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Gender Segregation and Gender Bias in Manufacturing Trade Expansion: Revisiting the "Wood Asymmetry"

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1. INTRODUCTION

Does globalization have a gender bias? Wood (1991) found an apparently fortunate asymmetry: trade between developed and developing countries corresponded with an increased female intensity of employment in developing countries and had no noticeable negative symmetric effect on the female intensity of employment in the traded-goods sector of industrialized countries. As Wood noted, the asymmetry is particularly striking because it contradicts the findings of research done in the mid-1980s. Schumacher (1984), using 1977 data, found that a representative (and trade-balance neutral) bundle of imports and exports between six European Union countries and developing countries had a distinct positive effect on male employment and negative effect on female employment. In addition, Baldwin (1984) found that women make up a disproportionately large share of workers displaced by foreign trade. Though at odds with both theoretical prediction and prior empirical evidence, Wood's asymmetry result has received surprisingly little attention. In this paper we revisit the Wood asymmetry, using more recent and disaggregated data (22 manufacturing industries) for ten OECD countries for 1978–95. We use factor content analysis to calculate changes in male and female employment associated with trade expansion. We find that in most of the countries in the sample (in particular Australia, Canada, Japan, the Netherlands, and the United States) trade expansion with non-OECD countries resulted in employment declines that disproportionately affected women. In most continental European countries in our sample (France, Germany, [1] and Italy) there was little or no gender bias in the decline in employment associated with the expansion of non-OECD trade.

Analysis at the industry level shows that in almost every case the gender bias of non-OECD trade is associated with developments in the Textiles, Apparel, Leather and Leather Goods industry. The high female percentage of employment in this industry indicates that gender segregation plays an important role in the gender bias of employment effects from non-OECD trade expansion. But given the strikingly high correlation in the female percentage of employment by industry across the sample of OECD countries, we conclude that the differences in gender bias observed across countries are not the result of gender segregation but due mainly to differences in trade performance in the Textiles, Apparel, Leather and Leather Goods industry.

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Our results constitute a reversal of the Wood asymmetry, most likely because our study covers a different time period. We consider 1978–95, while Wood analyzed the period 1960 through the mid-1980s. At the same time, our results raise another puzzle—a strong negative crosscountry correlation within the 1978 to mid-1990s period between the magnitude of gender bias resulting from non-OECD trade and the decline in the relative female intensity of manufacturing employment. We attribute this result to the relative importance of domestic (as opposed to international trade) factors related both to female employment directly and to demand changes occurring as part of the long-term process of economic growth.

This paper contains seven sections. In Section 2 we analyze the basic trends in trade and female employment in manufacturing since the late 1970s. In Section 3 we develop the algorithms used in the factor content calculations. In Section 4 we present the basic results on the employment effects of trade expansion at the country level. In Section 5 we explore the issue at the level of specific manufacturing industries in an attempt to explain the national-level results. In Section 6 we take up the new puzzle that arises from the results. Section 7 concludes with a discussion of potential explanations for the varying performance of the Textiles, Apparel, Leather and Leather Goods industry across industrialized countries.

2. MANUFACTURING TRADE EXPANSION AND THE FEMALE INTENSITY OF PRODUCTION

The last 20 years have seen the rapid expansion of world trade relative to output, that is the trade share. Despite globalization, most of world trade continues to be among OECD countries. But an important contributor to the growing world trade share has been a rapid increase in import penetration by developing countries into the OECD. Table 1 shows the rise in import penetration in manufacturing during 1970–95 for 10 countries. Import penetration rose over the period for every country. The figures are then broken out into trade with other OECD countries and with non-OECD countries. [2] The rise in import penetration with non-OECD countries exceeded that with other OECD countries for each of these countries.

Table 1. *Import penetration for manufacturing industries, 1970–95 (imports as a percentage of domestic consumption)*[a,b]

	World	OECD	Non-OECD
Australia			
1970	16.3	15.1	1.2
1978	21.2	18.0	3.1
1990	23.8	19.8	4.1
1995	31.7	25.5	6.2
Canada			
1970	24.6	23.7	0.8
1978	30.9	29.7	1.2
1990	37.2	34.9	2.4
1995	49.7	46.3	3.4
Denmark			
1970	41.1	39.0	2.1
1978	42.4	40.1	2.4
1990	50.7	47.8	3.0
1995	52.4	49.3	3.1
France			
1970	14.7	13.4	1.4
1978	19.4	17.9	1.5
1990	29.6	27.3	2.3
1995	32.0	29.1	2.9
Germany			
1970	13.4	12.0	1.4
1978	17.7	15.9	1.8
1990	25.0	22.6	2.4
1995	27.2	23.9	3.3
Italy			
1970	13.6	12.0	1.6
1978	17.3	15.6	1.6
1990	21.3	19.1	2.2
1995	27.2	24.2	3.0
Japan			
1970	4.0	2.9	1.1
1978	4.1	2.7	1.4
1990	6.8	4.5	2.3
1995	7.7	4.8	2.9
Netherlands			
1970	40.4	38.6	1.9
1978	49.0	46.4	2.7
1990	66.9	64.0	2.8
1995	70.7	66.5	4.2
United Kingdom			
1970	14.2	12.2	2.0
1978	22.5	20.2	2.3
1990	31.3	28.6	2.7
1995	36.7	33.0	3.8
United States			
1970	5.3	4.2	1.1
1978	8.5	6.3	2.2
1990	14.5	10.2	4.3
1995	17.9	11.9	6.0

[a] *Sources*: OECD *STAN* Database for Industrial Analysis (1998a), OECD Bilateral Trade Database (1998b).
[b] Germany refers to the former West Germany except for 1995, for which trade data include regions of the former East Germany.

What have these trends in world manufacturing trade and especially North-South trade meant for the demand for male and female labor? Wood (1991) finds no clear relation between changes in manufacturing import penetration and female intensity of manufacturing relative to female intensity in the nontradeables sector (with female intensity defined as the number of females divided by the number of males multiplied by 100 and the nontradeables sector defined by Wood as all sectors except agriculture, manufacturing, and mining). Wood notes (p. 176), "Surprisingly, given the expected effects of expanded North-South trade, [the results] show that there was not a general decline in the female intensity of developed-country manufacturing during 1960–85." He then breaks out blue-collar and white collar employment and finds exactly the opposite of what he expected: Female intensity for white-collar manufacturing employment fell relative to that in the nontradeables sector and for blue-collar workers, "where trade would be expected to have had more of an adverse impact," relative female intensity of manufacturing employment rose (Wood, 1991, p. 180).

More recent data on the female percentage of manufacturing employment, presented in Table 2, appear consistent with Wood's asymmetry. In all countries except France, Germany and the United Kingdom, the female percentage of manufacturing employment rose over 1978–95. The female percentage of manufacturing employment is remarkably stable in the face of serious manufacturing trade deterioration. In this case the exceptions truly prove the rule: Germany and France are two of the countries which, as described below, do not show a gender bias from trade with non-OECD countries over this period.

The problem is that trade effects on female intensity in manufacturing have likely been swamped by domestic institutional forces regarding the decline of the male-female wage gap and changes in educational attainment, household relations, and family leave and health care policies of the private and public sectors. As Wood himself admits:

> Needless to say, other things affecting female labour supply and demand have not in fact been equal. Economic, social, legal and cultural changes have altered the availability of women for paid work and the will-

Table 2. *Female percentage of manufacturing employment, 1975–97*[a,b]

	Australia	Canada	Denmark	France	Germany	Italy	Japan	Netherlands	United Kingdom	United States
1975		24.7	28.2	30.9	30.1		31.8	15.6	29.8	28.7
1976	26.0	25.8	28.5	30.9	30.0		32.7	14.8	29.3	29.5
1977	25.5	25.0	27.9	31.1	29.8	31.4	33.7	14.7	29.6	29.9
1978	25.4	25.6	28.3	31.0	30.1	31.3	34.4	15.2	29.5	30.4
1979	25.4	26.6	30.2	31.1	29.9	31.7	33.7	15.5	29.7	30.7
1980	25.3	26.9		30.9	30.4	32.1	34.0	16.3	29.4	31.1
1981	25.3	26.9	29.2	30.7	30.1	32.8	34.5	16.3	28.8	31.4
1982	25.3	27.2		30.6	29.5	32.9	34.1	16.4	28.7	31.9
1983	25.2	28.3	30.6	30.7	28.7	32.8	34.8	15.7	28.8	32.4
1984	25.6	28.2	31.3	30.8	28.9	32.8	34.9	16.2	29.3	32.5
1985	25.9	27.8	31.6	30.8	29.1	32.8	35.2	16.1	29.6	32.4
1986	26.3	28.7		30.7	28.8	32.7	35.4	16.2	29.7	32.6
1987	26.6	28.6		30.6	29.1	32.9	35.2	17.1	30.0	32.9
1988	27.0	28.6		30.4	28.9	32.8	35.3	18.4	30.2	32.9
1989	27.1	28.7		30.4	28.6	33.3	36.1	18.2	30.2	33.0
1990	28.0	28.8		30.5	29.8	33.6	36.1	19.6	30.2	32.9
1991	28.2	28.6		30.6	29.5	33.1	36.0	19.8	30.1	33.0
1992	28.0	28.7		30.5	29.5	32.7	35.7	20.2	30.1	32.9
1993	26.9	28.0		30.5	28.6		35.7	20.7	30.0	32.8
1994	27.2		32.4		28.7	31.7	35.1	19.8	29.7	32.7
1995	27.4		30.8		28.7		34.9	20.8	29.3	32.4
1996			31.4		28.6			20.9	28.8	32.2
1997			31.1		28.4			21.7		32.1

[a] *Source*: ILO Yearbook of Labour Statistics (various years). Missing years were not published in this source.
[b] Germany refers to the former West Germany.

