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Rising Foreign Outsourcing and Employment Losses in U.S. Manufacturing, 1987-2002

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Abstract

Foreign outsourcing, otherwise known as off-shoring, has become a matter of intense public debate and great concern in the United States presidential contest, especially in light of the large job losses experienced by U.S. workers since George Bush became president. Yet, there is a lack of good data on foreign outsourcing since the early 1990s. This paper presents updated measures of foreign outsourcing for the recent period. Its main findings are that the share of foreign-sourced goods in total manufactured inputs almost doubled – from 12.4% to 22.1% – in U.S. manufacturing between 1987 and 2002. Since the early 1990s, outsourcing has accelerated in key industries and has been associated with a loss of employment. In particular, for the period from 1997 to 2002, there has been a strong association between manufacturing job losses and foreign outsourcing.

Introduction

Against the backdrop of a collapse of manufacturing sector employment in recent years, the impact of outsourcing on the American economy has become a focus of public debate and anxiety. Foreign outsourcing, or off-shoring, by U.S. firms has been seen as a major culprit behind job loss in both manufacturing and service industries in recent years. Yet good measures of the extent of

outsourcing are difficult to find.¹ In this paper, we report a newly updated indicator of foreign outsourcing activities among U.S. manufacturing firms between 1987 and 2002. Our results show that the share of foreign-sourced goods in

The share of foreign-sourced goods in total manufactured inputs – a significant indicator of the extent of outsourcing activity – rose substantially, from 12.4% to 22.1% in the manufacturing sector as a whole between 1987 and 2002.

total manufactured inputs – a commonly used indicator of the extent of outsourcing activity – rose substantially, from 12.4% to 22.1% in the manufacturing sector as a whole between 1987 and 2002. Our findings show foreign outsourcing activity increased most rapidly in the later part of the 1990s through 2002. Especially high levels of outsourcing activity are found in those industry groups experiencing the highest levels of job loss in recent years, including those producing apparel, computers, and transportation equipment.

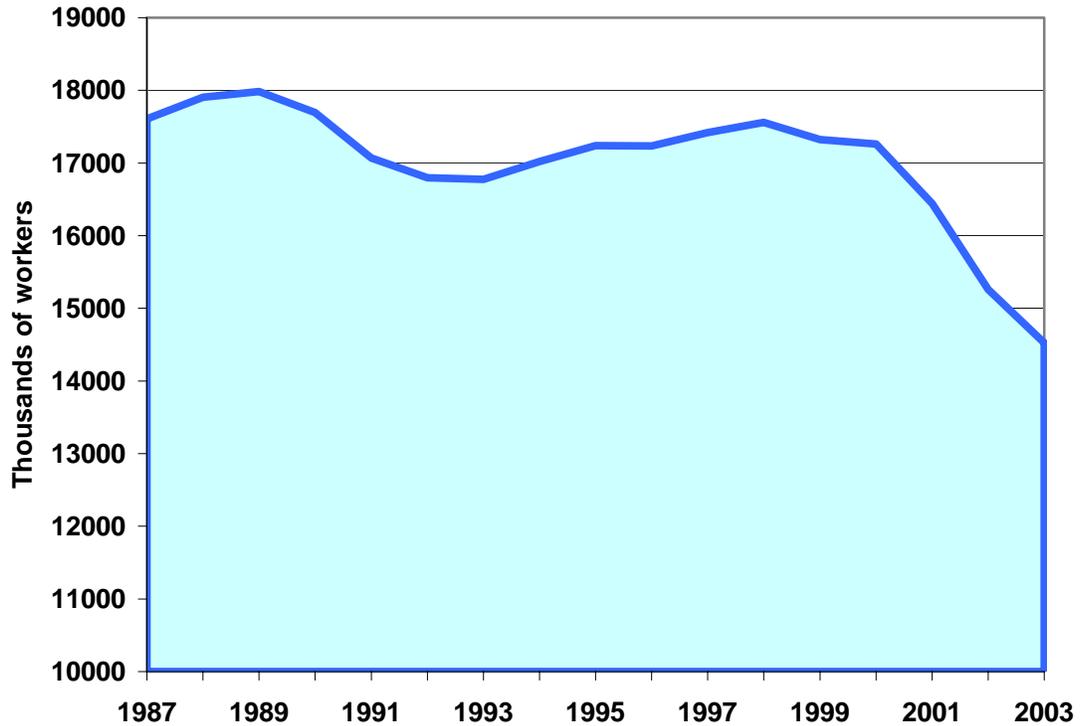
What Is Outsourcing and How Can We Track It?

