The effect of international agrifood trade and policy on international development

Maureen Kilkenny, Karine Daniel

The Effect of International Agrifood Trade and Policy on Intranational Development, Part I: Country Models

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by
Maureen Kilkenny, Dept. of Economics, Iowa State University
Karine Daniel, INRA Nantes, Université Paris I Sorbonne

Introduction

The pattern of agrifood trade between North America and Europe can be described generally as an exchange of *commodities* for *products* (see also dell'Aquila, Sarker, and Meilke, 1999). A *commodity* is a good with homogeneous characteristics, such as "Hard Red Winter Wheat" or "Number 2 Yellow Corn." A *product* has distinctive characteristics which vary across processors and/or the geographic source of the raw inputs or the location of processing, such as "Roquefort" or "Cognac."

North American farmers and food processors, serving domestic customers who value homogeneity, capitalize on their relative abundance of land and capital and benefit from increasing returns to scale. They specialize in and export homogeneous commodities. European farmers and processors, serving domestic customers who value heterogeneity, specialize in and export differentiated products. Thus, North Americans traditionally argue for increased access to export markets for their commodities. Europeans argue for protection of their domestic commodity producers as well as access to export markets for their differentiated products.

Both blocs use industrial and international trade policies in their attempts to enhance employment opportunities in their rural areas (c.f. OECD, 1994; Agra Europe, 1999). Factor immobility can undermine the potential gains from trade: if resources cannot reallocate, some resources earn rents while others may be unemployed. Indeed, it is well known that factor immobility provides a market-failure rationale for trade and industrial policy. Here we are concerned with two types of factor immobility. First is the spatial and sometimes sectoral immobility of land. Second is the costly mobility of labor across space. For geographically large nation-blocs like North America and Europe, labor supply in the short run is mobile (workers commute) *within* subnational areas.[1] In the medium run it may be mobile within a country, but not internationally. The agglomeration economies that atttract mobile households to concentrate in urban areas can leave rural land idle and rural household income low. These rural development problems are common to both blocs. It is not clear that the policies in use today are the

[1] The short run is the time within which household location is fixed; equivalently, workers do not migrate.

second best responses to these problems. This paper presents an abstract theoretical model of how the problems may arise, and ultimately, what may be done about them. We plan to use the models to simulate the effects of industrial and protectionist trade policies on land use, employment, and welfare in rural compared to urban areas.

This paper describes the 'new economic geography' models of two multi-region countries in which land is needed to produce location-specific and generic farm commodities, while labor is intersectorally and interregionally (but not internationally) mobile.[2] The other key features of the models are that consumers prefer variety, and that varieties are location-specific (i.e., Indication Géographique de Provenance (IGP) or Appelation d'Origine Controlée (AOC). Farm outputs are processed into either generic products or into differentiated varieties. Distance between regions is discrete and transport of both farm products and final goods is costly (as in Kilkenny, 1998). Households are proprietors who supply labor and land, and choose their region of residence and sector of employment such that there are no alternative higher utility opportunities. Household income is taxed to finance any subsidies (as in Walz, 1996).

Only total labor supply, regional land endowments, preferences, transport cost rates, and technology parameters are predetermined or exogenous. Thus, there is no closed-form solution for this model. For this reason we pose it as a Walrasian general equilibrium system and solve it numerically. That we do *not* assume *ad hoc* closure distinguishes this model from other new economic geography models (with the exception of Kilkenny, 1998). Our explicit general equilibrium approach allows us to conduct comparative static analyses of alternative stable, *asymmetric* spatial equilibria. This is particularly appropriate for analyzing rural development policy. Mainstream new economic geography models relying on ad hoc closure rules generate either symmetric or fully concentrated equilibria (see, for example, Fujita, Krugman, and Venables, 1999).

