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MFA PHASEOUT: IMPLICATIONS FOR THE U.S. FIBERS/TEXTILES/FABRICATED PRODUCTS COMPLEX

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OBJECTIVES:

1. To construct and validate an econometric model of the world textile industrial complex.
2. To utilize this econometric model to examine the impact of trade liberalization policies on the competitiveness of the U.S. fiber/textile/ fabricated products industry.

RELEVANCE TO NTC GOALS: The enactment of the North American Free Trade Agreement (NAFTA) and the completion of the Uruguay Round establishing the World Trade Organization (WTO) and phasing out the Multifiber Arrangement (MFA) will place increased competitive pressure on the U.S. textile industrial complex. The gradual phaseout of quotas and the reduction of tariffs on textile and apparel products, as specified in these trade agreements, will make it easier for imported textile products to enter the U.S., but should also open markets in other countries for products from the U.S. F/T/FP industry. Development of this econometric model should help U.S. corporate decision makers and public policy officials better understand the challenges and opportunities implicit in this environment of increased international trade.

TECHNICAL APPROACH:
Extensive literature review identified previous efforts to construct an econometric model of the textile industry. Based upon this review, and the previous work in econometric modeling by the University of Pennsylvania researchers, a preliminary model of the international F/T/FP Complex was constructed. Domestic supply and demand functions were estimated for two aggregate U.S. markets: textile mill products (SIC22) and apparel and other finished goods (SIC23). Equations were estimated using annual data from 1961-1991. Income and own-price elasticities of demand estimates were compared for the NTC model and for several other econometric models of the textile industry. These preliminary data were presented at the 1994 Annual NTC Forum.

Based upon discussion of the project by industry participants and NTC researchers at the Annual Forum, the project team organized a meeting to bring together industry representatives from all ~~parts of the textile industrial complex to discuss this project. This meeting, held on April 29,~~ included researchers and top corporate level representatives from the following segments of the industry:

Fibers/Textiles: Amoco, Springs, Johnston Industries
Apparel: Russell, Fruit of the Loom, Sara Lee
Retail: JC Penney, Sourcing & Technical Services, Inc. (a subsidiary of Kmart)
Supplier/Support: ATMI, NationsBank, Kurt Salmon Associates

All of the NTC research team members were also present, including the graduate students.

Discussion at this meeting pointed out the need for further disaggregation of the data if it was to be useful for corporate level strategic decision making. Difficulties in obtaining suitable data were discussed and plans presented/suggestions offered for addressing these difficulties. Following discussion at this April 29 meeting, a follow-up meeting was held in May with representatives of Swift Textiles, Oxford Industries, Russell Corporation and Kurt Salmon Associates.

Based upon the discussions with industry representatives it was determined that (1) the preliminary econometric model would be further refined and (2) data analysis and model testing would initially focus on the trade between the U.S., Mexico and Canada. This initial focus on the North American trade would be timely because of NAFTA and the impact that this trade agreement will have on the U.S. F/T/FP industry.

Project activity in the last quarter has focused on additional literature review concerning NAFTA, GATT/Uruguay Round, and econometric models of the textile industrial complex. Models studied included both computable general equilibrium (CGE) models (Hanson et al, 1993; Brown, et al, 1992; Harris & Cox, 199 ; Moran & Serra, 1993) and econometric models (Michigan Model, Deardorf & Stern, 1990; Whalley Model, 1985; Cline Model, 1990).

Data sources have been identified. A classification system has been proposed which would have the following categories:

- Raw Material
  - Cotton
  - Wool
  - Silk
  - Synthetic Fiber (Non-cellulosic)
  - Man-made Fiber (Cellulosic)
  - Other Fibers
- Textile Yarn, Fabrics
  - Cotton Yarn & Fabrics
  - Wool Yarn & Fabrics
  - Silk Yarn & Fabrics
  - Synthetic Fiber Yarn & Fabrics (Non-cellulosic)
  - Man-made Fiber Yarn & Fabric (Cellulosic)
  - Other Textile Fiber Yarn & Fabric
- Clothing
  - Men's or Boys' Outerwear
  - Women's or Girls' Outerwear
  - Babies' Clothing
  - Underwear & Swimwear
  - Articles of Apparel, of Textile Fabrics
  - Clothing Accessories, of Fabrics

Textile Products (Other than Clothing Accessories)
Housefurnishings
Industry Use

These data categories would be created from the SIC, SITC, or Harmonized Systems of classification.

