E C O N O M I C S   B U L L E T I N

Determinants of Agricultural Protection in Industrial Countries: An Empirical Investigation

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Abstract

This paper analyzes the economic and political determinants of agricultural protection in industrial countries during the period 1986-2004. Panel data regression analysis is conducted for the producer nominal assistance coefficient. The analysis reveals that the agricultural protection level is negatively associated with the agriculture¡¯s share in the total economy and the GDP per capita in agriculture. The analysis also reveals that agricultural protection levels increase when market conditions are unfavorable to agriculture, and in countries with a comparative disadvantage in agriculture. The post-UR dummy variables suggest that the Uruguay Round agreements on agriculture have not decreased international agricultural protection levels. The dummy variables for each ally in the WTO agricultural negotiations reveal that each ally has unique features and different levels of agricultural protection due to agricultural efficiency and a stance on multifunctionality of agriculture.

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1. Introduction

Agricultural protection remains high in industrial countries which have reached an advanced stage of economic development, while many developing countries have liberalized their agricultural sectors. It is said that agricultural protection creates negative externality to developing countries because agricultural protection distorts trade of the agricultural products that developing countries have a natural comparative advantage in producing.

Reasons for agricultural protection in industrial countries remain a puzzle for most economists because many studies show that the costs of protecting the agricultural sector outweigh the benefits to these countries (Blake *et al.*1999; Diao *et al.* 1999; Diao *et al.* 2002; CBO 2006). As an effort to liberalize agricultural trade, agricultural agreements were adopted at the conclusion of the Uruguay Round of multilateral trade talks. It is an open question whether the agricultural agreements have achieved the intended goals of substantial cuts in levels of agricultural protection in industrial countries having sophisticated measures of agricultural protection. There are several coalitions in the WTO agricultural negotiations. Each coalition has different positions on the agricultural negotiations. It is also an important question whether each coalition in the WTO agricultural negotiations possesses unique features of agricultural protection.

The paper focuses on agricultural protection of 23 industrial countries characterized by high per capita incomes and low shares of the agricultural sector in the total economy. Panel data regression is conducted for producer nominal assistance coefficients from OECD database to analyze economic and political determinants of agricultural protection during the period 1986-2004 and clarify whether the Uruguay Round agreements on agriculture have achieved the intended goals of substantial cuts in levels of agricultural protection in the industrial countries together with each ally's unique features of agricultural protection in the WTO agricultural negotiations.

2. Econometric Model and Methodology

2.1. The Model

The basic multivariate model, which is outlined in Honma and Hayami (1986), with the necessary modification to incorporate the producer nominal assistance coefficient (NAC_p)[1] is

$$\ln NAC_{pit}=\alpha+\beta_1\ln A_{sit}+\beta_2\ln G_{pit}+\beta_3\ln T_{rit}+\beta_4\ln C_{ait}+\varepsilon_{it} \quad (1)$$

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[1] In algebraic form: $NAC_p = (P_w \cdot Y+PSE)/P_w \cdot Y = 1 + (PSE/P_w \cdot Y)$.
where P_w denotes world market prices of agricultural products; Y denotes agricultural production; PSE denotes producer support estimate.
The PSE (Producer support estimate) is an indicator of the annual monetary value of gross transfers from consumers and taxpayers in order to support agricultural producers, measured at the farm gate level, arising from policy measures that maintain market price supports and provide budgetary payments to farmers. Therefore, $PSE/(P_{aw} \cdot Y)$ denotes rate of increase in agricultural producers' income by agricultural protection policies. If there is no agricultural protection at all, NAC_p is equal to one.

where the subscripts refer to country *i* and time *t*; NAC_p denotes the producer nominal assistance coefficient of OECD; A_s denotes agriculture's share in the total economy; G_p denotes GDP per capita in agriculture; T_r denotes international terms of trade; C_a denotes agricultural comparative advantage.