Furthermore, also unlike most new economic geography models, land is an explicit factor of production. Helpman (1998) models a mobile workforce relative to immobile local supplies of housing (land). Per unit housing rent is determined as local expenditure on housing divided by local housing supply. Expenditure on housing is a fixed share of local income, which includes the local population's share of nationwide rent. In contrast, in our model land value is the residual share of sectoral value-added, as envisioned by Ricardo, Von Thunen, and Alonso. Land rents are higher for high-priced products, high productivity land, or land closer (lower transport costs) to the market. Furthermore, land rent accrues only to farm households, in contrast with Helpman, 1998, or Fujita and Krugman, 1995, who

[2]Ultimately, we will build a system of at least two multi-region trading countries. Here we use the single-country models to investigate the implications of different preferences for variety on land use.

distribute rents equally to all citizens everywhere. Finally, given the perfect mobility of households, farm households are "land rich but dirt poor."

The next section presents some facts about factor endowments, regional population and farm land use densities, national preferences, and international agri-food trade. We design our stylized model with respect to these facts. The third section specifies the general equilibrium model for two countries that differ only in their preferences for variety. The fourth section compares the initial equilibrium solutions. We discuss how well our model mimics the stylized facts presented section 2. It should be noted that there are no explicit market failures other than land immobility in the base models. Nevertheless, we show that rural development problems arise, implying there is a role for trade/tax/subsidy policies.

Endowments, Regional Densities, Preferences, and Trade

The patterns of specialisation and trade can explained, in part, by differences in factor endowments.[3] The differences in labor:arable land proportions, and in population concentrations between USA , France, and Europe are documented in Table 1.

The USA and the European Community have similar endowment ratios, implying that intra-industry trade should be more significant rather inter-industry trade between the two blocs. Europe has a more evenly dispersed population (higher population densities everywhere) than the USA. The corollary is that the labor force is more spatially concentrated in the USA than in Europe. Also, a smaller share of the population lives on farms in the US (6%) than in Europe (11%). Taken together these facts are consistent with the fact that European rural areas, where there are fewer than 150 inhabitants per square kilometer, have higher population densities than rural areas in USA (OECD, 1994).

Table 1	labor force (1000s)	Arable Land (1000 ha)	L/T	% farm households	inhab. per rural km^2
USA	134,300[b]	70,426[c]	1.9	6%[d]	11[d]
France	24,869[a]	18,073[a]	1.4	11%[d]	51[d]
European Community	165,868[a]	76,134[a]	2.2		

Sources: (a) Statistiques de base de l'Union Européenne, Eurostat ed. 1996
(b) FedStats, US DoC, 2000
(c) NASS, USDA; 1999
(d) OECD, 1994

Figure 1 shows the state-level variations in population densities across the USA. Figure 2 shows the intensity of agricultural land use. Note that farming does not predominate in neither the least nor the most densely populated areas in the USA. Figure 3 shows population densities and Figure 4 shows the

[3] For a very recent spatial test of the factor proportions model, see Kim (1999).

intensity of farm land use across the European Union. In Europe, some of the most densely populated regions are also intensively farmed (c.f., England). This does not happen in the USA.

Next, consider the spatial pattern in agri-food processing. It is not necessarily in rural areas (near farms) even though the industry is input-oriented in the USA, as documented by Kim, 1999. Kim shows that food processing activities have a locational comparative advantage in states relatively well-endowed with agricultural activity and labor. The state level is not a fine enough geographic scale, however, to indicate whether food processing is predominantly a rural or urban activity. This depends on firm size, which depends on consumer demand as much as on technology or orientation.

A large agri-food processor needs to locate centrally to many farms in a large production area. The places in the USA that are most central or accessible to many farms are, however, now *cities* (Kilkenny, 1999). It is also the case worldwide that "the extent of urbanization is limited by the food surplus available to the city" (Bogart, 1998). Although some Old World cities chose inaccessible sites for purposes of defense, most cities have historically been, and still are, sites central to large farm supply regions. Furthermore, these cities are also usually optimal transshipment locations.

