	.804		1
q_2/p_{10}	.196		.082
ℓ/R^2	-315.4		.23

In the binomial regression, we expected to capture effects associated with the benefits of nationalization. The stock of direct investment (x_1), the growth rate (x_2), the export concentration (x_5), and the tax rate (x_6) all exerted the effects expected on this basis. Considering the one-sidedness of some of the hypotheses, x_2 and x_5 are significant at the 5 % level, the other two at the 10 %-level. The income level (x_4) did not exert any significant impact, giving no evidence that countries' ability to extract gains under foreign relative to domestic ownership at varying income levels played a role.

Taking the dependency over years into consideration, we expect the Markov model to capture discouraging effects of nationalization on direct investment. As the t-values in the Markov model are known to be underestimated, we compare the outcome of the two tests although no impacts are seemingly

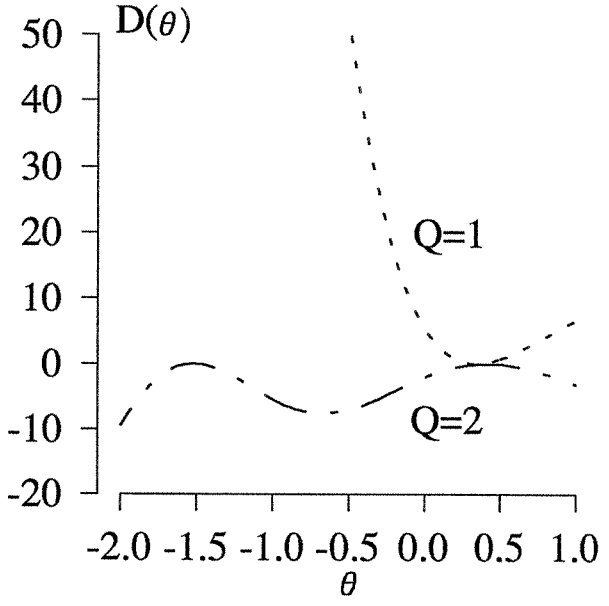

Fig. 1. The $D(\theta)$ functions ($Q = 2$) for the mixed binomial.

significant on the 5 %-level in the latter model. For x_2, x_5 and x_6 the Markov model test rendered the same results as the binomial regression, except that x_6 ceased to be significant. This is natural since we did not expect any association with the disincentive effect for these variables. For x_1, there should now be a negative influence counteracting the positive effect obtained in the binomial regression. The variable ceases to exert a significant influence in the Markov case, but the sign remains positive. We cannot rule out that this is due to the underestimation of the t-values in the Markov model tests. However, both the size of the economy (x_3) and the income level (x_4) now render impacts with larger t-values than in the binomial model tests, and with the signs expected from the disincentive effect on direct investment. The comparison between the binomial and Markov estimations consequently renders the result we should expect with discouraging effects on nationalization playing a role. The policy then becomes more probable the greater the size of the economy and the lower the income level - features which imply that less direct investment is discouraged from a country due to nationalization.

Let us take a closer look at the grouping of the individual countries included in the test. The calculated logistic discrimination probabilities (d) for the constant that produces the largest probability (-1.514 with probability 0.196) are displayed in the second column of Table 3. As can be seen, it is mainly countries with a high frequency of nationalization which have a high

probability for this constant. Column three reports the predictions based on that constant term which is most likely for each country. This yields a highly satisfactory goodness of fit ($\chi^2(46) = 33.4$).

It is plausible that the clustering of countries around different mass points is due to their position vis-à-vis other developing countries with which they compete for direct investment, and the behaviour of those countries. As can be seen, there is an overrepresentation in the northern part of Latin American and in central Africa, of small countries with high probabilities for the larger constant. A possible interpretation is that they nationalized more than motivated by their record in the dependent variables due to their clustered geographical locations. This would render a small discouraging effect of nationalization on direct investment. Countries like Algeria, Iraq, and Trinidad and Tobago also nationalized as part of 'global waves' within the petroleum industry.

VI. CONCLUSIONS

In this paper we have modelled the cross-country variation in nationalization over time. The studied period is 1968-1979, which constitutes the peak period of the policy, as well as the decline in the late 1970s. The encountered econometric problems resulted in the application of two model types appropriate for the posed questions and the characteristics of the data. Estimation on the basis of a binomial model verifies that variables associated with the benefits of nationalizations exerted significant impacts on the frequency of the policy. A larger stock of direct investment, slower growth, higher export commodity concentration and lower taxes rendered less nationalization.