Two alternative variables are used to represent a relative share of agriculture in a national economy. One is agriculture's share in labor force (L_s) and the other one is agriculture's share in GDP (G_a). After adding the post-Uruguay Round dummy variable, the equation can be written as

$$\ln NAC_{pit}=\alpha+\beta_1\ln L_{sit}+\beta_2\ln G_{pit}+\beta_3\ln T_{rit}+\beta_4\ln C_{ait}+\gamma_1 URDUMM+\varepsilon_{it} \quad (2)$$

$$\ln NAC_{pit}=\alpha+\beta_1\ln G_{ait}+\beta_2\ln G_{pit}+\beta_3\ln T_{rit}+\beta_4\ln C_{ait}+\gamma_1 URDUMM+\varepsilon_{it} \quad (3)$$

The data set comprises 23 countries[2] over the period from 1986 to 2004: in all there are 437 observations. Data sources and definitions together with descriptive statistics of the explanatory variables described above are reported in Appendix.

2.2. The Methodology

The ordinary least square method (OLS) is basically used for the parameters estimation. However, there are three possible econometric problems with the OLS method, which are briefly discussed and dealt with in this subsection.

In the OLS regression model, the emphasis is on estimating the average value of the dependent variable conditional upon the fixed values of explanatory variables. The cause-and-effect relationship, if any, in the model therefore runs from the explanatory variables to the dependent variable. However, some explanatory variables such as the agriculture's share in labor force (L_s), the agricultural comparative advantage (C_a), the agriculture's share in GDP (G_a) and the GDP per capita in agriculture (G_p) are very likely to be determined by the dependent variable, the producer nominal assistance coefficient (NAC_p).

To develop a statistical test of exogeneity, the Hausman test is utilized. The results of Hausman tests with respect to the producer nominal assistance coefficient (NAC_p) are reported in Table 1, which shows the computed Chi squares establishing the endogeneity of GDP per capita in agriculture (G_p), agriculture's share in labor force (L_s), agriculture's share in GDP (G_a), and agricultural comparative advantage (C_a).

[Table 1]

As a result, one year lagged variables of G_p, L_s, C_a and NAC_p together with the other right-hand side variables of equation 2 are included in the instrumental variables. Similarly, one year lagged variables of G_p, C_a and NAC_p together with the other right-hand side variables of equation 3 are included in the instrumental variables. The indexes of arable land per agricultural employment (A_l) and

[2] Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, Korea, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, the United States

agricultural machinery (A_m) are considered as proxy variables of land and capital to measure agricultural efficiency. These two variables are also included in the instrumental variables in each equation when the method of two-stage least-square (2SLS) is applied.

Another possible econometric problem derives from the cross-sectional time-series nature of the data. The OLS method assumes that the error terms, ε_{it}, are independent and identically distributed. However, the assumption is open to question for pooled data, which may exhibit correlation of the error term over time for a given country, as well as cross-section specific heteroskedasticity at a given point of time. In this regard, the regressions are re-conducted using generalized least squares (GLS) that gives consistent estimates of the covariance matrix in the presence of heteroskedasticity and both contemporaneous and serial correlation.

The other possible econometric problem is whether the results are affected by individual effects due to cross-sectional nature of the data. The only way to take into account the individuality of each country or each cross-sectional unit is to let the intercept vary for each country, which is known as the fixed effects model. However, it is not possible to use the fixed effects model using country-specific dummies because a NAC_p for each country in the EU is not available from OECD[3]. Instead of country-specific dummy variables, ally-specific dummy variables in the WTO agricultural negotiations are used, which can be the rough test to check whether individual effects affect the results to any degree. Furthermore, it is also expected to be clarified whether each ally in the WTO agricultural negotiations has unique features of agricultural protection by the fixed effect model. The United States is specified as the comparison ally. After the ally-specific dummy variables in the WTO agricultural negotiations are added to the equations 2 and 3, the two equations respectively become

$$\ln NAC_{pit}=\alpha+\beta_1\ln L_{sit}+\beta_2\ln G_{pit}+\beta_3\ln T_{rit}+\beta_4\ln C_{ait}+\gamma_1 URDUMM+\gamma_2 EUDUMM+\gamma_3 G10DUMM+\gamma_4 CAIRNSDUMM+\varepsilon_{it} \quad (4)$$

$$\ln NAC_{pit}=\alpha+\beta_1\ln G_{ait}+\beta_2\ln G_{pit}+\beta_3\ln T_{rit}+\beta_4\ln C_{ait}+\gamma_1 URDUMM+\gamma_2 EUDUMM+\gamma_3 G10DUMM+\gamma_4 CAIRNSDUMM+\varepsilon_{it} \quad (5)$$

where EUDUMM, G10DUMM and CAIRNSDUMM are dummies representing the EU, the Group10[4] and the Cairns group[5] in the WTO agricultural negotiations

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[3] OECD does not offer a NAC_p for each country in the EU. A country in the EU takes the same values of NAC_p as those of the EU for each year.