In USA, the locational Gini coefficient for the Food and Kindred Processing sector (SIC 20) at the county level of observation is 0.15.[4] This is significantly lower than the average for all sectors of 0.3 (Barkley and Henry, 1998), indicating that agri-food processing is one of the most widely dispersed industries in USA. There is, however, a statistically significant association between large size firms (more than 20 employees) and higher population density locations measured at the zip-code level (Kilkenny, 2000) . For example, in the state of Iowa, only 17% of large firms in the *Food and Kindred Processing* sector (SIC 20) are in rural areas, while 60% are in cities. 41% of Iowa's small firms are in the most rural areas. This positive correlation between large value-added agricultural firm density and population density is highly statistically significant ($\alpha < 0.05$).

Optimal firm size is determined by market demand as well as by technical and fixed cost issues. Consumer preference for variety can support the proliferation of many small firms in one location when variety is firm-specific (Anderson, DePalma, and Thisse, 1992). The more subsitutable products are, from the consumer's perspective, the lower are price premia for diversification. In this setting, we expect fewer, larger firms. Alternatively, the more discretion consumers have, the higher the price premia for product diversity, the more small size firms there can be.

Compare the distribution of cheese processing plants, by employee size, of USA and France. The total employment divided by the number of cheese establishments in the USA is 1,950, while the most common firm size category is up to 50 employees (Figure 5a). In France, the most common firm also has less than 50 employees, but total cheese employment divided by the number of firms 80, and there is no firm producing cheese in France employing more than 700 people.[5] This evidence is consistent with the hypothesis that French cheese consumers value product variety more than consumers of US cheese.

Another way to document the extent of product differentiation is to count varieties. In France, 480 products were formally registered as AOC in 1998.[6] In addition to dozens of wines and cheeses, there are olives, ham, beef, and poultry, special fruits and vegetables, shellfish, and many other agri-food items with IGP labels. Furthermore, the most obvious testament of the relevance of geographic origin to French consumers, for example, is that the province or country of origin is written on all shelf labels, along with the name of the item and its unit price.

In contrast, American consumers reveal by their patronage of national brand commodities of consistent quality (no variation) that they prefer homogeneity. There is, however, some evidence that American consumers are developing a taste for variety (Federal Reserve Bank of Dallas, 1998). Retailers in the USA code and keep track of different brands or products using "shelf keeping units" (SKUs). The Dallas Fed reported that the number of cheese SKUs increased from 65 in 1980 to over 300 in 1998, a fourfold increase in less than twenty years. (Note, however, that there are far fewer SKU's in USA than there are just AOC products in France!) Where are these varieties produced? Data on agri-food trade (Table 3 below) shows that the USA is a net importer of differentiated agri-food products, such as cheese. This occurs despite the fact that at least six units of milk are needed to make a unit of cheese, while milk production per capita in Europe is only 1.2 times higher than in USA (Table 2). This indicates that the competitive advantage of the European cheese processing has some basis other than relative abundance of the raw input (milk). External scale economies, such as those supported by a European willingness to pay for differentiated varieties, is the hypothesized source of competitive advantage in this case.

Table 2.	milk production Q (1000 mt)	population (1000s)	Q/cap
European Union [a]	121,628	372,654	.33
USA[b]	73,959	272,500	.27

Sources(a) 1996 data, Eurostat (op. cit.)
(b) 1999 data; http://www.nass.usda.gov:81/IPEDB

[4] 1998 data is County Business Patterns, U.S. Bureau of the Census; http://www.census.gov/CBP/.
[5] Enquête Annuelle d'Entreprises, 1996.
[6] http://europa.eu.int/comm/dg06/qual/en/index.htm.