Table 3. *Relative female intensity of employment, 1978–94*[a,b]

	Australia	Canada	Denmark	France	Germany	Italy	Japan	Netherlands	United Kingdom	United States
Female intensity of employment in manufacturing (traded goods)										
1978	34.0	34.4	39.4	45.0	43.1	45.5	52.5	17.9	41.7	43.7
1994	38.0	38.8	47.9	44.9	42.4	46.5	54.0	24.8	42.3	48.5
Female intensity of employment in nontraded goods sectors										
1978	71.1	76.5	97.5	77.3	71.6	41.6	61.3	53.8	93.6	84.2
1994	100.4	96.1	107.4	98.2	82.0	49.2	67.4	85.7	120.2	106.4
Ratio of female intensity of employment in manufacturing-to-nontraded goods sectors										
1978	0.48	0.45	0.40	0.58	0.60	1.09	0.86	0.33	0.45	0.52
1994	0.38	0.40	0.45	0.46	0.52	0.95	0.80	0.29	0.35	0.46
Difference	−0.10	−0.05	0.04	−0.12	−0.08	−0.15	−0.05	−0.04	−0.09	−0.06

[a] *Source*: ILO Yearbook of Labour Statistics (various years).

[b] Female intensity is defined as the number of female employees divided by the number of male employees in percentage terms; Nontraded goods sectors are defined as nonagricultural sectors minus manufacturing and mining; Mining data are unavailable for Canada; All data are for paid employment, excluding self-employed and unpaid family workers; For Canada and France, data are for 1978 and 1993. For Germany, data are for 1978 and 1990.

ingness of employers to hire them. Moreover, these changes have occurred at varying speeds and to varying extents in different countries (Wood, 1991, p. 169).

Wood's response is to control for these other factors by normalizing the female intensity in manufacturing by female intensity of employment in the nontradeables sector. We do the same exercise for 1978–94, normalizing the female percentage of manufacturing employment by the female percentage of employment in nontraded goods sectors. The results are summarized in Table 3. These ratios show a decline in the relative female percentage of manufacturing for all countries except Denmark. This is quite different from Wood's results, and we attribute that to the fact that we are looking at a different time period. For the more recent period that we are considering, the direct effects of trade on female employment resulting from the surge in developing country import penetration have had more time to work through. Moreover, and perhaps more important, the structural changes regarding female participation and sectoral demand have also played out over a longer period of time than the 1960 to mid-1980s period that Wood analyzed.

Because of the presence of these well-known structural factors, we do not take the Table 3 figures as a necessary indication of a gender bias in the employment effects of changing trade patterns. A more direct measure of the gendered employment effects of trade expansion is one that Wood himself championed in his later work: factor content analysis (Wood, 1994). We turn now to this approach, and return in the conclusion to the question of how to reconcile the results of Table 3 both with the Wood asymmetry and with the crosscountry gender bias pattern that the factor content analysis reveals.

3. FACTOR CONTENT ALGORITHMS

In keeping with much of the literature on employment effects of trade, we calculated the change in factor content resulting from a change in the structure of international trade. [3] As with Sachs and Schatz (1994, p. 28), the change in trade structure for each industry over the period from 1978 to 1995 is defined as follows:

$$T = [X^{95} - (X^{95}(x^{78}/x^{95}))] - [M^{95} - (M^{95}(m^{78}/m^{95}))], \quad (1)$$

where T is the vector of changes in total trade intensity, X, M are the vectors of export and import values, respectively, and, x, m are the vectors of export and import propensities, respectively. Export propensity, for example, is total exports divided by domestic production in the industry. Superscripts refer to the beginning and end of the period. [4]

The trade expansion vector gives the difference between actual export and import levels at the end of the period and what these levels would have been at the end of the period if the sectoral export and import propensities had remained constant over the period. That is, the trade expansion vector is the difference between actual net exports at the end of the period and counterfactual net exports, more clearly shown when Eq. (1) is rewritten as follows:

$$T = (X^{95} - M^{95}) - (X^{78} - M^{78})(Q^{95}/Q^{78}), \quad (2)$$

where Q is the vector of domestic production.

Since T is a measure of the effect of trade changes on final demand, total employment gains or losses resulting from the change in the structure of trade are given by

$$L = \hat{E}[(I - A)^{-1}T], \quad (3)$$

where L is the vector of changes in total employment associated with a change in the structure of world trade, $\hat{E}$ the diagonal matrix of labor coefficients (employment per unit of output), I the identity matrix, and, A is the technical coefficients matrix.

The female labor embodied in a given change in total trade structure is given by the following:

$$L^{f} = \hat{G}L, \quad (4)$$

where L^{f} is the vector of change in female employment associated with a change in the structure of trade, and, $\hat{G}$ is the diagonal matrix of female coefficients of employment (number of female employees divided by the number of total employees).

The residual is the change in male employment:

$$L^{m} = [I - \hat{G}]L, \quad (5)$$

where L^{m} is the vector of change in male employment associated with a change in the structure of trade.

Since our interest is mainly in North–South trade, we define the non-OECD trade intensity vector as follows:

$$T_{n} = [X_{n}^{95} - (X_{n}^{95}(x_{n}^{78}/x_{n}^{95}))] - [M_{n}^{95} - (M_{n}^{95}(m_{n}^{78}/m_{n}^{95}))], \quad (6)$$

where the subscript n refers to non-OECD trade and all else is as defined in (1). The employment changes for non-OECD trade may then be written as follows:

$$L_{n} = \hat{E}[(I - A)^{-1}T_{n}], \quad (7)$$

$$L_{n}^{f} = \hat{G}L_{n}, \quad (8)$$

$$L_{n}^{m} = [I - \hat{G}]L_{n}. \quad (9)$$

4. EMPLOYMENT EFFECTS OF TRADE EXPANSION

The employment effects of trade expansion are summarized in Table 4. Input–output data are from OECD (1995); output, total employment, and price deflator data are from OECD (1998a); and trade data are from OECD (1998b). Data on the female percentage of employment are from UNIDO (1999) and country sources. [5] The total effects of world trade relative to our counterfactual base-year trade position are largest for the United States, Japan and the United Kingdom. Average annual employment is estimated to decline by over two million workers in the United States, 849,000 workers in Japan, and 651,000 workers in the United Kingdom as a result of world trade. The figure for the United States is larger than the 1.2 million found by Sachs and Shatz (1994, p. 7), but their calculation covered only 1978–90. A number of countries had an increase in labor demand as a result of trade. Trade is estimated to have increased employment by 176,000 workers in the Netherlands, by 105,000 in Denmark, by 89,000 in Italy and by 69,000 in Canada. Germany's trade was largely neutral for employment, with a loss of 15,000 workers (with magnitudes in worker years).

The large share of these employment effects accounted for by non-OECD trade is striking, especially given the still low *level* of import penetration by non-OECD countries, as shown above in Table 1. For the United States, non-OECD trade accounted for 1.29 million of the 2.03 million decline. For the United Kingdom and Japan, the non-OECD share is even higher. For France and Germany, increases in labor demand from trade with other OECD countries was more than offset by declines in labor demand brought about by trade expansion with non-OECD countries.