[4] The Group 10 includes ten countries identified by the WTO which are vulnerable to imports due to ongoing reform in the agricultural sector. The Group 10 consists of Switzerland, Japan, Korea, Taiwan, Liechtenstein, Israel, Bulgaria, Norway, Iceland, and Mauritius.

[5] The Cairns Group is a coalition of 19 exporting countries, which are Argentina, Australia, Bolivia, Brazil, Canada, Chile, Colombia, Costa, Rica, Guatemala, Indonesia, Malaysia, New Zealand, Pakistan, Paraguay, Peru, the Philippines, South Africa, Thailand, and Uruguay. The Cairns Group has been influential in the agricultural negotiations since its formation in 1986. The group has continued to play a key role in pressing WTO members to meet the far-reaching

respectively.

3. Results and Discussion

The empirical results of determinants of producer nominal assistance coefficient estimated by OLS, GLS and 2SLS methods together with the fixed effects model are reported in Tables 2, 3 and 4 respectively.

[Table 2]

[Table 3]

[Table 4]

First of all, the agriculture's share in labor force is negatively associated with the producer nominal assistance coefficient and statistically significant in every regression. The negative coefficients of the agriculture's share in labor force are in line with previous empirical studies (Swinnen *et al*. 2000; Olper 2001). Likewise, the agriculture's share in GDP is also negatively related to producer nominal assistance coefficient in every regression and statistically significant in four regressions. The results are worth noticing. The negative effect of the agriculture's share in GDP on agricultural protection is inconsistent with the results of most previous empirical studies (Honma and Hayami 1986; Swinnen *et al*.1998; Swinnen *et al*. 2000; Olper 2001; Thies and Porche 2007) except for Olper (1998) and Beghin and Kherallah (1994)[6] The negative coefficient of the agriculture's share in GDP suggests that the negative impact of income redistribution effect on the level of agricultural protection is stronger than the positive impact of the size of the vested interest on it in industrial countries. As a result, it can be said that levels of agricultural protection decline when agriculture's share in terms of both GDP and total employment increases, whereas levels of agricultural protection rises when agriculture's share decreases in industrial countries. Thus, the results support the so-called paradox of number suggested by Olson (1986). The decline in a share of agriculture in national income and employment thus made it less burdensome for the industrial sector to shoulder the cost of supporting domestic agricultural producers. In industrial countries, the agricultural sector is small enough to facilitate political cohesion for agricultural protection policy. That is, the agricultural sector can put political pressure efficiently on the politician or the government for agricultural protection policy. For this reason both coefficients of

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mandate set in the Doha Development Agenda.

[6] Honma and Hayami (1986) find positive signs on the agriculture's share both in total employment and GDP. Beghin and Kherallah (1994) use the share of agriculture only in GDP and find that it is positively associated with the PSE and negatively with the NPC(nominal protection coefficient). They cast some doubt on the ability of this variable to capture the Olsonian story on decreasing free riding and political resistance associated with economic development and industrialization. Swinnen *et al*.(2000) and Olper (2001) find that the negative effect of agriculture's share in labor force on agricultural protection which shows Olsonian logic and the positive effect of agriculture's share in GDP on agricultural protection which shows the so-called development paradox. Swinnen *et al*. (2001) find the positive effect of agriculture's share in GDP. Thies and Porche (2007) find no consistent effects of the share of agriculture in both GDP and labor force on agricultural protection. However, Olper (1998) analyzes determinants of agricultural protection in the EU and finds that negative sings on the agriculture's share both in total employment and GDP.

the agriculture's share in labor force and GDP show the negative signs. It is consistent with the hypothesis that decline of agriculture strengthens political power in the agricultural sector.