Table 3. Net Exports ($1,000s) from USA to EC-15

	Calendar Year				
	1995	1996	1997	1998	1999
BULK COMMODITIES	$3,690,801	$3,885,044	$3,690,983	$2,854,483	$2,147,763
SOYBEANS	$1,998,362	$2,340,311	$2,301,319	$1,527,358	$1,032,860
TOBACCO	$589,970	$657,127	$659,499	$684,427	$667,257
WHEAT	$126,352	$132,918	$197,190	$208,916	$205,976
RICE	$92,367	$132,070	$114,946	$137,515	$118,188
PEANUTS	$151,386	$92,948	$114,678	$86,329	$81,145
PULSES	$84,904	$76,972	$79,863	$78,090	$75,364
COTTON	$170,258	$143,988	$115,844	$114,945	$50,586
OTHER BULK COMMODITIES	$112,858	$64,352	$81,998	$124,868	$28,780
COARSE GRAINS	$527,495	$361,585	$167,756	$2,087	($15,166)
INTERMEDIATES	$1,243,872	$1,046,875	$1,160,755	$915,311	$478,018
FEEDS & FODDERS	$910,786	$896,738	$771,233	$608,402	$548,787
PLANTING SEEDS	$188,605	$188,561	$181,938	$242,286	$181,510
SUGARS& SWEETENERS	$43,905	$78,341	$55,384	$32,638	$42,565
OTHER INTERMEDIATES	$77,179	$36,762	$46,232	($59,491)	$9,831
LIVE ANIMALS	$61,918	$25,632	$43,625	$38,254	($38,708)
TREE NUTS	$629,259	$830,976	$608,491	$634,764	$481,646
FRUIT & VEG JUICE	$3,367	($25,800)	$9,947	$44,301	$92,961
CONSUMER-ORIENTED	($2,425,423)	($2,437,828)	($2,917,601)	($3,272,896)	($4,148,410)
VEGETABLE OILS	($226,482)	($307,978)	($278,931)	($204,317)	($228,441)
RED MEATS (fcf)	($5,603)	($8,423)	($30,504)	($26,146)	($51,246)
PROC FRUIT & VEG	$18,587	($13,328)	($44,466)	($56,064)	($110,358)
FRESH VEGE	($73,857)	($85,704)	($95,437)	($127,616)	($114,450)
NURSERY & FLOWERS	($179,774)	($167,964)	($163,716)	($183,367)	($192,879)
OTHER consumer-oriented nec	($264,005)	($200,353)	($151,007)	($219,801)	($323,078)
CHEESE	($360,848)	($407,009)	($365,092)	($387,432)	($438,016)
SNACKS	($375,308)	($408,411)	($464,092)	($554,704)	($637,107)
WINE & BEER.	($1,567,085)	($1,752,950)	($1,975,937)	($2,139,199)	($2,464,503)

data source: U.S. Bureau of the Census
tabular source: http://www.fas.usda.gov (BICO files)

As Table 3 shows, the pattern of trade between the United States and Europe is clearly an exchange of *commodities* for *products*. The USA exports unprocessed commodities such as soybeans and tobacco to Europe, and imports processed products from Europe such as wine and cheese.

To explain the pattern of land use within and trade between these two blocs, we focus in this paper on two different types of scale economies as the bases of comparative advantage. First, as in all 'new economic geography' models, consumer preferences for variety are the source of *external* increasing returns in a location. The more consumers are willing to pay for firm-specific characteristics, the more firms there can be in the same geographic location. The more utility workers get from the varied products available at low transport costs in a location, the lower nominal wages need be to retain them (see also David and Rosenbloom, 1990). Firm size may be relatively small. The hypothesis is that the European bloc's much stronger preferences for variety supports European processing *industries* at larger scale (comprised of many small firms) ergo Europe's competitive advantage in processed agri-food *products*.

There are few other analyses of the role of preferences for variety as the basis for economies of scale and comparative advantage in international trade. There are studies, however, of the relevance of preferences in explaining the patterns of international trade (Andaluz, 2000; Fontagne, 1999; Osterhaven & Hoen, 1998; Roy & Viane, 1998; Stine & Lee, 1995; Hunter, 1991; Farrell, 1991; Lancaster, 1991).

Second, fixed costs give rise to *internal* increasing returns to scale. In this case, firm size may be relatively large. The hypothesis is that America's domestic consumer preferences for homogeneity support the development of very large scale firms, which can then exploit internal scale economies. Those internal scale economies are the source of the U.S.'s competitive advantage in *commodities*. The third and fourth hypotheses are that these assumptions lead to less employment of farm land in the variety-preferring bloc, and a reduction of variety under free trade (see also Lancaster, 1991). The protectionism we now have may be motivated by the desire to avoid those outcomes.