Model Specification

Most of the studies on the effects of NAFTA rely on a computable general equilibrium (CGE) model. Recent examples are Hanson et al.(1993), Brown et al.(1992), Harris & Cox(19) and Moran & Serra(1993). As Brown(1992) pointed out, CGE model approaches have been useful for identifying the sectoral distribution of the gains and losses from trade liberalization and other major problem areas. However, these studies also revealed some shortcomings of the CGE analysis. Seemingly minor differences in model strategy can lead to significantly dissimilar results. For example, estimated gains to Mexico range from 1%-7% of its GDP, based upon differences in the structure of the model. In general, most CGE models which suggest the long-term direction of change tend to understate the adjustment cost.

Others make use of econometric models. Cline(1990), Deardorff & Stern(1990), Coleman & Thigpen(1991) are recent examples. These econometric models are different in that they do not rely heavily on arbitrary assumptions as do the CGE models. Now, we try to establish an econometric model to analyze the effect of NAFTA on the U.S. international trade of textile and apparel.

Based upon the previous work of the project team and the modeling work of other researchers, the project team has proposed the following econometric model to analyze the effect of NAFTA on the U.S. international trade of the textile industrial complex.

NTC MODEL

1) Production

$$Q_i = Q_i(L_i, K_i, H_{1i}, H_{2i}, ..., H_{ni}; T_i)$$

where, i=1,2,...,n denotes industries(or commodity)
L_i : labor employed in industry i
~~K_i : capital stock in industry i~~
$H_{1i}, H_{2i}, ..., H_{ni}$: intermediate inputs from industry 1, 2, ..., n industry i
T_i : exogenous technology of industry i.

2) Factor Demand[1]

$K_i = K_i(w, r, Q^o_i)$
$L_i = L_i(w, r, Q^o_i)$

where, w : wage rate
r : rental rate
Q^o_i : level of output in industry i.

3) Supply[2]

$S_i = S_i(P_i)$

4) Nontariff Barriers(ad valorem equivalents)[3]

$B_i = (P_i/\min(e^j * P_i^j)) - N_i - T_i - 1, (B_i \geq 0)$

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1 Here, demands for intermediate inputs are not considered explicitly if they are not from textile or apparel industry.

Factor demands are derived from the cost-minimization problem such as
minimize $C = wL_i + rK_i$
subject to $f(L_i, K_i) = Q^o_i$.

Since this is a problem of constrained minimization, form the Lagrangian function
$L = wL_i + rK_i + \lambda[Q^o_i - f(L_i, K_i)]$.

The first-order conditions for a minimum are
$L_1 = w - \lambda f_1 = 0$
$L_2 = r - \lambda f_2 = 0$
$L_\lambda = Q^o_i - f(L_i, K_i) = 0$.

The sufficient second-condition for an interior minimum is that the following bordered Hessian determinant be negative.

$$\Delta = \begin{vmatrix} -\lambda f_{11} & -\lambda f_{12} & -f_1 \\ -\lambda f_{21} & -\lambda f_{22} & -f_2 \\ -f_1 & -f_2 & 0 \end{vmatrix} < 0$$

By applying the implicit function theorem to the first order conditions ; 'if the determinant of the first partials of a system of equations is nonzero, those equations can be solved, locally for those variables being differentiated as explicit functions of the remaining variables of the system'. Since Δ is such a determinant and is nonzero, in fact negative, by the sufficient second-order conditions, the first order conditions can be solved for L_i, K_i, and λ in terms of the parameters, w, r, and Q^o_i as
$L_i = L^*_i(w, r, Q^o_i)$
$K_i = K^*_i(w, r, Q^o_i)$
$\lambda_i = \lambda^*_i(w, r, Q^o_i)$.