Secondly, the international terms of trade are negatively related to the producer nominal assistance coefficient and statistically significant in the six regressions. The negative effect of international terms of trade on agricultural protection is the same as other previous empirical studies (Honma and Hayami 1986; Olper 2001; Thies and Porche 2007)[7]. The results imply that levels of agricultural protection decrease in case relative prices of agricultural products in terms of industrial products rise. It is consistent with the hypothesis that levels of agricultural protection should be raised when world market prices of agricultural products rise in order to keep domestic prices of agricultural products high enough.

Thirdly, the GDP per capita in agriculture is negatively associated with the producer nominal assistance coefficient and statistically significant in every regression. It implies that levels of agricultural protection decrease in case agricultural GDP per agricultural population increases. As economic growth by industrialization advances, income of the industrial sector exceeds income of the agricultural sector. As income gaps between the agricultural sector and the industrial sector widens, resistance to agricultural protection from the industrial sector becomes less strong. That is, political costs of agricultural protection policy decline for the politician, with the result that it becomes a favorable political environment for the policymaker to strengthen agricultural protection so as to fill up the widened income gaps. From the results of both the GDP per capita in agriculture and the agriculture's share in the total economy, it can be said that agricultural protection is interaction between the politician and the consumer of the industrial sector or the farmer in a political market.

Fourthly, the agricultural comparative advantage is negatively associated with the producer nominal assistance coefficient in every regression and statistically significant in five regressions. The negative signs of the agricultural comparative advantage are in line with previous empirical studies (Honma and Hayami 1986; Beghin and Kherallah 1994; Olper 2001; Thies and Porche 2007). The results support the hypothesis that levels of agricultural protection should be raised in order to reduce income differentials between the agricultural sector and the industrial sector if a degree of an agricultural comparative disadvantage is high.

Fifthly, the coefficients of the post-UR dummy variables show inconsistent signs in general and even the positive signs in four regressions statistically significant. The results are different from those of Thies and Porche (2007). Thies and Porche (2007) use the average producer nominal protection coefficient (APNPC) as the dependent variable[8]. It is arguable that the ANNPC is able to

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[7] Beghin and Kherallah (1994) find the international terms of trade had no significant impact on agricultural protection.

[8] The APNPC is the average producer nominal protection coefficient across all available commodity categories. The producer nominal protection coefficient (NPC_p) measures the ratio between the average price received by producers (at the farm gate), including payments based on output (PO/tonne), and the border price (at the farm gate). In algebraic form

capture the sophisticated measures of agricultural protection in industrial countries, especially agricultural exporting countries. In this study, NAC_p, a better measurement than the ANNPC, is adopted. The result suggests that the Uruguay Round agreements on agriculture have not achieved the intended goals of substantial cuts in levels of agricultural protection in spite of the successful inclusion of agricultural products in the international multilateral negotiations [9].

Finally, the ally-specific dummy variables are considered. The coefficients of the dummy variables for the Group 10 and the EU are always positive and statistically significant whereas for the Carins group it is negative and not significant. It implies that the Group 10 and the EU have unique features compared with the United States whereas the Cairns group does not. It is difficult to tell unique features exactly because each country has different agricultural conditions. The highly positive coefficients of the Group 10 dummy variables statistically significant may show agricultural inefficiency and concerns over multifunctionality of agriculture such as food security, environment and rural development. The positive coefficients of the EU dummy variables also may reveal relatively lower agricultural efficiency and concerns over multifunctionality of agriculture such as environment and rural development[10]. The Cairns group is statistically the same as the United States. Both the Cairns group and the United States are agricultural exporters. The negative coefficients of the Cairns group show relatively higher agricultural efficiency. As a result, it can be said that each ally has different levels of agricultural protection due to a stance on multifunctionality of agriculture and agricultural efficiency.