To better understand the magnitude of the employment effect and to address the question of gender bias, we calculated the employment effects in manufacturing as a percentage of the average total, male and female manufacturing employment for 1978–80. Table 5 gives the

Table 4. *Employment effects from trade of manufactures: absolute numbers (numbers of employees in worker years)*[a]

	(1) Total	(2) Male	(3) Female
Australia (1978–92)			
World Trade	−125,386	−93,927	−31,458
OECD Trade	−94,965	−77,169	−17,796
Non-OECD Trade	−30,421	−16,758	−13,663
Canada (1978–95)			
World Trade	69,406	87,565	−18,159
OECD Trade	280,025	221,000	59,025
Non-OECD Trade	−210,619	−133,435	−77,184
Denmark (1978–94)			
World Trade	105,492	73,431	32,061
OECD Trade	126,087	85,156	40,931
Non-OECD Trade	−20,595	−11,725	−8,870
France (1978–95)			
World Trade	−85,627	−49,465	−39,122
OECD Trade	92,471	58,368	25,389
Non-OECD Trade	−178,099	−107,833	−64,511
Germany (1978–90)			
World Trade	−14,996	−2,140	−12,856
OECD Trade	412,340	303,973	108,367
Non-OECD Trade	−427,336	−306,113	−121,223
Italy (1978–94)			
World Trade	88,830	43,074	45,756
OECD Trade	195,330	128,243	67,087
Non-OECD Trade	−106,500	−85,169	−21,331
Japan (1978–95)			
World Trade	−848,953	−436,795	−412,158
OECD Trade	−273,556	−151,108	−122,448
Non-OECD Trade	−575,397	−285,686	−289,710
Netherlands (1978–95)			
World Trade	175,775	148,002	27,773
OECD Trade	259,432	212,549	46,883
Non-OECD Trade	−83,657	−64,547	−19,110
United Kingdom (1978–94)			
World Trade	−651,041	−447,467	−203,574
OECD Trade	−205,730	−147,002	−58,728
Non-OECD Trade	−445,311	−300,465	−144,846
United States (1978–95)			
World Trade	−2,026,870	−1,163,044	−863,826
OECD Trade	−736,779	−513,726	−223,054
Non-OECD Trade	−1,290,091	−649,319	−640,772

[a] *Sources*: OECD STAN Database for Industrial Analysis (1998a), OECD Bilateral Trade Database (1998b), OECD Input–Output Database (1995). See notes to Table 6 for sources on female percentage of employment.

percentage change in total, male and female manufacturing employment from manufacturing trade expansion by country for world trade, non-OECD trade and OECD trade. [6] The US decline is 9.9% of total manufacturing employment. [7] Australia is most negatively affected of the countries in our sample, with labor demand in manufacturing falling by 10.4%. The UK decline was 8.9% and for Japan the decline was 6.1% of manufacturing employment. The figure for Japan is surprising given their well-known export success. Using similar methods, Kucera (1998) finds that Japan is estimated to have gained employment

Table 5. *Employment effects from trade of manufactures: relative to 1978–80 manufacturing employment (%) and measures of gender bias*[a]

	(1)	(2)	(3)	(4)	(5)	(6)
	Relative to 1978–80 manufacturing employment (%)			Measures of gender bias[b]		
	Total	Male	Female	Female %–Male %	$((F^{95}/M^{95})/(F^{95}_{nt}/M^{95}_{nt}) - 1) * 100$	$((F^{78} + T_f)/(M^{78} + T_m)-(F^{78}/M^{78})) * 100$
Australia (1978–92)						
World Trade	−10.40	−10.45	−10.28	0.16	1.02	0.06
OECD Trade	−7.88	−8.58	−5.82	2.77	3.34	1.03
Non-OECD Trade	−2.52	−1.86	−4.46	−2.60	−2.30	−0.90
Canada (1978–95)						
World Trade	3.83	6.55	−3.84	−10.39	−10.81	−3.44
OECD Trade	15.47	16.52	12.49	−4.03	−7.04	−1.22
Non-OECD Trade	−11.63	−9.97	−16.34	−6.36	−4.36	−2.50
Denmark (1978–94)						
World Trade	21.30	20.95	22.15	1.20	−4.23	0.41
OECD Trade	25.46	24.29	28.28	3.99	−2.19	1.32
Non-OECD Trade	−4.16	−3.34	−6.13	−2.78	−1.66	−1.19
France (1978–95)						
World Trade	−1.56	−1.31	−2.29	−0.98	−1.35	−0.45
OECD Trade	1.69	1.55	1.49	−0.06	−0.03	−0.03
Non-OECD Trade	−3.25	−2.86	−3.78	−0.91	−1.30	−0.43
Germany (1978–90)						
World Trade	−0.17	−0.03	−0.53	−0.49	−0.51	−0.19
OECD Trade	4.62	4.69	4.43	−0.26	−0.20	−0.09
Non-OECD Trade	−4.79	−4.72	−4.96	−0.24	−0.31	−0.09
Italy (1978–94)						
World Trade	1.51	0.99	2.98	1.99	2.40	0.70
OECD Trade	3.32	2.95	4.37	1.42	1.56	0.49
Non-OECD Trade	−1.81	−1.96	−1.39	0.57	0.82	0.21
Japan (1978–95)						
World Trade	−6.12	−4.79	−8.67	−3.88	−2.72	−2.12
OECD Trade	−1.97	−1.66	−2.57	−0.92	−0.63	−0.49
Non-OECD Trade	−4.14	−3.13	−6.09	−2.96	−2.16	−1.59
Netherlands (1978–95)						
World Trade	17.16	17.13	17.34	0.21	−0.65	0.03
OECD Trade	25.33	24.60	29.27	4.67	6.09	0.70
Non-OECD Trade	−8.17	−7.47	−11.93	−4.46	−4.09	−0.89
United Kingdom (1978–94)						
World Trade	−8.92	−8.46	−10.11	−1.65	−1.73	−0.69
OECD Trade	−2.82	−2.78	−2.92	−0.14	−0.07	−0.05
Non-OECD Trade	−6.10	−5.68	−7.20	−1.51	−1.73	−0.61
United States (1978–95)						
World Trade	−9.92	−8.22	−13.74	−5.52	−4.23	−2.67
OECD Trade	−3.60	−3.63	−3.55	0.08	0.47	0.04
Non-OECD Trade	−6.31	−4.59	−10.19	−5.60	−4.81	−2.61

[a] *Sources*: OECD STAN Database for Industrial Analysis (1998a), OECD Bilateral Trade Database (1998b), OECD Input–Output Database (1995). See notes to Table 6 for sources on female percentage of employment.

[b] The first measure is column 3 minus column 2; the second is the ratio of female-to-male employment with trade (i.e., based on actual employment in endpoint years) divided by the ratio of female-to-male employment with no trade (i.e., based on actual employment in endpoint years minus trade effects (columns 2 and 3 of Table 4)) minus one (as a percentage); the third is the ratio of female-to-male employment in 1978–80 plus trade effects (columns 2 and 3 of Table 4) minus the ratio of female-to-male employment in 1978–80 (as a percentage).

from both world and OECD trade for 1970–91, with estimated losses from non-OECD trade. Results for 1978–91 are similar to those for 1978–95, indicating that Japan's negative employment effect is driven by weaker trade performance after the late 1970s.

The big success stories among these countries are Denmark, the Netherlands, and Canada, whose trade performance brought an increase in employment of 21.3 and 17.2 and 3.8% respectively compared to the counterfactual. This may seem surprising in light of the high levels of import penetration in these countries, especially Denmark and the Netherlands (see Table 1). The explanation is that import penetration figures alone largely veil the role of export performance. For each of these three countries, and only these countries among the 10 in our study, the export propensities for world trade of manufactures rose more rapidly than import propensities during 1978–95.

We present three ways of calculating the gender bias of the employment effects, and they are presented in columns 4 through 6 of Table 5. In the first measure (column 4), gender bias is captured by the simple difference in the percentage changes for male and female employment. The second measure (column 5) is a proportional change indicator constructed by dividing the female-to-male employment ratio with trade (based on actual employment in endpoint years) by the female-to-male employment ratio with no trade (i.e. based on the actual employment in endpoint years minus trade effects from columns 2 and 3 of Table 4), subtracting one, and multiplying by 100. [8]

If we arbitrarily designate a difference between male and female employment changes of greater than two percentage points to constitute a "gender bias," we see that for most of the countries in the sample, world trade did not have a gender-biased employment effect over 1978–95. Only Canada, Japan and the United States experienced such a bias and in each case it was against female employment. For trade expansion with other OECD countries, there was a gender bias in the employment effects for four countries (Australia, Canada, Denmark, and the Netherlands). Of these, only the Canadian bias is against women's employment, and this was a case of employment *gains* from trade: the bias was that male employment gains exceeded female employment gains by four percentage points.