2 Supply function can be derived from 1, 2, and profit maximization condition with an assumption of no inventory change.

3 Roningen, Vernon and Alexander Yeats(1976), 'Nontariff Distortions of International Trade ; Some Preliminary Empirical Evidence', *Weltwirtschaftliches Archiv* 112.

where P_i : price of domestic commodity i
e^j : exchange rate(home currency/country j's currency)
P_i^j : price of commodity i produced in country j
N_i : nominal tariff rate
T_i : estimated ad valorem incidence of various taxes

5) Demand for Domestic Good

(1) demand for good i as intermediate inputs

$$D^I_i = D^I_i(IP, P_i/((1+N_i+T_i+B_i)*(PW_i*e^M_i)))$$

where, IP : industrial production(index) of i's forward industry
PW_i : world price of commodity i
e^M_i : real exchange rate confronted by industry i (weighted by the country's import shares of commodity i by country).

(2) demand for good i as final consumption

$$D^C_i = D^C_i(YD, P_i/((1+N_i+T_i+B_i)*(PW_i*e^M_i)), POP, DEMO)$$

where, YD : disposable income
POP : total population
DEMO : demographic variable(eg. share of active population in the labor market)

(3) total demand for domestic good i

$$D_i = D^I_i + D^C_i$$
$$= D_i(IP, YD, P_i/((1+N_i+T_i+B_i)*(PW_i*e^M_i)), POP, DEMO)$$

6) Exports

(1) export demand for good i as intermediate inputs

$$X^I_i = X^I_i(IPW, ((1+NW_i+TW_i+BW_i)*(P_i/e^X_i))/PW_i)$$

where, IPW: industrial production (index) of i's forward industry for foreign countries (weighted by the country's export shares of commodity i by country)
e^X_i : real exchange rate confronted by industry i (weighted by the country's export shares of commodity i by country)
NW_i, TW_i, BW_i: world equivalents correspond to N_i, T_i, B_i, respectively (weighted by the country's export shares of commodity i by country).

(2) export demand for good i as final consumption

$$X^C_i = X^C_i(YDW, ((1+NW_i+TW_i+BW_i)*(P_i/e^X_i))/PW_i, POPW)$$

where, YDW : disposable income of foreign countries(weighted by the country's export shares of commodity i by country)
POPW : total population of foreign countries(weighted by the country's export shares of commodity i by country).

(3) total exports

$$X_i = X^I_i + X^C_i$$
$$= X_i(IPW, YDW, ((1+NW_i+TW_i+BW_i)*(P_i/e^X_i))/PW_i, POPW)$$

7) Imports

(1) import demand for good i as intermediate inputs

$$M^I_i = M^I_i(IP, ((1+N_i+T_i+B_i)*(e^M_i*PW_i))/P_i)$$

(2) import demand for good i as final consumption

$$M^C_i = M^C_i(YD, ((1+N_i+T_i+B_i)*(e^M_i*PW_i))/P_i, POP, DEMO)$$

(3) total imports

$$M_i = M^I_i + M^C_i$$
$$= M_i(IP, YD, ((1+N_i+T_i+B_i)*(e^M_i*PW_i))/P_i, POP, DEMO)$$

8) Goods Market Equilibrium

$$D_i = S_i - (X_i - M_i)$$

Work is currently under way to obtain the data and test this model for the U.S., Canadian, and Mexican trade in textiles and textile products. Additionally, one of the graduate students on this project will begin to model the U.S./Chinese textile trade as his M.S. thesis. This Master's research will fit into the global model as specified above.

DATA SOURCES:

1. Central Statistical Office, *Business Monitor : Guide to the Classification for Overseas Trade Statistics*, HMSO Publications, London, 1993.
British imports and exports statistics by SITC.