4. Concluding Remarks

The empirical findings offer several main aspects of agricultural protection in industrial countries. The empirical analysis reveals that agricultural protection increases when market conditions are against farming industry and in countries with a agricultural comparative disadvantage. Therefore, it is clarified that international trade theory such as a comparative advantage and international terms of trade still works on agricultural protection in industrial countries. Agricultural protection increases when a share of agriculture decreases, which provides empirical support to the Olsonian logic, so called the paradox of number. Agricultural income is also an important determinant of levels of agricultural protection, suggesting that agricultural protection is political income redistribution to agricultural producers. It is found that the intended goals of Uruguay Round

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$NPC_p=(P_p + PO/tonne)/P_b =[(P_p-P_b)+PO/tonne]/P_b +1$
where P_p is producer prices and P_b is border prices of agricultural products.

[9] Green and Amber box supports in the OECD countries amounted to US$259 billion in nominal terms in 1996, which was higher than US$221 billion, that of the base period 1986-1988. Moreover, the share of Green box that is not subject to reduction commitments under the UR agreement on agriculture, increased from 24% to 46% in total Green and Amber box supports. More recent data from OECD shows that total transfers to agriculture in these countries amounted to US$371 billion in 2003-2005, compared with US$303 billion in 1986-1988.

[10] The EU mainly considers securing necessary food in countries where food is actually insufficient as the food security whereas the Group 10 considers self-sufficiency as the food security.

agreements on agriculture, substantial cuts in levels of agricultural protection, are so far without results in industrial countries and each ally has unique features and different levels of agricultural protection due to agricultural efficiency and a stance on multifunctionality of agriculture such as food security, environment and rural development.

Consequently, it can be concluded that agricultural protection in industrial countries is composed of multiple determinants. Both economic and political determinants play a vital role in agricultural protection of industrial countries. No evidence is found that the UR agreements on agriculture have lowered actual levels of agricultural protection. In the WTO agricultural negotiations, an industrial country has formed a coalition with countries which have a similar stance on multifunctionality of agriculture and similar agricultural conditions.

Appendix
Variable definition and Data sources
Agricultural comparative advantage (C_a)

The comparative advantage in agriculture is a labor productivity ratio in this paper. The labor productivity ratio is defined as the ratio of labor productivity in agriculture to labor productivity in industry, both expressed in real terms. Real agricultural labor productivity is defined as agricultural GDP per agricultural employment and real industrial labor productivity is defined as industrial GDP per industrial employment at 2000 constant prices converted to US dollars using purchasing power parity of OECD. Agricultural comparative advantage is expressed as index form setting the United States value in 2000 at 100.

The data of agricultural and industrial GDP are from the homepage of OECD (http://www.oecd.org). The data of agricultural and industrial employment are also from the homepage of OECD (http://www.oecd.org) with the following exception. The data of agricultural employment from 1986 to 1994 for Denmark are from the homepage of ILO (http://www.ilo.org). The data of agricultural employment from 1986 to 1997 for Ireland are from the homepage of ILO (http://www.ilo.org). The data of agricultural employment from 2002 to 2004 for the United Kingdom are from the homepage of ILO (http://www.ilo.org). The data of agricultural employment in 2004 for the United States are from the homepage of ILO (http://www.ilo.org). The data of industrial employment from 1986 to 1994 for Denmark are from the homepage of ILO (http://www.ilo.org). The data of industrial employment from 1986 to 1997 for Ireland are from the homepage of ILO (http://www.ilo.org). The data of industrial employment from 2002 to 2004 for the United Kingdom are from the homepage of ILO (http://www.ilo.org). The data of industrial employment in 2004 for the United States is from the homepage of ILO (http://www.ilo.org). The data of industrial employment for Belgium, France, Luxemburg, Greece, and Netherlands are from the homepage of Eurostat (http://epp.eurostat.ec.europa.eu) except for the data from 1986 to 1991. Those data from 1986 to 1991 are extrapolated from the data of economically active population on the homepage of ILO (http://www.ilo.org).

International terms of trade (T_r)

The international terms of trade are defined as the ratio of the world unit export value index for agricultural products to the world unit export value index for industrial goods. The international terms of trade are expressed as an index with the value in 2000 set at 100. 23 countries take the same value for each year. The world unit export value indexes for agricultural products are from the homepage of FAO (www.fao.org). The world unit export value indexes for industrial goods are from the United Nations, *Statistical Yearbook*.