If we consider non-OECD trade—the focus of the Wood study—then the number of countries that experienced gender-biased employment effects from trade expansion jumps to six: Australia, Canada, Denmark, Japan, the Netherlands and the United States. In each case there is an employment decline and it is female employment that is estimated to fall disproportionately.

The spirit of these results is largely unchanged if we use the proportional change measure of gender bias (column 5) and assign the designation "gender bias" to any change of greater than 2%. The crosscountry results are unchanged except for Denmark, which now falls below the threshold. [9]

The input–output technique underpinning the factor content analysis has come under a variety of criticisms. To address these criticisms, we use some alternative estimates of employment effects. These alternatives also allow a test of the robustness of the results presented in Tables 4 and 5. One criticism is that the analysis does not account for technological change, an assumption that will directly impact the labor productivity figures and thus the measured employment effects. [10] To address this concern we recalculated all employment effects using average labor and technical coefficients for 1978–95. The use of the average labor and technical coefficients led to the expected increase in all estimates of absolute employment effects (since it is based on lower productivity) but did not alter the nature of gender bias. In fact, crosscountry differences in the two methods are very highly correlated with differences in productivity growth in manufacturing as a whole.

A second concern is that trade volumes in some industries are highly volatile—lumpy—and thus it may be problematic to capture trade trends with export and import propensities in endpoint years. To address this we recalculated the employment effects excluding industries for which trade is highly volatile because of its lumpiness, where, for instance, a large order may take place every few years. These industries include Shipbuilding and Repairing, Other Transport (which includes railway cars), Aircraft, and Petroleum and Coal Products. [11]

The exclusion of industries with highly volatile trade data had little effect on the results, with the exception of Australia. For Australia, very large employment gains are estimated to occur in the Petroleum and Coal Products industry, in which the female percentage of employment is very low. As a consequence, the gender bias of non-OECD

trade drops considerably with the exclusion of trade-volatile sectors, from −2.6% to −1.2% points.

A third criticism of factor content analysis is its failure to account for changes in labor market conditions over the period under study. To address this concern, we adjusted for the change in the female percentage of manufacturing employment between 1978 and the year of the female coefficients of employment (most often 1990), as follows:

$$L^f = \hat{G}[(I - A)^{-1}T](i^{78}/i^{90}), \tag{10}$$

where i^{78} and i^{90} refer to female percentage of manufacturing employment. Thus if the female percentage of employment rose during 1978–90 (as it did in all countries except Germany and France), the female employment effects are adjusted downward. [12] This allows us to abstract from changes in nontrade factors, including changes on the supply side of the labor market and demand effects of domestic origin. The adjustments, however, are small and the revised results are essentially unchanged from those presented in Table 5, especially the measure given in column 5 of Table 5, with Denmark not experiencing a gender bias in the employment effect of manufacturing trade over the period. [13]

5. INDUSTRY-LEVEL ANALYSIS

What is driving these relatively robust results of the gender bias in employment effects of non-OECD trade expansion? For any given industry, female employment effects can be broken into four components: (a) labor productivity (the inverse of labor coefficients); (b) female percentage of employment; (c) trade imbalances and; (d) trade propensity changes. We can see these four components in the factor content algorithm. Writing out the full expression for female employment effects from non-OECD trade (by combining expressions (6)–(8) above) gives the following:

$$L_n^f = \hat{G}\{\hat{E}[[(I - A)^{-1}][(X_n^{95} - (X_n^{95}(x_n^{78}/x_n^{95})))$$
$$- (M_n^{95} - (M_n^{95}(m_n^{78}/m_n^{95})))]]\}. \tag{11}$$

Gender bias could thus result from a industry profile in which some industries have a combination of disproportionately high female percentage of employment ($\hat{G} * 100$), low productivity ($1/\hat{E}$), large trade imbalances (X_n^{95}, M_n^{95}) or high growth of the import propensity relative to export propensity ((x_n^{78}/x_n^{95}), (m_n^{78}/m_n^{95})).

Table 6 shows the female percentage of employment by industry for each of the 10 OECD countries under consideration, in the base year provided by the year of the input–output data. With the exception of the Netherlands, the female percentage of employment for all of manufacturing was between 27.1% and 36.3%. [14] Within this narrow band of averages there is enormous variation across industries. On average (across the 10 countries) the most female intensive industries are Textiles, Apparel, Leather and Leather Goods (62.8%), Jewelry, Musical Instruments, Toys and Sporting Goods (43.4%), Drugs and Medicines (40.0%), Radio, TV and Communication Equipment (37.1%), Professional Goods and Precision Instruments (36.2%), and Food, Beverages and Tobacco (36.1%). The least female-intensive industries were Iron and Steel (9.0%), Shipbuilding and Repairing (9.7%), Petroleum and Coal Products (11.3%), Other Transport (12.2%) and Non-ferrous Metals (13.0%). One possible explanation for the crosscountry variation in gender bias is the differences in the female intensity of production. But we can quickly rule this out because of the strikingly high correlation across countries of the cross-industry variations in the female percentage of employment—at 0.90 on average, with all coefficients significant at the 1% level—as shown in Table 7. [15] We leave the explanation of these correlation coefficients to future research and simply reiterate here that they indicate that gender segregation cannot account for crosscountry variation in trade-based gender bias—since relative female intensities are essentially identical across the 10-country sample. [16]

Our results on gender bias then appear to be driven by a surprisingly simple phenomenon: the trade performance of the Textiles, Apparel, Leather and Leather Goods industry (which includes leather footwear). This industry is relatively labor-intensive, relatively female-intensive and is a classically mature industry that has seen rapidly rising import penetration from non-OECD countries. To illustrate this point, we recalculated the factor content changes, this time excluding the Textiles, Apparel, Leather and Leather Goods industry. The results are reported in Table 8. The gender bias of non-OECD trade expansion is presented using three measures, as in Table 5. Using the same thresholds as before for the simple difference in

Table 6. *Female percentage of manufacturing employment by industry*[a,b]

ISIC code	Industry	Australia 1989	Canada 1990	Denmark 1990	France 1988	Germany 1990	Italy 1991	Japan 1990	Netherlands 1986	UK 1990	US 1990	Unweighted average
31	Food, beverages and tobacco	31.0	32.3	43.4	35.6	42.2	26.5	54.5	23.5	39.0	32.5	36.1
32	Textiles, apparel, leather and leather goods	66.4	70.6	65.1	60.5	62.8	68.7	42.2	61.4	66.8	62.8	63.1
33	Wood products and furniture	16.6	16.5	24.4	29.1	20.8	23.3	30.8	9.7	18.8	22.2	21.2
34	Paper, paper products and printing	34.0	30.2	35.7	35.6	27.9	24.7	31.4	22.1	33.3	38.1	31.3
351 + 352-3522	Industrial chemicals	25.5	26.2	31.7	21.0	22.9	15.8	26.0	14.9	24.6	26.7	23.5
3522	Drugs and medicines	46.9	38.6	52.6	46.6	51.4	25.1	26.0	25.0	42.8	44.9	40.0
353 + 354	Petroleum and coal products	5.9	21.0	10.7	4.9	13.0	8.2	13.3	10.0	10.2	16.3	11.3
355 + 356	Rubber and plastic products	30.2	26.1	36.1	28.9	28.6	25.3	38.6	13.8	29.9	35.1	29.2
36	Non-metallic mineral products	10.7	19.1	24.0	19.2	21.9	16.6	25.0	6.9	14.2	19.7	17.7
371	Iron and steel	7.3	7.7	16.0	8.4	8.5	6.8	10.9	6.9	6.8	10.1	9.0
372	Non-ferrous metals	7.9	10.7	23.6	14.3	15.2	10.4	20.3	0.0	9.8	18.3	13.0
381	Fabricated metal products	17.3	17.8	21.7	18.5	22.0	17.3	26.9	8.2	18.1	22.2	19.0
382-3825	Non-electrical machinery	13.3	19.6	20.5	19.2	15.7	13.5	20.5	8.0	16.1	18.4	16.5
3825	Office and computing machinery	32.5	32.9	28.8	32.7	30.1	24.8	41.9	16.0	24.0	34.2	29.8
383-3832	Electrical apparatus, other	31.7	29.8	36.0	34.2	31.8	29.3	41.9	16.0	29.2	42.9	32.3
3832	Radio, TV and communication equipment	43.3	40.5	43.9	34.2	46.4	32.4	41.9	16.0	30.7	41.7	37.1
3841	Shipbuilding and repairing	7.7	8.9	9.4	14.3	6.0	4.1	18.5	6.3	8.4	13.8	9.7
3842 + 44-+49	Other transport	4.2	7.6	20.3	14.3	11.5	9.8	18.5	6.3	7.5	21.9	12.2
3843	Motor vehicles	15.7	23.0	16.7	17.7	15.2	14.4	18.5	6.3	11.6	19.4	15.9
3845	Aircraft	10.8	20.7	15.0	14.3	14.1	10.3	18.5	6.3	12.2	22.6	14.5
385	Professional goods and precision instruments	47.5	40.5	43.2	19.2	40.2	38.0	37.9	22.2	31.9	41.4	36.2
39	Jewelry, musical instruments, toys and sporting goods, misc	33.9	41.7	50.3	N/A	50.4	54.1	49.6	19.3	44.6	46.4	43.4