Foreign outsourcing (or off-shoring) by American firms involves the relocation of some domestic production of goods/services to foreign countries. Foreign outsourcing by a U.S. firm can involve the relocation of production that is either *internal* or *external* to the firm. Outsourcing of production internal to the firm involves replacing the firm's own domestic production with foreign production, while the outsourcing of production

external to the firm involves replacing the firm's purchase of U.S.-sourced inputs with purchases of inputs produced in foreign countries.²

The various channels through which the outsourcing of production takes place and its multiple effects help to explain why measuring outsourcing activity has been challenging using available economic data. Our analysis of the extent and growth of outsourcing focuses on the share of imported inputs in total manufacturing inputs for industries in the U.S. manufacturing sector. Increased outsourcing activity is expected to increase the import of intermediate goods as outsourcing firms replace intermediate stages of their domestic production with foreign production, or shift their purchases of inputs from domestic to foreign suppliers. While changes in the share of imports in intermediate goods will not fully capture the extent of outsourcing – some outsourcing by U.S. firms will show itself as a displacement of U.S. production of final goods and exports rather than an increase in imports of intermediate goods – it does provide a measurable indicator that can be tied directly to outsourcing activity.³ Tracking the share of imported intermediate goods/services in total purchases of intermediate goods/services should reliably allow us to discern changes in outsourcing over time.⁴

Chart 1: U.S. manufacturing employment, 1987-2003



Source: BLS, Current Employment Statistics

Measuring the Share of Imported Inputs in U.S. Manufacturing Industries

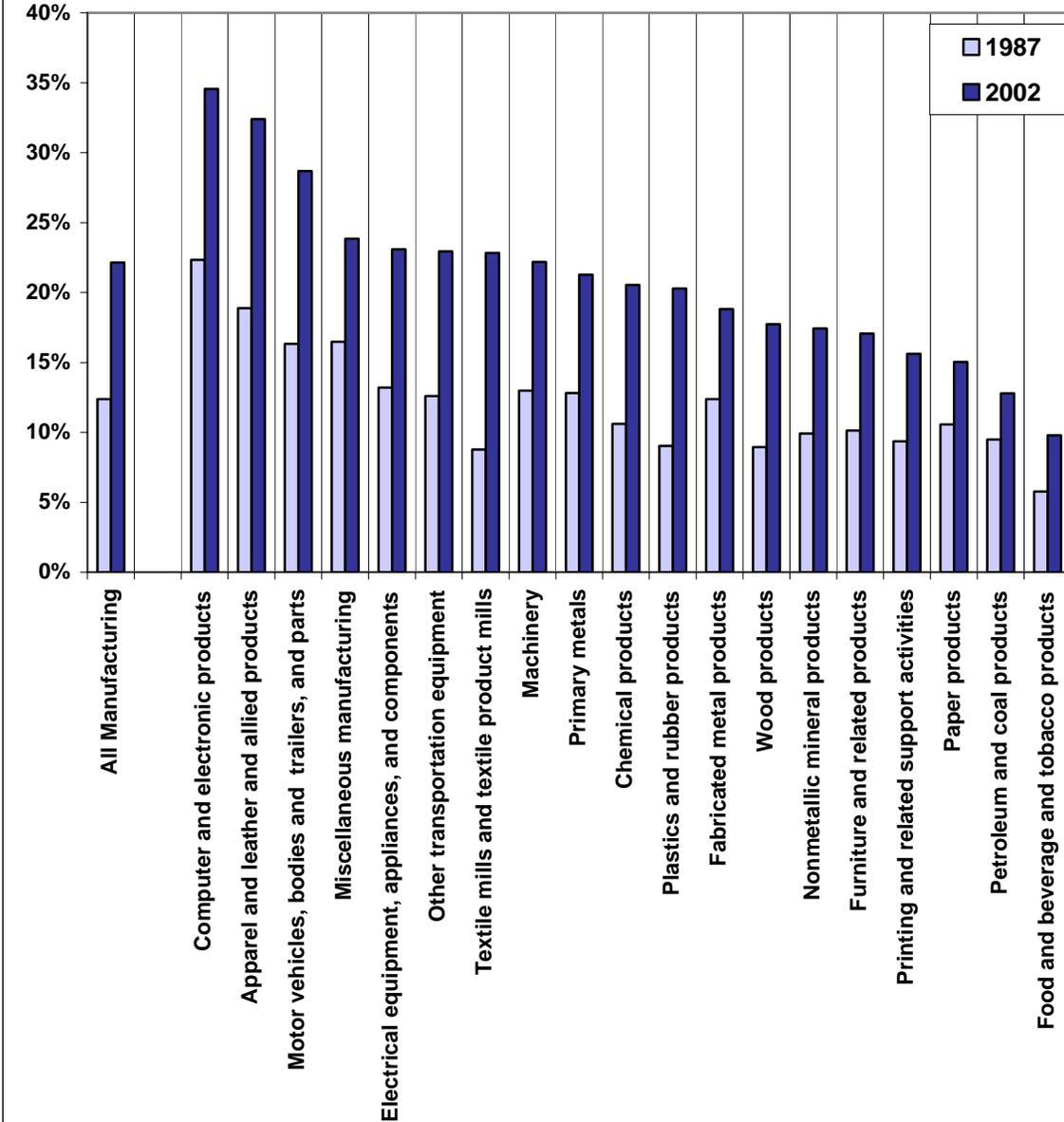
Employment in U.S. manufacturing has fallen precipitously since the late 1990s (see Chart 1 above). Between 1998 and 2003, employment in manufacturing declined by over 3 million jobs to reach its lowest level in over half a century. There has been considerable debate among economists and policymakers about the causes of the dramatic dislocation of manufacturing workers. In addition to increased outsourcing, other factors that have been put forth as playing a role in the collapse of manufacturing employment include trade competition, rising labor productivity, and shifts in the demand for manufactured goods. As part of an effort to shed new light on this debate, we focus on measuring the growth of outsourcing in manufacturing industry groups between 1987 and 2002.