GDP per capita in agriculture (G_p)

The GDP per capita in agriculture is defined as the ratio of agricultural GDP to agricultural population. The data of agricultural GDP are from the homepage of OECD (http://www.oecd.org). The data of agricultural population are from the homepage of FAO (www.fao.org).

Agriculture's share in labor force (L_s)

The agriculture's share in labor force is defined as the ratio of agricultural employment to labor force. The data of labor force are from the homepage of OECD (http://www.oecd.org).

Agriculture's share in GDP (G_a)

The agriculture's share in GDP is defined as the ratio of agricultural GDP to GDP. The data of GDP are from the homepage of OECD (http://www.oecd.org).

Agricultural machinery (A_m)

The agricultural machinery is defined as the ratio of the sum of agricultural tractors and harvesters-threshers in use to agricultural employment. Agricultural machinery is expressed as index form setting the United States value in 2000 at 100. The data of both agricultural tractors and harvesters-threshers in use are from the homepage of FAO (www.fao.org).

Arable land (A_l)

The Arable land is defined as the ratio of arable land to agricultural population. Arable land is expressed as index form setting the United States value in 2000 at 100. The data of arable land are from the homepage of FAO (www.fao.org).

Dummy variables

The UR dummy variable is specified as zero from 1986 to 1993 and one from 1994 to 2004. The EU dummy variable is specified as one for the EU 15 countries; otherwise it is zero. The Group10 dummy variable is specified as one for Japan, Korea, Norway and Switzerland; otherwise it is zero. The Cairns dummy is specified as one for Canada, Australia and New Zealand; otherwise it is zero.

Descriptive Statistics

[Table 5]

References

Beghin. J.C., and M. Kherallah (1994) "Political Institutions and International Patterns of Agricultural Protection." *The Review of Economics and Statistics* **76**, 482-489.

Blake, A.T., A. J. Rayner, and G. V. Reed (1999) "A Computable General Equilibrium Analysis of Agricultural Liberalization: The Uruguay Round and Common Agricultural Policy Reform," *Journal of Agricultural Economics* **50**, 401-424.

CBO (2006) *The Effects of Liberalizing World Agricultural Trade: A Review of Modeling Studies*.

de Goter, H., and Y. Tsur (1991) "Explaining Price Policy Bias in Agriculture: The Calculus of Support-Maximizing Politicians." *American Journal of Agricultural Economics* **73**, 244-1254.

Diao, X., J. Dyck, C. Lee, D. Skully, and A. Somwaru (1999) "Structural Change and Agricultural Protection: The Costs of Korean Agricultural Policy 1975 and 1990," Agricultural Economic Report Number 809.

Diao, X, T. Roe, and A. Somwaru (2002) "Developing Country Interests in Agricultural Reforms under the World Trade Organization," *American Journal of Agricultural Economics* **84**, 782–790.

Harrison, G. W, T. F. Rutherford, and D. G. Tarr (1997) "Quantifying the Uruguay Round," *The Economic Journal* **107**, 1405-1430.

Honma, M., and Y. Hayami (1986) "Determinants of Agricultural Production Levels: An Econometric Analysis" *The Political Economy of Protection*, Boston: Allen and Unwin.

OECD (2004) *Methodology for the Measurement of Support and Use in Policy Evaluation*.

Olper, A. (1998) "Political Economy Determinants of Agricultural Protection Levels in EU Member States: An Empirical Investigation" *European Review of Agricultural Economics* **25**, 463-487.

Olper, A. (2001) "Determinants of Agricultural Protection: The Role of Democracy and Institutional Setting." *Journal of Agricultural Economics* **52**, 75-92.

Olson, M. (1965) *The Logic of Collective Action*, Cambridge: Harvard University Press.

Olson, M. (1986) "Space, Organization and Agriculture." *American Journal of Agricultural Economics* **67**, 923-937.

Swinnen J. F. M, A. N. Banerjee, G. C. Rausser, and H. de Gorter (2000) "The Political Economy of Public Research Investment and Commodity Policies in Agriculture: An Emprical Study" *Agricultural Economies* **22**,111-122.