toys and sporting goods, misc

3												
	Total female percentage of employment	27.1	28.5	33.9	30.6	27.1	27.3	36.3	16.2	28.2	32.9	28.8
	Male employment (in thousands)	774	1,505	338	2,931	5,194	2,000	7,348	804	3,445	12,792	
	Female Employment (in thousands)	288	600	173	1,293	1,926	751	4,190	155	1,353	6,285	
	Total employment (in thousands)	1,061	2,105	511	4,223	7,120	2,751	11,538	959	4,798	19,077	
	Manufacturing employment as a Share of total civilian employment	14.9	16.0	22.8	21.6	31.6	22.1	24.1	19.3	25.5	18.0	21.6
	Female percentage of labor force	40.7	44.2	46.1	42.6	40.8	36.9	40.6	34.8	42.9	44.7	41.4

[a] *Sources for male and female employment: Australia, Denmark, Germany, Italy, and the United Kingdom: UNIDO Industrial Statistics Database (1999).*
Canada: Statistics Canada, *Labour Force Survey; France: Ministere de l'economie, des Finances et du Budget, Annuaire Statistique de la France (1990).*
Japan: Japan Ministry of Labour, Yearbook of Labour Statistics (1990); Netherlands: ILO Yearbook of Labour Statistics (1988);.
United States: Bureau of Labor Statistics, Employment, Hours, and Earnings, United States, 1990–95.
Source for manufacturing employment as a share of total civilian employment and female percentage of labor force: OECD Historical Statistics, 1960–95.
[b] Year represents year of input–output data from OECD Input–Output Database (1995), or, in the case of France and Italy, nearest available year for which male–female employment data are available. (Input–output data are for 1990 for France and 1985 for Italy.); there are duplicate data for some industries in France, Japan, and the Netherlands, when data for these industries are combined in the original data sources.

Table 7. *Correlation coefficients for female percentage of manufacturing employment in 22 industries*[a]

								Mean	0.90
Canada	0.94								
Denmark	0.93	0.91							
France	0.86	0.84	0.91						
Germany	0.93	0.93	0.97	0.88					
Italy	0.86	0.91	0.91	0.86	0.91				
Japan	0.82	0.84	0.86	0.84	0.86	0.90			
Netherlands	0.92	0.92	0.90	0.87	0.87	0.84	0.82		
United Kingdom	0.93	0.93	0.97	0.93	0.96	0.91	0.88	0.94	
United States	0.95	0.94	0.95	0.90	0.93	0.92	0.87	0.90	0.95
	Australia	Canada	Denmark	France	Germany	Italy	Japan	Nether-lands	UK

[a] *Sources and notes*: See Table 6.

percentage changes (column 4) and the proportional change measure (column 5), we see that the gender bias disappears in every case except that of Australia. And in almost every case (Canada, Denmark, Japan, the Netherlands, and the United States) the disappearance of the bias results from the difference in the effect on female employment resulting from the exclusion of this one industry—male employment effects being largely unchanged. [17]

The UK case is also instructive. There is no gender bias (by our definition) with or without the Textiles, Apparel, Leather and Leather Goods industry. But the exclusion of the industry from the factor content calculation results in a large swing from a slight employment effect against women's employment to a slight employment effect against men's employment. This simply reinforces our point about the importance of this one industry in our overall results: even in cases when the differential effect on male and female labor demand is small, the change in the differential is large if we exclude the Textiles, Apparel, Leather and Leather Goods industry.

The reason that the Textiles, Apparel, Leather and Leather Goods industry plays such a crucial role is that it is both relatively labor-intensive and female-intensive, and in many countries had a large trade deficit along with a relatively rapid increase in import propensity relative to export propensity for non-OECD trade. As shown in Table 9, labor productivity in the industry is on average about one-half that of manufacturing as a whole. Moreover, the female percentage of employment in the industry is more than twice the average for manufacturing as a whole. Note that for both relative labor productivity and relative female intensity, the standard deviations of the 10-country sample are very small (0.12 and 0.20), with coefficients of variation of 0.21 and 0.09, respectively. This is not the case for trade deficits, as shown in Table 10. While all countries except Italy experienced a deterioration in the non-OECD trade balance for the industry over the sample period (column 3), the relative extent of the deterioration varied considerably. The picture is also evident by looking at the trade propensities, shown in Table 11. Six countries experienced a greater increase in import propensity than export propensity while the other four actually had a greater increase in the export propensity compared to import propensity. The countries with a greater increase in import propensity are Canada, France, Japan, the Netherlands, United Kingdom and United States—largely the same countries for which this industry mattered most in creating a gender bias from non-OECD trade.

Figure 1 is a scatterplot of the gender bias of the employment effect (column 5 from Table 5) and the change in net exports relative to domestic consumption in the Textiles, Apparel, Leather and Leather Goods industry (column 5 from Table 10), both as regards non-OECD trade. The relation is clearly positive: countries with better trade performance in this industry are those with less gender bias. The United States, Canada, Netherlands and Denmark, with among the largest deficits (relative to total trade) are those with the largest gender bias. The correlation coefficient of 0.73 is statistically significant at the 5% level.

Note also that excluding the Textiles, Apparel, Leather and Leather Goods industry effects the measured bias from trade expansion with other OECD countries (Table 8). The bias disappears for Australia. The gender bias against men's employment for Denmark and

Table 8. *Employment effects from trade of manufactures: excluding textiles, apparel, leather and leather goods (ISIC 32) relative to 1978–80 manufacturing employment (%) and measures of gender bias*[a]

	(1)	(2)	(3)	(4)	(5)	(6)
	Relative to 1978–80 manufacturing employment (%)			Measures of gender bias[b]		
	Total	Male	Female	Female %– Male %	$((F^{95}/M^{95})/(F^{95}_{nt}/M^{95}_{nt})-1)*100$	$((F^{78}+T_f)/(M^{78}+T_m)-(F^{78}/M^{78}))*100$
Australia (1978–92)						
World Trade	−11.57	−11.08	−13.02	−1.95	−0.80	−0.74
OECD Trade	−9.20	−9.29	−8.91	0.38	1.13	0.14
Non-OECD Trade	−2.37	−1.78	−4.11	−2.32	−2.06	−0.81
Canada (1978–95)						
World Trade	6.46	7.84	2.56	−5.28	−6.45	−1.73
OECD Trade	15.17	16.39	11.71	−4.68	−7.69	−1.42
Non-OECD Trade	−8.71	−8.55	−9.16	−0.60	0.46	−0.23
Denmark (1978–94)						
World Trade	20.17	20.41	19.60	−0.81	−6.14	−0.28
OECD Trade	22.57	22.88	21.84	−1.04	−7.19	−0.35
Non-OECD Trade	−2.40	−2.46	−2.24	0.22	0.71	0.10
France (1978–95)						
World Trade	−0.33	−0.61	0.10	0.72	0.96	0.33
OECD Trade	1.73	1.58	1.58	0.00	0.06	0.00
Non-OECD Trade	−2.07	−2.19	−1.47	0.72	0.89	0.33
Germany (1978–90)						
World Trade	0.39	0.31	0.60	0.29	0.31	0.11
OECD Trade	4.38	4.55	3.94	−0.60	−0.57	−0.22
Non-OECD Trade	−3.99	−4.24	−3.34	0.90	0.83	0.35
Italy (1978–94)						
World Trade	0.06	0.17	−0.23	−0.39	−0.49	−0.14
OECD Trade	1.95	2.17	1.32	−0.85	−1.20	−0.29
Non-OECD Trade	−1.88	−2.00	−1.55	0.46	0.68	0.16
Japan (1978–95)						
World Trade	−3.28	−3.33	−3.17	0.16	0.39	0.08
OECD Trade	−1.29	−1.31	−1.26	0.05	0.14	0.03
Non-OECD Trade	−1.98	−2.02	−1.91	0.11	0.25	0.06
Netherlands (1978–95)						
World Trade	15.24	15.74	12.52	−3.22	−4.98	−0.52
OECD Trade	20.36	21.01	16.89	−4.12	−6.80	−0.63
Non-OECD Trade	−5.12	−5.26	−4.36	0.90	1.18	0.18
United Kingdom (1978–94)						
World Trade	−6.46	−7.02	−4.98	2.04	3.03	0.84
OECD Trade	−2.22	−2.43	−1.66	0.77	1.19	0.30
Non-OECD Trade	−4.24	−4.59	−3.32	1.27	1.94	0.51
United States (1978–95)						
World Trade	−6.21	−6.25	−6.11	0.14	0.78	0.07
OECD Trade	−3.22	−3.43	−2.75	0.68	1.06	0.31
Non-OECD Trade	−2.99	−2.82	−3.36	−0.54	−0.25	−0.25

[a] *Sources*: OECD STAN Database for Industrial Analysis (1998), OECD Input–Output Database (1995). See notes to Table 6 for sources on female percentage of employment.