Using data provided in the BEA's national input-output accounts, we calculate the share of imported goods in total purchases of intermediate manufactured goods for manufacturing groups and for the sector as a whole for the years 1987, 1992, 1997, and 2002. The input-output accounts show how industries provide input to, and use output from, each other to produce goods in the economy. The data tables that make up these accounts allow us to calculate the import share of each commodity (the share of the commodity used in the U.S. economy that is imported) as well as the value of each commodity used in the production process of each industry. For an industry, then, we multiply the value of each commodity used by the import share of that commodity to find the value of imported inputs of each commodity used by the industry. We then sum the imported inputs of each commodity to get the industry's total imported inputs (see the appendix).⁵

Chart 2 shows the change between 1987 and 2002 in the share of imported inputs in total inputs of manufactured goods for the manufacturing sector as a whole and for 19 manufacturing industry groups that make up the sector. For the manufacturing sector as a whole and for every industry group, the share of imported inputs has risen substantially over the time period. For all manufacturing, the share of imported inputs rose from 12% to 22% between 1987 and 2002. Among the industry groups with the highest shares of foreign-sourced manufactured inputs were the computer/electronic products group, the apparel/leather products group, and the motor vehicles/bodies and trailers/parts group. In these three industry groups, imported inputs made up about one-third of all manufactured inputs in 2002.

Table 1 shows the share of imported inputs in the whole manufacturing sector and manufacturing industry groups in 1987, 1992, 1997, and 2002. Between 1987 and 2002, the industry groups with the largest increases in the share of imported inputs were the textiles group, the apparel/leather products group, the motor vehicles/bodies and trailers/parts group, and the computer/electronic products group. For these groups, the foreign-produced share of total manufactured inputs rose by between 12 and 14 percentage points during the period. Table 1 also shows that the growth in the share of imported inputs in the manufacturing sector as a whole accelerated in the later parts of the 1987 to 2002 period. Of the total increase of 9.8 percentage points in the import share for

Chart 2: Imported inputs of manufactured goods, 1987 and 2002, as share of total inputs