Further, we have recorded a general clustering of countries in the binomial model test, with the constant term varying over sub-sets of countries. The existence of such sub-sets speaks for omitted variables, or for different structural relationships among groups of countries. This is in line with our notion that countries' behaviour is influenced by that of others with which they compete for direct investment. The implication is that there may be large marginal effects if countries are shifted from one sub-set to another. Considering dependency in nationalizations over time through a Markov model, we also found that variables associated with the discouraging effects on direct investment behaves in line with our expectations. The t-values were underestimated due to collinarity problems. Still, it was verified that a country nationalizes less the higher the income level. Previous studies, confined to

TABLE 3

Countrywise nationalization frequencies (y), 1968-1979, along with the predicted logistic discrimination probability (d) for the larger constant term θ_2 and the predicted frequency ($\hat{y}$) based on the more probable constant term (breakpoint $d = 0.5$)

Country	y	d	$\hat{y}$	Country	y	d	$\hat{y}$
BRAZIL	0	0.00	1.46	MEXICO	4	0.198	1.86
DOM. REP.	1	0.03	1.40	GABON	2	0.00	2.68
EL SALVADOR	1	0.01	1.19	SENEGAL	1	0.00	1.55
INDONESIA	1	0.00	1.33	GUATEMALA	2	0.05	1.15
MALAYSIA	1	0.04	0.73	COLOMBIA	3	0.04	1.78
THAILAND	1	0.02	1.19	COSTA RICA	5	0.99	3.53
SINGAPORE	0	0.02	0.47	PERU	8	0.99	7.69
PAPUA	0	0.00	2.54	PANAMA	2	0.01	1.56
PARAGUAY	0	0.03	0.36	VENEZUELA	2	0.00	3.08
URUGUAY	0	0.02	0.52	BANGLADESH	3	0.02	2.07
CAMEROON	0	0.00	1.08	INDIA	4	0.00	4.39
MALAWI	3	0.37	1.03	KENYA	3	0.39	1.01
SIERRA LEONE	1	0.00	1.59	ZAIRE	5	0.00	6.52
TOGO	1	0.09	0.54	ZAMBIA	7	0.89	7.95
EGYPT	0	0.10	0.13	MAROCCO	4	0.93	3.79
OMAN	1	0.01	1.21	HONDURAS	2	0.01	1.59
TUNISIA	0	0.04	0.35	PAKISTAN	2	0.00	2.26
TURKEY	0	0.00	0.86	SRI LANKA	4	0.87	4.35
IVORY COAST	0	0.01	0.65	CONGO	6	0.99	4.82
BARBADOS	0	0.04	0.42	GHANA	5	0.00	4.40
SOUTH KOREA	0	0.01	0.60	NIGERIA	5	0.01	4.28
NICARAGUA	1	0.00	1.78	EQUADOR	6	0.99	5.07
BOLIVIA	3	0.01	2.26	GUYANA	3	0.86	2.72
HAITI	2	0.01	1.64	JAMAICA	4	0.01	2.90
PHILIPPINES	2	0.00	1.89	TR & TOB	6	0.99	5.26
CHILE	4	0.02	2.84	KUWAIT	3	0.00	3.16
IRAN	3	0.00	3.34	TANZANIA	4	0.88	4.24
ARGENTINA	5	0.05	3.15	ETHIOPIA	2	0.00	2.09

certain sectors and time periods, have argued the opposite. Our framework provides a more general explanation for the variation in nationalization over time across more or less all sectors.

The above results call for further studying of the interdependency in host country behaviour through the testing of shifts in structural relationships. Andersson and Brännäs (1991) analyse the termination of nationalization, while Andersson and Brännäs (1990) uses panel data to study how the impact of host country behaviour vis-à-vis direct investment changes over time. The findings of these studies are in line with those recorded here.

Notes

1. Among the studies that have failed to verify effects of nationalization on the flow of direct investment Green (1972) and Thunell (1977) can be mentioned .

2. An alternative would have been to use some proxy for openness, such as the prevalence of trade distortions. For the many developing countries studied here there are no satisfactory estimates of openess, however. For the usefulness of GDP in this context, see Huizinga (1988).

3. The following countries nationalized but were excluded because of a small stock; Antigua, Afganistan, Burma, Cambodja, Laos, Nepal, Benin, Chad, Central African Republic, Mauretania, Sierra Leone, Swaziland, Somalia, Uganda, Abu Dhabi, Bahrain, Dubai, Lebanon, Oman, Quatar, Syria and Yemen. An additional 22 countries did not have the required stock and did not nationalize.

4. Brännäs and Rosenqvist (1988) provide examples of the use of the criterion function in count data models. Brännäs (1991) presents Monte Carlo evidence that this informal test has an actual size far above the nominal one.

5. A Markov chain in steady state has $\mu_{11}^{(11)} = \mu_{01}^{(11)} = 11\pi_1$. This corresponds to the expected frequency of nationalization for the binomial distribution Bin(11, π_1). The expected number of years of nationalization in the overdispersed binomial logit model is, using a second order Taylor expansion of $1/(1+\exp(x\beta+\theta))$ around $E(\theta) = 0$, given by $E(y) = \pi_1(12+\sigma_\theta^2\pi_0(\pi_0-\pi_1))$. The leading term corresponds to the expected frequency under a Markov assumption but higher order terms differ. The variance of the overdispersed binomial model is, to first order, $V(y) = 12\pi_1(1-\pi_1)[1+\sigma_\theta^2\pi_1(1-\pi_1)]$.

6. In estimating the nonlinear regression model the heteroskedasticity of the random error term $\epsilon_i = y_i - \mu_i$ may influence the standard errors of parameter estimators. A heteroskedasticity consistent covariance matrix estimator is available. Let $\gamma' = (\beta', p_{10})$ denote the parameter vector, then $Cov(\hat{\gamma}) = F^{-1}JF^{-1}$, where general F and J expressions are given by Gallant (1987, ch. 2). In the absence of heteroskedasticity the covariance matrix reduces to F^{-1}.

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