2. Economic Commission for Latin America and the Caribbean, *Statistical Yearbook for Latin America and the Caribbean, 1992.*
General social and economic statistics for Latin America and the Caribbean countries.

3. Global Trade Information Services Inc.(GTI), *World Trade Atlas*, 1993.
U.S. and Japanese imports and exports data by 2, 4, 6, or 10 digit HS code and by over 230 countries for 1991 - 1993.

4. IMF, *Direction of Trade Statistics Yearbook*, 1994.
Exports and Imports of countries to and from other countries.

5. Statistical Division of the U.N., *Monthly Bulletin of Statistics.*
Monthly average production by industry for countries.

6. Statistical Office of the UN, *World Trade Annual, Walker & Company*, 1990.
International trade data of 23 developed countries by SITC code and by countries.

7. U.N. Industrial Development Organization, *Handbook of Industrial Statistics*, 1992.
Leading producers (countries) in major manufacturing branches by ISIC (321 Textile, 322 Wearing Apparel). Structure of the manufacturing sector (share in total value added, total employment by ISIC code), Growth rate of production and relative rate of production by ISIC code.

8. U.S. Bureau of the Census, *U.S. Merchandise Trade : Exports, General Imports, and Imports for Consumption*, 1992.
Value of exports, general imports, and imports for consumption data by SITC commodity groupings.

9. U.S. International Trade Commission, *Harmonized Tariff Schedule of the U.S.*, 1994.
U.S. tariff rates on imports by HS 9 digit.

10. United Nations, *Industrial Statistics Yearbook*, 1991.
Commodity production statistics by ISIC code for about 45 countries.[4]

11. United Nations, *International Trade Statistics Yearbook*, 1993.
Imports and exports statistics by SITC for about 50 countries.

[4]ISIC stands for International Standard Industrial Classification. The relationships between SITC and ISIC are available in United Nations, *Classification of Commodities by Industrial Origin*, 1966.

SELECTED REFERENCES:

1. Anderson, Kym ed., *New Silk Roads: East Asia and World Textile Markets*, Cambridge University Press, 1992.
   Analysis of the changing patterns of production and international trade in fibers, textiles and clothing (from Europe, to Japan, to NICS, and to the new generation of NICS) and also the adjustment in the established supplier countries.

2. Auguiler, Linda M., 'NAFTA: A Review of the Issues', *Economic Perspectives* Jan.-Feb. 1993, Federal Reserve Bank of Chicago, 1993.
   Review issues of NAFTA and its impact on regional economy.

3. Belous, Richard S. and Jonathon Lemco eds., *NAFTA as a Model of Development: The Benefits and Cost of Emerging High and Low Wage Areas*, National Planning Association, 1993.

4. Bosworth, Barry P. eds., *North American Free Trade*, The Brookings Institution, 1992.
   Impact of NAFTA on labor markets, industry, agriculture, the rest of the world and nontraded issues and also modeling issues.

5. Brandis, R. Buford, *The Making of Textile Trade Policy, 1935 - 1981*, American Textile Manufactures Institute, 1982.
   Review U.S. textile trade policy.

6. Brown, Drusilla K. et al., 'A North America Free Trade Agreement: Analytical Issues and a Computational Assessment', *The World Economy* 15, 1992.
   Review some issues analyzing the economic impact of a NAFTA and provide some quantitative estimates of the effects by use of a CGE model of 29 sectors.

7. Central Statistical Office, *Business Monitor: Guide to the Classification for Overseas Trade Guide*, HMSO Publications, London, 1993.

8. Cline, William R., *The Future of World Trade in Textiles and Apparel, Revised Edition*, Institute for International Economics, 1990.
   Overview of the textile and apparel industry of U.S., Europe, Japan and developing countries; forms an econometric model of U.S. international trade in textile and apparel.

9. Coleman, J. and Thigpen, M.E. *An Econometric Model of the World Cotton and Non-Cellulosic Fibers Markets*, World Bank Staff Commodity Working Paper, #24, 1991.