The Model

The model is designed to generate most of the above stylized facts endogenously, given relative factor endowments and differences in consumer preferences between the trading countries. In this paper we present the basic country model structure in detail. Lowercase *Greek* is used for parameters of endowments, taste, and technology. Lowercase English letters are set indices, and uppercase English letters are the variables. First we present our assumptions about endowments, the role of space and distance, and consumer preferences. Then we show how production and the various discrete choices, such as where to live, where to work, and whose products to buy, are formalized.

"Country One" has two regions with unequal endowments of land and population. The "rural" region has eighty percent of the country's arable land ($\varphi_{rural} = 0.8$). There are four types of industry (indexed by subscript i or j) in each region: generic and specific, farming and processing (i = g,s,m,a). Generic farming (i = g) in region (r) employs land ($H_{r,g}$) and labor ($L_{r,g}$), and supplies raw materials to generic processing (i = m) located in any region. Specific farming (i = s) employs land and labor to supply raw inputs into specific processing (i = a) in the same region only. This latter industry produces final consumer goods (indexed by c) called "AOC" (c = aoc) for this reason. There are eight types of households (indexed by r or rr, and hh), distinguished by their region of residence (rural or urban) and the sectoral source of their income (generic or specific, farming or manufacturing).

Transport costs are incurred on agricultural and processed products shipped from one regional location to another. This is formalized by the assumption that some of the product (labor) is used up in transit, so that the quantities delivered ($QD_{r,i,rr}$) are less than the quantities supplied ($QS_{r,i,rr}$) by the cost of transporting the product i from region r to region rr ($T_{r,i,rr}$):

(1) $QD_{r,i,rr} = QS_{r,i,rr}(1-T_{r,i,rr})$.

This implies that delivered prices (DP) must exceed mill prices (P):

(2) $DP_{r,i,rr} = P_{r,i}/(1-T_{r,i,rr})$.

The numeraire is the urban specific agricultural product. Not only does this imply a "stable urban food price" monetary policy, it also is most tractable mathematically, since agriculture is a constant-returns-to-scale industry, and urban AOC products will always be demanded (given preferences shown in equation (4) below). Finally, material balance requires an equation of quantity produced ($Q_{r,i}$) to the quantities supplied to all regions:

(3) $Q_{r,i,} = \sum_{rr} QS_{r,i,rr}$.

Household preferences are formalized by a Cobb-Douglas utility function over generic goods (c= mnf), and AOC final products from their own region or imported (c = aoc, aocm):

(4) $U_{r,hh} = \Pi_c C_{c,r,hh}^{\alpha c}$.

where each type of final good (C_c) is a CES composite (see (5) below) of manufactured products from the i industries. Regional prices of final goods are determined by market clearing. The material balance equations in each region equate the sum of each households' final demands ($C_{c,r,hh}$) to delivered industry supplies ($QD_{r,c,rr}$):

(5) $\sum_{hh} C_{c,r,hh} \cdot L_{r,hh} = [\sum_{r,i,} \varsigma_{r,i,c,rr} \cdot N_{r,i} \cdot QD_{r,i,rr}^{\rho c}]^{1/\rho c}$,

where $\varsigma_{r,i,c,rr}$ aggregates the industrial goods into final goods, and N_{ri} is the (endogenous) number of firms in each industry. Under the typical mill-pricing monopolistic competition assumptions, for the increasing returns to scale AOC industries with fixed costs *K*, it is possible to analytically predict the optimal AOC firm size, $Q^* = K/(1/\rho + 1/\rho\gamma - 1/\gamma - 1)$, in zero-profit equilibrium (γ is the intermediate input-output coefficient introduced in Equation 11 below). The number of AOC firms can then be determined as limited by the regional labor supply. For generic manufactured goods which are produced at constant returns to scale, N is unitary.