[b] See notes to Table 5 (except that trade employment effects in absolute terms are not shown for analysis excluding ISIC 32).

Table 9. *Labor productivity and female percentage of employment in the textiles, apparel, leather and leather goods industry (ISIC 32)*[a,b]

	Base year	(1) Labor productivity(output/employee in millions of national currency in base year)			(4) Female percentage of employment		(6)
		ISIC 32	Total manufacture	(3) Relative labor productivity	ISIC 32	Total manufacture	Relative female percentage
				Column 1/ Column 2			Column 4/ Column 5
Australia	1989	0.08	0.13	0.64	63.09	27.12	2.33
Canada	1990	0.08	0.17	0.48	66.43	28.51	2.33
Denmark	1990	0.50	0.69	0.72	70.55	33.87	2.08
France	1988	0.49	0.81	0.61	65.11	30.61	2.13
Germany	1990	0.16	0.22	0.69	60.54	27.05	2.24
Italy	1991	76.37	113.48	0.67	62.76	27.31	2.30
Japan	1990	7.37	22.05	0.33	68.69	36.31	1.89
Netherlands	1986	0.18	0.28	0.62	42.22	16.16	2.61
United Kingdom	1990	0.03	0.06	0.48	61.37	28.20	2.18
United States	1990	0.08	0.15	0.50	66.80	32.95	2.03
Mean				0.58	62.76	28.81	2.21
S.D.				0.12	7.89	5.49	0.20
Coefficient of variation				0.21	0.13	0.19	0.09

[a] *Sources*: OECD STAN Database for Industrial Analysis (1998); See notes to Table 6 for sources on female percentage of employment.

[b] For labour productivity "Base Year" represents year of input–output data from OECD Input–output Database (1995). For female percentage of employment, "Base Year" represents year of input–output data from OECD Input–output Databas, 1995, or in the case of France and Italy, nearest available year for which male–female employment data are available. (Input–output data are for 1990 for France and 1985 for Italy.)

the Netherlands is reversed and the balance instead becomes a bias against women's employment. This last result reflects that the direction of trade expansion in this industry differed strongly for trade within and outside the OECD.

6. A NEW PUZZLE?

The factor content analysis of gender bias in manufacturing employment due to trade (Table 5) confirms the results of the relative female-intensity of manufacturing employment (Table 3), that there was a broadly-shared gender bias in the employment effects of manufacturing trade expansion. On closer look, however, these two independently derived sets of results present a new puzzle. Specifically, those countries with a larger decline in the relative female intensity of manufacturing employment had a smaller gender bias as measured by the factor content analysis. To better compare these two approaches to the gender bias question, we calculated a new indicator of gender bias from the factor content data. This measure is the ratio of female-to-male employment during 1978–80 plus trade effects (columns 2 and 3 of Table 4) minus the ratio of female-to-male employment during 1978–80 in percentage terms. The measure is given in column 6 of Table 5. Comparing this measure with the changes in relative female intensity (last row of Table 3) we find there is a negative crosscountry correlation, with a correlation coefficient of −0.51. If we exclude Denmark from the calculation, the one country for whom the relative female-intensity of manufacturing employment rose, the correlation coefficient is-0.73.

How can we explain this apparent puzzle? Putting aside the question of data errors, we suggest that the answer lies in the failure to control for the myriad of social, political, demographic and economic changes that

Table 10. *Trade deficits with non-OECD countries for the textiles, apparel, leather and leather goods industry (ISIC 32)*[a]

	Base year[c]	(1) Trade deficit (in thousands of constant national currency in base year) 1978–80	(2) Trade deficit (in thousands of constant national currency in base year) 1993–95	(3) Percent change 1978–80 to 1993–95	(4) Trade deficit in 1993–95 as a percentage of total trade in 1993–95 $(X-M)/(X+M)*100$	(5) Change in trade pefor-mance from 1978–80 to 1993–95[b]
Australia	1989	−1,093	−1,314	20.22	−40.86	−1.36
Canada	1990	−1,800	−3,866	114.81	−92.78	−12.65
Denmark	1990	−2,879	−4,911	70.61	−68.27	−12.98
France	1988	−6,401	−24,158	277.42	−40.96	−8.70
Germany	1990	−10,774	−15,687	45.60	−57.96	−5.51
Italy	1991	−508,954	−379,688	−25.40	−3.03	0.28
Japan	1990	−41,903	−1,438,483	3332.86	−55.61	−9.68
Netherlands	1986	−1,612	−4,091	153.88	−61.95	−23.95
United Kingdom	1990	−1,356	−3,478	156.58	−65.35	−11.77
United States	1990	−8,030	−39,056	386.40	−68.60	−14.88
Mean				453.30	−55.54	−10.12
S.D.				1019.20	23.68	6.99
Coefficient of variation				2.25	−0.43	−0.69

[a] *Sources*: OECD STAN Database for Industrial Analysis (1998), OECD Bilateral Trade Database (1998), OECD Input–Output Database (1995). See notes to Table 6 for sources on female percentage of employment.
[c] Trade performance is defined as net exports relative to domestic consumption in percent terms, or $((X_n - M_n)/(Q + M - X))*100$, where subscript n = non-OECD, X = exports, M = imports, and Q = domestic output, with change referring to the percentage point difference between the 1993–95 and 1978–80 periods.
[b] "Base Year" represents year of input–output data from OECD Input–Output Database (1995); Deficits represent three-year averages. For some countries, data do not run to 1993–95. See span of years following country headings in Tables 4, 5 or 8 in this regard.

Table 11. *Export and import propensities with non-OECD countries for the textiles, apparel, leather and leather goods industry (ISIC 32) (non-OECD exports and imports in relation to domestic production)*[a,b]

	(1) Export Propensity 1978–80	(2) Export Propensity 1993–95	(3) Ratio of change Column 2/ Column 1	(4) Import Propensity 1978–80	(5) Import Propensity 1993–95	(6) Ratio of change Column 5/ Column 4	(7) Difference in ratios Column 3– Column 6
Australia	0.031	0.100	3.19	0.162	0.238	1.46	1.73
Canada	0.008	0.012	1.46	0.113	0.319	2.81	−1.35
Denmark	0.030	0.072	2.40	0.189	0.384	2.03	0.36
France	0.036	0.092	2.53	0.063	0.220	3.51	−0.98
Germany	0.037	0.070	1.90	0.154	0.263	1.71	0.19
Italy	0.027	0.063	2.37	0.033	0.067	2.02	0.34
Japan	0.058	0.046	0.80	0.061	0.162	2.67	−1.87
Netherlands	0.101	0.158	1.57	0.279	0.674	2.41	−0.84
United Kingdom	0.046	0.061	1.31	0.111	0.291	2.62	−1.30
United States	0.033	0.059	1.79	0.090	0.318	3.54	−1.76
Mean	0.041	0.073	1.93	0.125	0.293	2.48	−0.55
S.D.	0.025	0.038	0.70	0.073	0.161	0.70	1.16
Coefficient of variation	0.607	0.524	0.36	0.583	0.548	0.28	−2.11

[a] *Sources*: OECD STAN Database for Industrial Analysis (1998), OECD Bilateral Trade Database (1998).
[b] Export and import propensities represent three-year averages. For some countries, data do not run to 1993–95. See span of years following country headings in Tables 4, 5 or 8 in this regard.