10. Deardorff, Alan V. and Stern, Robert M. *Computational Analysis of Global Trading Arrangements*, University of Michigan Press, 1990.

11. Dickerson, K.G. *Textiles and Apparel in the International Economy*, Macmillan, 1991.

12. Friman, H. Richard, *Patchwork Protectionism: Textile Trade Policy in the U.S., Japan, and We t Ger any,* Cornell University Press.
    A comparative analysis of textile trade policy choices in the U.S., Japan, and West Germany.

13. Grinspun, Ricardo and Maxwell A. Cameron eds., *The Political Economy of North American Free Trade*, St. Martin's Press, 1993.
    Overview and analyze the impacts of NAFTA on the three countries and the continentalizing North American auto and petroleum industry.

14. Hanson, Kenneth et al., 'U.S. Adjustment in the 1990s: ACGE Analysis of Alternative Trade Strategies', *International Economic Journal* vol. 7 no. 2, 1993.
    Investigate the implications for the structure of the U.S. economy of a reduction in the U.S. trade deficit by use of a 30 sector CGE model of the U.S. (comparison of two alternative adjustment scenarios, successful world trade liberalization and lapse of the world economy into a protectionist environment.)

15. Harris, Richard G. and David Cox, 'North American Free Trade and Its implication for Canada: Results from a CGE Model of North American Trade', 19 .
    Impact of NAFTA on Canadian economy by use of a 19 industry CGE model.

16. Khanna, S.R. The New GATT Agreement: Implications for the world's textile and clothing industries; *Textile Outlook International*, 52, 1994.

17. Moran, Cristian and Pablo Serra, 'Trade Reform Under Regional Integration: Policy Simulations Using a CGE Model for Guatemala', *Journal of Development Economics* 40, 1993.
    Evaluates the effects of alternative trade policy reforms to the Central American Common External Tariff (CET) Schedule on the Guatemala economy by use of a CGE model which allows for product differentiation, sector specific capital, and substitution in production and consumption.

18. Moss, Ambler H. Jr. ed., *Assessments of the NAFTA, North-South Center*, University of Miami, 1993.
    An overview of NAFTA.

19. OECD, *Textile and Clothing Industries: Structural Problems and Policies in OECD Countries*, 1983.
    Overview of the changing place of the OECD textiles and clothing industries in the overall context and analyze broad trends of structural change in the industry over the post-war period; examines the policy response to structrual change.

20. O'Driscoll, Gerald P. Jr. ed., *Free Trade Within North America: Expanding Trade for Prosperity*, Kluwer Academic Publishers, 1993.

Potential opportunities and hazards for liberalized trade between North and South America, also implications of NAFTA on regional economies.

21. Office of Technology Assessment, Congress of the U.S., *The U.S. Textile and Apparel Industry: A Revolution in Progress,* Special Report, 1987.
    Overview of U.S. textile and apparel industry with respect to technology and structural change by major industry sectors and issues related to technology, employment, and policy.

22. Orme, William A. Jr., *Continental Shift: Free Trade and the New North America,* the Washington Post Company.
    Overview issues on NAFTA, especially what he called NAFTA myths and misconceptions.

23. Toyne et al., *The Global Textile Industry,* George Allen & Urwin, 1984.
    A worldwide analysis of the textile mill product industry and identifies policy and strategy alternatives for the industries of both developed and developing countries.

24. U.S. International Trade Commission, *Harmonized Tariff Schedule of the United States,* USITC Publications 2449, 1992.

25. U.S. International Trade Commission, *Potential Impact on the U.S. Economy and Industries of the GATT Uruguay Round Agreements* (USITC Publications 2790, v. 1-2), 1944.

26. U.S. International Trade Commission, *Potential Impact on the U.S. Economy and Selected Industries of the NAFTA,* 1993.
    Overall economic effects of NAFTA, NAFTA provisions and related legal changes, also short run and long run impact of NAFTA on specific sectors.

27. Whalley, John, *Trade Liberalization Among Major World Trading Areas,* The MIT Press, 1985.