Note also that the elasticity of substitution, $\sigma = 1/1-\rho$,is associated with the product, not the consumer. Thus both local and imported AOC varieties have the same elasticity of substitution. This means that in zero-profit equilibrium, all AOC firms everywhere use the same mark-up over marginal cost, and will be the same size everywhere. Given those preferences, the demand for AOC products facing each AOC firm is $QD = k P^{-\sigma}$ where *k* is a constant (sector and region subscripts dropped for simplicity).

Production technology in the agricultural industries is formalized by a Leontief function:

(6) $Q_{r,g} = \min(L_{r,g}, H_{r,g})$,

$Q_{r,s} = \min(L_{r,s}, H_{r,s})$;

which is that a unit of labor on a unit of land (by proper choice of units) produces a unit of farm product (e.g., one farm household + 100 hectares = 1 ton grain). The marginal cost of farm production is thus the local farm wage ($W_{r,f}$) plus land rent ($V_{r,f}$) where sector-specific wages are determined by market clearing. Labor supplied (LS) by mobile households is demanded (L) by mobile firms:

(7) $LS_{r,i} = L_{r,i}$.

Land rents ($V_{r,i}$) are the residual of sectoral value-added at mill prices (subtracting transport costs) that is not distributed to mobile labor. Rents can also rise if land demand exceeds land supply ($\varphi_r \cdot H\O$) in the region:

(8) $\sum_f H_{r,f} \leq \varphi_r \cdot H\O$.

Finally, the farm industries are competitive, so they supply the quantities such that marginal costs are just covered by the market price plus any subsidies:

(9) $W_{r,f} + V_{r,f} = P_{r,f} + S_f$.

Wages and rents accrue to households according to the sector in which they supply labor. If farm subsidies are provided, they go directly to farm households working in the subsidized sector(s). Household income (YH) can be defined either by industry or by household type as:

(10) $YH_{r,i} = N_{r,i} \cdot [LS_{r,i} \cdot W_{r,i} + (S_i + V_{r,i}) \cdot H_{r,i}]$.

The subsidy (or tax) variable S_f is clearly being treated as a "coupled" subsidy. It can raise (or lower) sectoral value-added, which is distributed as wages and rents. Any change will signal a change in factor supply, and thus output. The specific subsidy S_f can be set exogenously as a rate per unit output, or it can be determined endogenously as the difference between an exogenous target or threshhold price and the endogenous market-clearing price (as in Kilkenny, 1991). It can also measure a license or quota rent (Kilkenny, op. cit.).

The manufacturing industries employ labor and intermediate agricultural inputs (I) in constant proportions:

(11) $Q_{r,m} = \min(L_{r,m}, \gamma I_{g,m,r})$,

$Q_{r,a} = \min(L_{r,a} - K, \gamma I_{s,a,r})$;

implying that $1/\gamma$ units of raw farm input are needed per unit of processed manufactured output in either sector. Increasing returns in AOC production is formalized by the assumption that labor must also be devoted to the fixed cost (K), such that $L_{r,a} = Q_{r,a} + K$.

Total costs in all manufacturing industries are $W_{r,i}Q_{r,i} + 1/\gamma \cdot Q_{r,i} \cdot P_{,r,f,}$; marginal costs are $W_{r,i} + 1/\gamma \cdot DP_{r,f}$. The profit-maximizing level of output is chosen to equate marginal revenue at mill prices (which is equal to $P \cdot \rho$ for AOC processors, but is parametric for generic processors) to marginal cost:

(12) $P_{r,a} = (1/\rho) \cdot [W_r + 1/\gamma \cdot P_{r,s}]$,

$P_{r,m} = W_r + 1/\gamma \cdot IP_{r,g}$,

where IP is the price of the generic farm input, a weighted average of local and non-local generic delivered prices. Since generic farm inputs are perfect substitutes in generic manufacturing, processors will use whichever region's farm product is cheaper, or both regional products if their delivered prices are the same. This is formalized parsimoniously by a modified Kuhn-Tucker condition for interior or corner solutions (c.f. Kilkenny, 1998):