**Table 1: Imported Inputs in U.S. Manufacturing Industries,
1987, 1992, 1997, 2002**

Industry	Imported Inputs as a Share of Total Inputs				
	1987	1992	1997	2002	Change in Share, 1987 - 2002
All Manufacturing	12.4%	13.9%	17.7%	22.1%	9.8%
Computer and electronic products	22.3%	26.5%	32.7%	34.6%	12.2%
Apparel and leather and allied products	18.9%	24.1%	24.5%	32.4%	13.5%
Motor vehicles, bodies and trailers, and parts	16.3%	18.0%	19.1%	28.7%	12.4%
Miscellaneous manufacturing	16.5%	18.6%	18.0%	23.8%	7.4%
Electrical equipment, appliances, and components	13.2%	14.8%	18.3%	23.1%	9.9%
Other transportation equipment	12.6%	15.9%	18.5%	22.9%	10.3%
Textile mills and textile product mills	8.8%	11.3%	14.3%	22.8%	14.1%
Machinery	13.0%	13.9%	17.1%	22.2%	9.2%
Primary metals	12.8%	14.3%	21.2%	21.3%	8.5%
Chemical products	10.6%	12.0%	15.7%	20.5%	9.9%
Plastics and rubber products	9.0%	10.6%	13.3%	20.3%	11.2%
Fabricated metal products	12.4%	12.5%	15.8%	18.8%	6.4%
Wood products	8.9%	8.8%	14.3%	17.7%	8.8%
Nonmetallic mineral products	9.9%	10.4%	13.8%	17.4%	7.5%
Furniture and related products	10.1%	10.6%	13.1%	17.1%	6.9%
Printing and related support activities	9.4%	8.1%	14.9%	15.6%	6.3%
Paper products	10.6%	10.3%	15.2%	15.0%	4.5%
Petroleum and coal products	9.5%	8.5%	9.4%	12.8%	3.3%
Food and beverage and tobacco products	5.8%	6.1%	6.5%	9.8%	4.0%

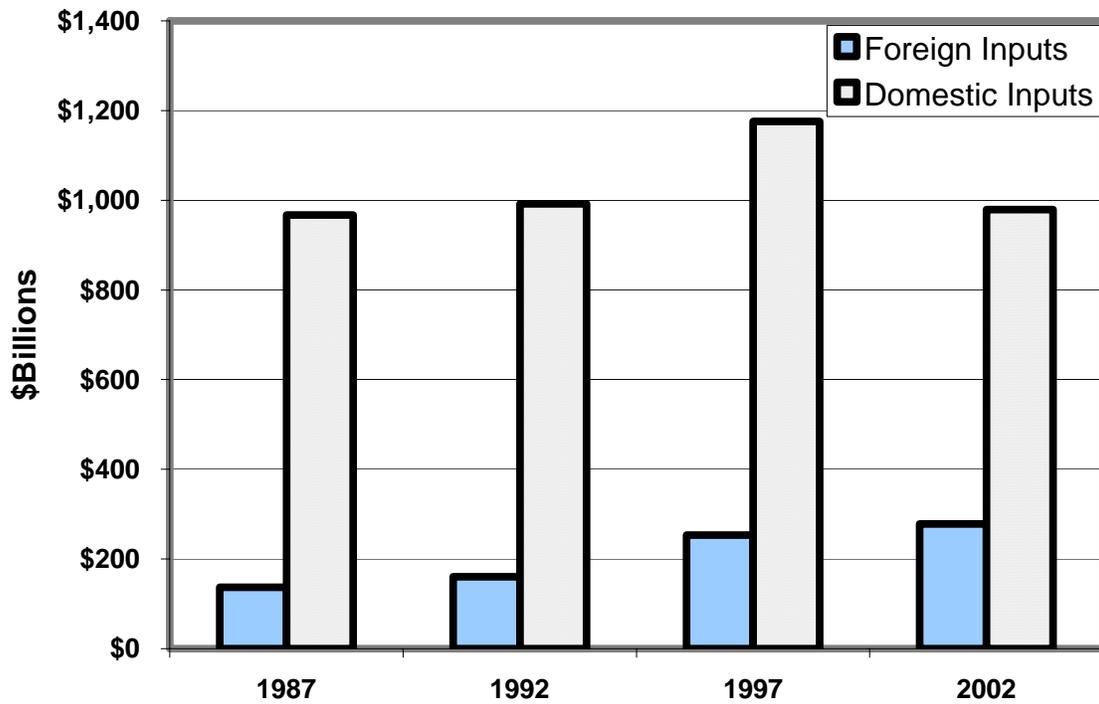
the period, the earliest period (1987-92) accounts for 1.5 percentage points, the middle five-year period (1992-97) accounts for 3.8 percentage points, and the latest five-year period (1997-2002) accounts for 4.4 percentage points. Faster growth in the share of imported inputs in the most recent 1997-2002 period are also seen in 13 of the 19 manufacturing industry groups. The increase in the latest period was especially fast for the motor vehicles/bodies and trailers/parts industry group, in which the years from 1997 to 2002 accounted for three-quarters of the increase in the share of foreign-sourced inputs. Of the 12.4 percentage point increase in that group's imported input share between 1987 and 2002 (from 16.3% to 28.7%), the most recent five-year period accounted for 9.6 percentage points.