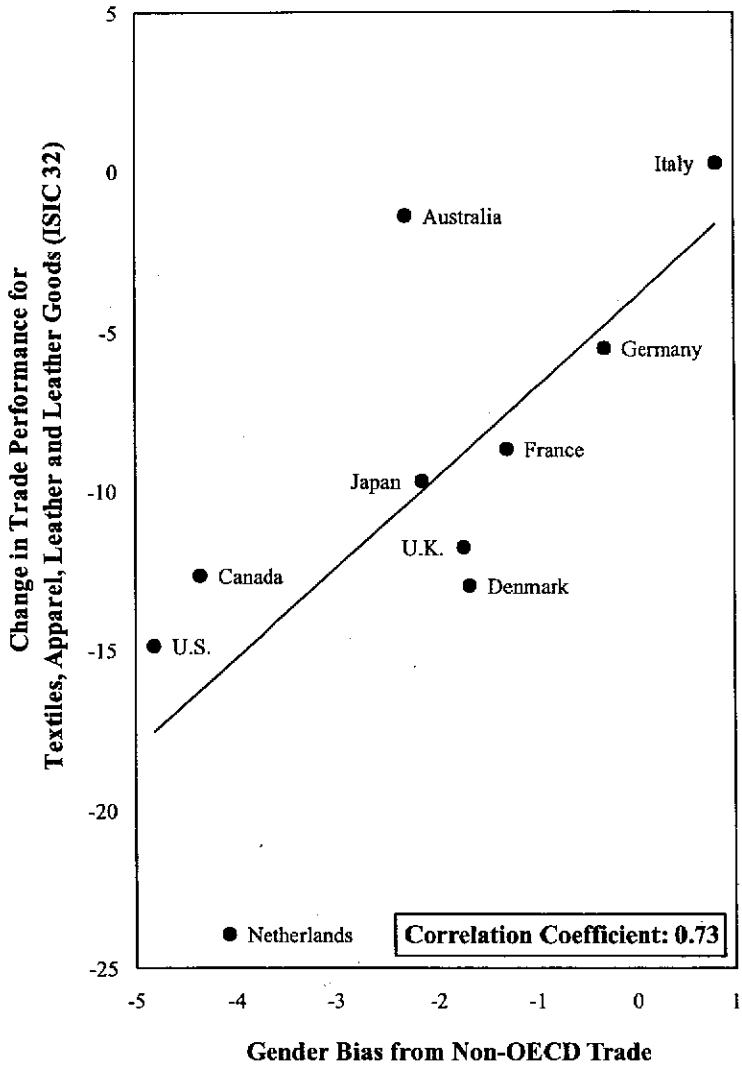

Figure 1. *Gender bias from non-OECD trade and change in trade performance for textiles, apparel, leather and leather goods (ISIC 32). (Note: Gender bias from non-OECD trade is from column 5 of Table 5 and defined therein; trade performance is defined as net exports relative to domestic consumption in percent terms, or* $((X_n - M_n)/(Q + M - X)) * 100$, *where subscript n = non-OECD, X = exports, M = imports, and Q = domestic output, with change referring to the percentage point difference between 1993–95 and 1978–80.)*

determine the female-intensity of manufacturing employment relative to female employment in nontraded sectors. Different labor market, health care and family-related polices may play a role. Variations in industrial composition may matter. Moreover, women's employment is concentrated in the production of goods (food, beverages and tobacco; textiles, apparel, leather and leather goods) for which the income elasticity of demand is relatively low. This Engel's Law effect creates a persistent relative demand shift away from women's manufacturing employment for reasons having nothing to do with foreign trade. Since we have not controlled for these structural changes in the female-intensity data, we cannot expect this measure to be consistent, much less highly correlated, with a measure based on purely trade-related employment effects.

7. CONCLUSION: EXPLAINING NATIONAL DIFFERENCES IN GENDER BIAS

In this paper we tried to measure the degree of gender bias in the employment effects of the expansion of international trade for ten OECD countries. Focusing on trade with developing countries we found that in most cases a gender bias did exist. North–South trade of manufactures has in many industrialized countries reduced female employment relatively more than male employment. Globalization of production does not seem to be the win–win situation for Northern and Southern women workers found by Wood in his "asymmetry." Our results constitute a reconfirmation of the earlier studies by Schumacher and Baldwin.

The gender bias varied considerably across countries, however, and was nonexistent in some. How can we explain the crosscountry differences in the effect of trade expansion on female employment? Given the high cross-industry correlation of female-intensity among OECD countries, we must rule out a role for gender segregation. In addition, given that the gender bias in most cases disappears completely when the Textiles, Apparel, Leather and Leather Goods industry is excluded from the analysis, the different national outcome is not the result of some broad-based increase in international outsourcing, which is typically identified as one of the key causes of expanding world trade. Instead, the results appear to hinge on the issue of how well a country's Textiles, Apparel, Leather and Leather Goods industry responded to foreign competition. Those with a disproportionately large drop in female manufacturing employment as a whole are those countries that saw the worst trade performance in this industry. Italy, for example, is well known for its continued importance in the international fashion industry. On the other extreme, the United States experienced one of the largest increases in import penetration in that sector among industrialized countries, due in part to preponderance of large firms, in particular retailers, and their propensity for outsourcing (especially in Asia), and in part to its preferential treatment of Latin American and Caribbean nations in textiles trade. [18] For sure, the gradual phase-out of the Multifiber Arrangement under the Uruguay Round Agreement will have important implications for the gender bias of labor market changes in the future.

While our results appear, for now, to overturn the Wood asymmetry, they seem to raise another paradox. Those countries with a larger gender bias according to the factor content analysis generally had a smaller decline in the relative female-intensity of manufacturing employment. We explained this by appealing to a host of social and political forces that determine the female-intensity of employment, the combined effect of which is likely to be very different from the effects of international trade *per se* relative to a narrowly defined counterfactual trade scenario.

NOTES

1. Throughout this study, Germany refers exclusively to the former West Germany or the regions of the former West Germany, except as noted in Table 1 for 1995.

2. Throughout this study, the newer members of the OECD (the Czech Republic, Hungary, Poland, Mexico, and South Korea) are included among the non-OECD countries.

3. See, for example, Schumacher (1984), Sachs and Shatz (1994), Wood (1994), Lee and Schmitt (1996), and Kucera (1998).

4. The endpoints were calculated as three-year averages. Thus "78" refers to the average for 1978–80 and "95" refers to the average for 1993–95. These averages are used to account for the volatility of export and import propensities. In order to match the averages for export and import propensities and export and import levels in 1993-95, three-year averages are also used for employment levels in the beginning of the period (1978–80) and the female percentage of employment for the manufacturing sector as a whole in the beginning of the period (1978–80), in regards to results in Tables 5 and 8, for instance. For some countries, data do not run to 1993–95. See span of years following country headings in Tables 4, 5 or 8 in this regard.

5. See Appendix A for more information.

6. OECD trade is simply the difference between world and non-OECD trade.

7. This compares to the 5.9% decline found by (Sachs and Shatz 1994, Table 13).

8. A third measure of gender bias (shown in Column 6) is the ratio (in percentage terms) of female-to-male employment in 1978–80 plus trade effects (columns 2 and 3 of Table 4) minus the ratio of female-to-male employment in 1978–80. This measure is most useful for a comparison with the Table 3 figures on the change in the relative female intensity of manufacturing employment. We discuss this comparison below.

9. Dropping Denmark from the group that experienced a gender bias employment effect from trade is also indicated by another calculation in which the employment effects were adjusted for changes in the female percentage of manufacturing employment. This exercise is discussed in the next section.

10. See Leamer (1994) and the response in Wood (1995).

11. These industries were identified by examining the growth rates of exports and imports. The volatility of the Petroleum and Coal Products industry is likely the result of price volatility. Indirect demands for these industries' output from other industries was included in the analysis, since these indirect demands have no bearing on the trade volatility of the four problematic industries.

12. Effects on male employment were taken as the difference between total and female employment changes.

13. Results of the exercises described in this and the previous paragraphs are available from the authors on request.

14. The low level of female participation in the Netherlands is partly explained by the fact that policies that support employment for mothers with children are very limited by European standards. See (Gornick *et al.*, 1998, Table 1).

15. Note that the Spearman correlation coefficient average is 0.88, with all coefficients again significant at the 1% level.

16. Gender segregation is labor market segmentation along gender lines. We take wide variations in female intensity across industries to be an indication of gender segregation.

17. That is, we are comparing the non-OECD trade employment effects in Tables 5 and 8.

18. See Christerson and Appelbaum (1995) for a discussion of the determinants of outsourcing behavior in the US apparel sector.

REFERENCES

Baldwin, R. (1984). Trade policies in developed countries. In R. Jones, & P. Kenen, *Handbook of international economics*, vol. 1, Amsterdam: North-Holland.