(13) $QD_{rr,g,r}(DP_{rr,g,r} - DP_{r,g,r}) \leq 0$,

which says that the generic product from region rr will be demanded by firms in region r ($QD_{rr,g,r}>0$) if its delivered price is less than the delivered price of the local generic product, or, if the delivered prices are equal. The amounts demanded sum to the amount needed:

(14) $I_{g,m,r} = \sum_{rr} QD_{rr,g,r}$

Similarly, households will work as proprietors in a regional industrial sector as long as they can obtain at least as high utility from what they earn in that industry and location as they could elsewhere:

(15) $LS_{r,i} \cdot (U_{r,i} - U_{rr,j}) \geq 0$

Note how the aliasing of industries with households (i = hh) formalizes this specification. Furthermore, as given in (4), household utility arises from the consumption of the three types of final goods, at their respective delivered prices. Households are uniformly taxed per head, however, to finance the provision of subsidies. This is formalized by the per firm (or household) budget equation:

(16) $\alpha_{c,r} \cdot YH_{r,hh} - (L_{r,hh} \cdot TAX) = C_{c,r,hh} \cdot CP_{c,r} \cdot L_{r,hh}$,

where α is the budget share, given the Cobb-Douglas preferences, TAX is the head tax, C is composite final good consumption (defined above), and CP is the composite final good price. CP is the delivered quantity weighted average of the delivered prices of industrial outputs in the final good aggregates.

Subsidies are financed by the head tax on all households:

(17) $TAX \cdot L\O = \sum_{r,i} S_i \cdot H_{r,i}$.

These seventeen sets of equations, plus two sets of equations defining the composite prices for intermediate goods and final goods, a set of first-order conditions for consumer expenditure minimization (which determine the mix of regional and firm products in final demand), and the zero profit condition for AOC firms, and a national full employment constraint, comprise the twenty one equation types in the general equilibrium model. Formally, given the two regions and four industrial sectors (and household types) the model has 223 equations and 224 endogenous variables. Walras' Law requires that one equation be solved implicitly: we chose to drop the market-clearing equation for the numeraire good, urban AOC. We verify that the general equilibrium system is just-identified implicitly when the urban AOC market also clears given the other solution variables.

Intra-national Development Implications of Differences in Preferences

We make the following assumptions: the countries are endowed with 100 units of labor and 50 units of land (*LØ* = 100, *HØ* = 50). Four units of manufactured output can be produced per unit of farm product ($\gamma = 4$). Fixed and transport costs require about 10% per unit output or productive resource (K, T = 0.10), when applicable. Consumer preferences are such that half of disposable household income is spent on generic manufactures ($\alpha_{mnf} = 0.5$), less than a third on local firm-specific products using strictly local inputs ($\alpha_{aoc} = 0.3$), and the rest is spent on imported differentiated products. In "Country One" AOC products are twice as differentiated as generic products ($\sigma_{aoc} = 2$; $\sigma_{mnf} = 4$). From the perspective of consumers in "Country Two", they are equally undifferentiated ($\sigma_c = 4$ for all c). All the other variables are endogenous.

These general equilibrium models generate two different asymmetric initial equilibria endogenously. Consider the variety-loving Country One. As Table 4 shows, the land-abundant "rural" region with 80% of the land has 57% of the population. The other 43% of the population concentrates on 20% of the land in the "urban" region. Twenty-two percent of the rural households are farming and 78% are in non-farm industry. In the urban region, only six percent of the households farm, and these farmers specialize in the production of inputs for the diversified processing industry. More than half the urban workers are employed in the urban AOC industry. AOC firms sizes are the same everywhere (and exactly as predicted analytically (page 8 above).