Swinnen J. F. M, A. N. Banerjee, and H. de Gorter (2001) "Economic Development, Institutional Change, and the Political Economy of Agricultural Protection: An Econometric Study of Belgium since the 19th Century" *Agricultural Economics* **26**, 25-43.

Thies, C. G., and S. Porche (2007) "The Political Economy of Agricultural Protection," *The Journal of Politics* **69**, 116-127.

WTO (2004) *Agricultural Negotiations: The Issues, and Where We Are Now*.

Table 1: Hausman test statistics

Equation 2	G_p	L_s	C_a	Joint(G_p, L_a, C_a)
	6.282*	7.287*	3.854*	54.227*
Equation 3	G_p	G_a	C_a	Joint(G_p, C_a)
	6.925*	0.428	5.620*	16.059*

*Reject exogeneity at 5%

Table 2: Estimation Results of OLS

Equation	2	3	4	5
$\ln L_s$	-0.046*		-0.046***	
$\ln G_a$		-0.029		-0.021**
$\ln T_r$	-0.227	-0.225	-0.200**	-0.198*
$\ln G_p$	-0.235***	-0.212***	-0.075***	-0.041***
$\ln C_a$	-0.369***	-0.353***	-0.011	-0.002
URDUMM	0.065*	0.064*	-0.018	-0.023
EUDUMM			0.249***	0.247***
G10DUMM			0.926***	0.918***
CARINSDUMM			-0.010	-0.031
Intercept	3.640	3.551	1.199	1.154
Adj R^2	0.312	0.309	0.906	0.904
S.E of regression	0.265	0.265	0.098	0.099
No.obs	437	437	437	437

Notes: ***,**and* indicate significance at the 0.01,0.05 and 0.10 levels respectively

Table 3: Estimation Results of GLS

Equation	2	3	4	5
$\ln L_s$	-0.061*		-0.040***	
$\ln G_a$		-0.053*		-0.017***
$\ln T_r$	-0.171***	-0.174***	-0.191	-0.194
$\ln G_p$	-0.192***	-0.163***	-0.057***	-0.027***
$\ln C_a$	-0.144	-0.108	-0.024*	-0.016
URDUMM	0.028	0.027	-0.027	-0.013
EUDUMM			0.256***	0.253***
G10DUMM			0.913***	0.906***
CARINSDUMM			-0.021	-0.040
Intercept	2.145	1.935	1.195	1.182
Adj R^2	0.717	0.730	0.934	0.932
S.E of regression	0.231	0.230	0.097	0.099
No.obs	437	437	437	437

Notes: ***,**and* indicate significance at the 0.01,0.05 and 0.10 levels respectively

Table 4: Estimation Results of 2SLS

Equation	2	3	4	5
$\ln L_s$	-0.044*		-0.049***	
$\ln G_a$		-0.019		-0.018*
$\ln T_r$	-0.334	-0.333	-0.353***	-0.356***
$\ln G_p$	-0.225***	-0.197***	-0.076***	-0.034*
$\ln C_a$	-0.428***	-0.420***	-0.012	-0.007
URDUMM	0.082**	0.080**	0.007	0.002
EUDUMM			0.248***	0.245***
G10DUMM			0.926***	0.917***
CARINSDUMM			-0.011	-0.039
Intercept	4.376	4.347	1.884	1.883
S.E of regression	0.265	0.266	0.095	0.096
No.obs	414	414	414	414

Notes: ***,**and* indicate significance at the 0.01,0.05 and 0.10 levels respectively

Table 5: Descriptive Statistics

Variable	Mean	Median	Std. Dev.	Min	Max
$\ln NAC_p$	0.513	0.441	0.319	0.006	1.533
$\ln L_s$	-3.335	-3.346	0.607	-4.796	-1.854
$\ln G_a$	-3.636	-3.633	0.619	-5.378	-2.247
$\ln G_p$	2.306	2.350	0.458	1.079	3.257
$\ln T_r$	4.623	4.605	0.059	4.540	4.757
$\ln C_a$	4.670	4.658	0.333	3.723	5.385
$\ln A_l$	2.928	2.983	1.208	0.099	5.595
$\ln A_m$	4.039	4.270	0.818	-0.562	5.082