Christerson, B., & Appelbaum, E. (1995). Global and local subcontracting: space ethnicity and the organization of apparel production. *World Development, 23* (8), 1363–1374.

Gornick, J., Meyers, M., & Ross, K. (1998). Public policies and the employment of mothers: a cross-national study. *Social Science Quarterly, 79* (1), 35–54.

Kucera, D. (1998). *Foreign trade and men and women's employment and earnings in Germany and Japan.* CEPA Working Papers on Globalization, Labor Markets, and Social Policy: A Project Funded by the John D. and Catherine T. MacArthur Foundation, Working Paper No. 9, April (Revised August).

Leamer, E. (1994). *Trade, wages and revolving-door ideas.* Working Paper No. 4716, Cambridge, MA: National Bureau of Economic Research.

Lee, T., & Schmitt, J. (1996). *Trade and income distribution: theory new evidence and policy alternatives.* Washington, DC: Mimeo, Economic Policy Institute.

OECD (1995). *Input–output database*, Paris: OECD.

OECD (1998a). *STAN database for industrial analysis.* Paris: OECD.

OECD (1998b). *Bilateral trade database.* Paris: OECD.

Sachs, J., & Shatz, H. (1994). Trade and jobs in US manufacturing. *Brookings Papers on Economic Activity, 1*, 1–84.

Schumacher, D. (1984). North–South trade and shifts in employment. *International Labour Review, 123* (3), 333–348.

UNIDO (1999). *Industrial statistics database.* Vienna: UNIDO.

Wood, A. (1991). North–South trade and female labour in manufacturing: an asymmetry. *The Journal of Development Studies, 27* (2), 168–189.

Wood, A. (1994). *North–South trade employment and inequality: changing fortunes in a skill-driven world.* Oxford: Clarendon Press.

Wood, A. (1995). How trade hurt unskilled workers. *Journal of Economic Perspectives, 9* (3), 57–80.

APPENDIX A. DATA NOTES

This study makes use of the most recent versions of the OECD's STAN Structural Analysis databases, the Input–Output Database (1995) for input–output data, the Bilateral Trade Database (1998) for trade data, and the STAN Database for Industrial Analysis (1995, 1998) for output, total employment, and price deflator data (the last derived from data on value added in real and nominal terms, which are not provided for Australia in the 1998 edition and for which the 1995 edition is used). These datasets have the advantage of being largely standardized by industry classification, following what the OECD calls an "Adjusted ISIC Revision 2 Classification," for which there are 22 distinct manufacturing industries. The classification scheme is shown in Table 6 by both ISIC code and industry description.

The OECD Input–Output Database provides data only on the 10 countries considered in this paper. For the bulk of the analysis, input–output data are used for the most recent year available, usually 1990. These are the "Base Years" noted in Tables 9 and 10, which also show the deviations from 1990. For the construction of average technical coefficients for 1978–95, technical coefficients derived from input–output data for the most recent year are averaged with technical coefficients derived from input–output data for the mid- to late-1970s (Australia, 1974; Japan, 1975; Canada, 1976; Denmark, France, the Netherlands, and the United States, 1977; Germany, 1978, and the United Kingdom, 1979). For Italy, input–output data are for 1985 only, and thus no analysis is done using average technical coefficients (only average labor coefficients). For Australia, Denmark, Germany, and the Netherlands, input–output data do not perfectly conform to the "Adjusted ISIC Revision 2 Classification." Thus data from the STAN Database for Industrial Analysis and Bilateral Trade Database are modified to match the input–output data for these countries whenever feasible. For Australia, ISIC 3832 also includes ISIC 3825; for Denmark, ISIC 382-3825 also includes ISIC 3825 and ISIC 3843 also includes 3842 + 44 + 49 and 3845; for Germany, ISIC 351 + 352 also includes ISIC 3522 and ISIC 383-3832 also includes ISIC 3832 (ISIC 3842 + 44 + 49 is omitted, as input–output data for it is spread among industries in such a way that a correction is not feasible); for the Netherlands, ISIC 371 also includes ISIC 372 and ISIC 383-3832 also includes ISIC 3832).

Regarding the definition of the OECD and non-OECD regions in the Bilateral Trade Database, the data documentation states: "The relatively new OECD member countries (Czech Republic, Hungary, South Korea, Mexico and Poland) are currently included in the Non-OECD" region.

Whenever possible, the analysis uses data from 1978–95. As a result of missing employment and production data, however, the analysis runs only to 1992 for Australia and 1994 for Denmark, Italy, and the United Kingdom. For Germany (that is, the former West Germany), trade data include regions of the former East Germany after 1990, and thus the analysis runs only to 1990. In addition, employment data in Australia for ISIC 3845 run begin in only 1981; employment data in Japan for ISIC 3842 + 44 + 49 and ISIC 3825 begin in only 1984. Thus other data for these industries in these two countries is also truncated to match the shorter period. Employment and production data for ISIC 3842 + 44 + 49 are missing for all years for Australia, Canada, Denmark, the Netherlands, and the United States; employment and production data for ISIC 3845 are missing for all years for Denmark. These industries in these countries are thus excluded from the analysis.

Industry-level price deflators are used in the construction of average labor coefficients. Price data are missing for eight of the 10 countries for ISIC 3825, Office and Computing Equipment. Thus labor coefficients for the year of the input–output data are used for this industry.

For industry-level data on the female percentage of manufacturing employment, data for Australia, Denmark, Germany, Italy, and the United Kingdom are from the UNIDO Industrial Statistics Database (1999), for which data are classified by ISIC code. (For France and Netherlands, UNIDO dataset does not provide data on the number of women employees; for Japan and the United States, UNIDO data are not available in the year of the most recent input–output data; for Canada, data from Statistics Canada are of equivalent quality to UNIDO data.) For Netherlands, data are from the ILO Yearbook of Labour

Table 12. *Industry classification and OECD data*

Adj. ISIC Rev. 2	Canada 1980 SIC	France (NAP 40)	Japan	US 1987 SIC
31	101–122	02,03	12–13	20,21
32	171–249	18,19	14,15,24	22,23
33	251–269	20	16,17	24,25
34	271–284	21,22	18,19	26,27
351 + 352–3522	371–379–374	11	20	28–283
3522	374	12	20	283
353 + 354	361,369	4	21	29
355 + 356	151–169	23	22,23	30
36	351–359	10	25	32
371	291–294	7	26	331,332
372	295–299	8	27	333,335,336
381	301–309	13	28	34
382–3825	311–319	14	29	35–357
3825	336	15A	30	357
383–3832	331–333, 337–339	15A,15B	30	36–366
3832	334,335	15A,15B	30	366
3841	327,328	17	31	373
3842 + 44 + 49	326,329	16	31	37–(371 + 372 + 373)
3843	323–325	16	31	371
3845	321	17	31	372
385	391	14	32	38
39	392–399	N/A	33–34	39

Statistics and are also classified by ISIC code. For the other four countries, sources are noted in Table 6. Using the industry classifications provided in the country data sources, matches with the OECD data are shown in Table 12.

Industry-level data on men and women's manufacturing employment (used to construct $\hat{G}$) are for the same year as the most recent year of input–output data, with two exceptions. For Italy, the data are for 1991 (the most recent input–output data is for 1985); for France, the data are for 1988 (the most recent input–output data is for 1990). UNIDO data do not go back to 1978–80. Thus data from the ILO Yearbook of Labour Statistics are used to obtain the female percentage of employment for the manufacturing sector as a whole for the 1978–80 period, necessary for the estimates of gender bias in relation to average employment in 1978–80. There are some differences, generally very small, in the female percentage of manufacturing employment between the ILO and other data (from UNIDO and country sources). Thus adjustments are made to the average female percentage of employment for 1978–80 from the ILO data. The assumption is made that the difference between the ILO and other data in the 1978–80 period is proportionate to the difference in the year of the industry-level data on men and women's manufacturing employment. (That is, the average female percentage of employment for 1978–80 for the manufacturing sector as a whole is divided by $f^{\text{ILO}}/f^{\text{UNIDO}}$, where the numerator stands for female percentage of employment from the ILO Yearbook of Labour Statistics and the denominator stands for the female percentage of manufacturing employment from the UNIDO dataset or country sources, with both terms for the manufacturing sector as a whole in the year of industry-level data on men and women's employment.) This enables one to make best use of the continuity over time provided by the ILO data and the industry detail provided by data from UNIDO and country sources. In any case, the analysis is quite robust in this regard. The exception is Denmark, for which there are no years of overlap between the ILO and UNIDO data. Thus data for 1978–81 (data for 1980 are not published) are used straight from the ILO Yearbook of Labour Statistics.