Table 4. Country One: Regional Densities and Factor Employment

Population and Labor Force		**Rural**	**Urban**	**Total**
Farm sector	Generic	10.4	0	**10.4 %**
	Specific	2.6	2.4	**5.0 %**
Non farm sector	AOC	23.2	21.8	**45.0 %**
	Manufacturing	21.2	18.4	**39.6 %**
	Totals	**57.4 %**	**42.6 %**	**100 %**
Land				
Farm sector	Generic	20.8	0	**20.8 %**
	Specific	5.2	4.8	**10.0 %**
vacant		54.0	15.2	**69.2 %**
	Totals	**80 %**	**20 %**	**100 %**

The lowest nominal wages in Country One are earned by rural farmers producing Specific raw products(Table 5). Rural generic farmers earn slightly higher wages. Rural manufacturing workers, and all urban farmers and manufacturing workers earn the highest wages. Rural farmers also earn rents for their farmland (.089 per unit). The return to land used for IGP or OAC products, however, is 10% higher (0.098). In sum, rural farm households are "land rich but dirt poor."

Both nominal rural wages and prices are slightly lower than nominal urban wages, so that all households enjoy the same real welfare everywhere(U=0.216; not shown). Urban land rents would be higher (.109, not shown), so urban land is not used to produce generic farm products. All generic agricultural production occurs in the rural region. The price for the urban AOC final good (2.5) is twice the price of urban generic goods (1.27).

Table 5. Prices, Wages, Rents		Rural			Urban		
		P	W	V	P	W	V
Farm sector	Generic	.998	.909	.089	1.110		
	Specific	.998	.900	.098	1	1	
Non farm sector	AOC	2.495	.998		2.500	1	
	Manufacturing	1.247	.998		1.277	1	

Country Two is also endowed with 100 units of labor and 50 units of land ($L\emptyset = 100$, $H\emptyset = 50$), processing technology parameters, transport costs, fixed costs, and top-level consumer preferences are the same as in County One. AOC products, however, are considered no different from generic manufactures ($\sigma_c = 4$ for all c). That difference is the only difference between the two countries. In autarky, this leads to relatively extensive farming in Country Two and less idle farmland (-8%) in Country Two. Firms are larger in Country Two. All of these are the hypothesized and/or observed differences between the blocs.

Table 6. Country Two: Regional Densities and Factor Employment				
Population and Labor Force		**Rural**	**Urban**	**Total**
Farm sector	Generic	10.4	0	**10.4 %**
	Specific	3.86 (+50%)	3.64 (+50%)	**7.5 %**
Non farm sector	AOC	21.89 (-5%)	20.61 (-5%)	**42.5 %(- 5%)**
	Manufacturing	21.16	18.43	**39.6 %**
	Totals	**57.4 %**	**42.6 %**	**100 %**
Land				
Farm sector	Generic	20.8	0	**20.8 %**
	Specific	7.72 (+50%)	7.28 (+50%)	**15.0 %**
vacant		51.5	12.7	**64.2% (-8%)**
	Totals	**80 %**	**20 %**	**100 %**

In the benchmark solution for Country Two, firms in the sector which process only locally-available farm inputs are three times larger than their AOC counterparts in Country One. Output per firm is half-again higher, industry-wide fixed costs are lower by half, and there are half as many plants. Employment in the whole AOC industry, however, is lower by 5% in Country Two even though output is higher, since fewer resources are needed to reproduce fixed costs. Consumption of the "AOC" products is significantly higher, but there is half as much variety. Nominal wages are not different (rural residents have lower nominal incomes in both countries) and the only price difference is that AOC products are 33% cheaper in Country Two.

These simulation outcomes suggest why farmers and rural residents in both countries argue for protection and subsidies. Returns to the rural factors of production are lower, in nominal terms, in both types of countries. Furthermore, a larger amount of farm land is idle in the rural region of Country One than in Country Two. Country One households may envy the large quantities of goods available per capita in Country Two - they may forget that this quantity is available at the expense of quality (variety). They should also fear opening to trade with Country Two, since autarky prices for "AOC" products are lower in Country Two. The next stage in the analysis is to further differentiate Country Two, then to open trade between the two blocs.

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