Chart 3 shows the levels of domestic and foreign-sourced inputs of manufactured goods in U.S. manufacturing production for 1987 to 2002 in constant 2002 dollars. The data presented in this chart and the accompanying table adds some detail to the picture of a rising share of imported inputs used in U.S. manufacturing during this period. In the earlier period, from 1987 to 1997, the share of imported inputs rose as their use in production grew at a faster rate than the growth in the use of domestic goods. Between 1987 and 1997, foreign-sourced inputs grew by 85% in real terms (from \$137 billion to \$252 billion) while domestic inputs grew by 22% (from \$967 to \$1,176 billion). In the later period, from 1997 to 2002, the share of imported inputs grew as the result of continued growth in imported inputs while the volume of domestic inputs fell. During those years, with U.S. manufacturing employment falling sharply and poor growth in production over the period, the real value of total inputs of manufactured goods used in U.S. manufacturing fell by 12%. During these years, the value of foreign-sourced inputs rose by 10% (from \$253 billion to \$278 billion) while the value of domestic inputs fell by 17% (from \$1,176 billion to \$979 billion in 2002 dollars).

Job Loss and the Rising Share of Foreign-Sourced Inputs in U.S. Production

Against the backdrop of poor job growth and the collapse of employment in the U.S. manufacturing sector since the late 1990s, the outsourcing of production has become a

**Chart 3: Sources of Manufactured Inputs,
All US Manufacturing Industries, 1987 - 2002**
Constant 2002 Dollars, Billions



		1987	1992	1997	2002
	Dollars	967	992	1176	979
	Share	87.6%	86.1%	82.3%	77.9%
Imported Inputs	Dollars	137	160	253	278
	Share	12.4%	13.9%	17.7%	22.1%
Total Inputs		1,104	1,152	1,429	1,258

growing source of anxiety to U.S. workers. When a U.S. industry experiences substantial and rapid outsourcing from production sites at home to foreign production sites, it can generally be expected that there will be job loss in that industry. Using the measure of outsourcing activity we have calculated – the share of imported goods in total manufactured inputs – we present initial tests of the connection between the extent of outsourcing and job loss in U.S. manufacturing industries.⁶

We focus on job loss during between 1997 and 2003, the period in which manufacturing employment underwent its sharp decline. During this period, employment declined in all 19 manufacturing industry groups that make up the sector and the sector as a whole saw a total decline of 3.3 million jobs. While employment for the manufacturing sector as a whole declined by about 19%, the rate of decline for the 19 individual industry groups ranged from just 4% to 56%. (Table A.1 in the appendix shows the manufacturing job loss between 1997 and 2003, broken down by industry groups.)

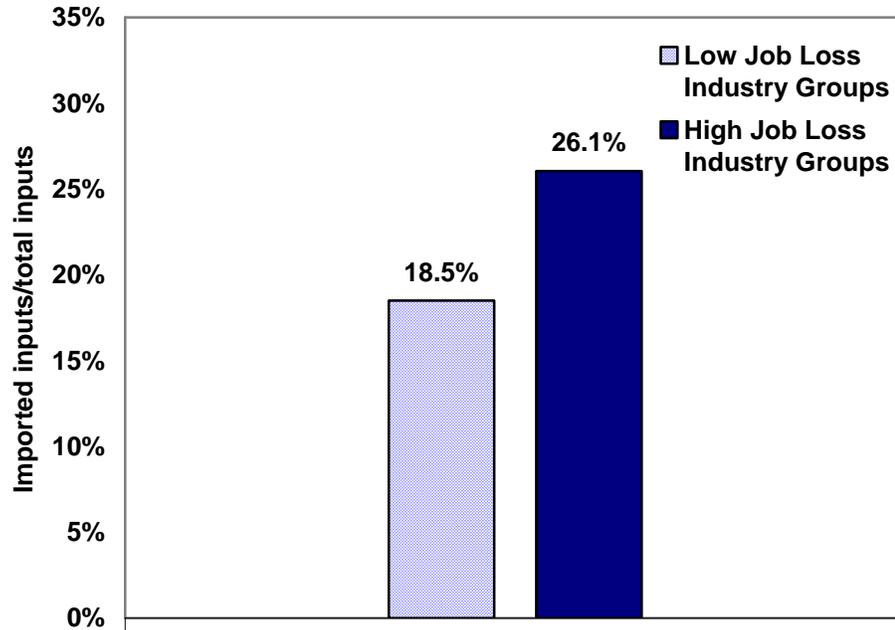
First, for the 19 manufacturing groups, we compare the average share of foreign-sourced inputs in 2002 for the six industries with the highest rate of job loss between 1997 and 2003 (the period in which manufacturing employment underwent its sharp decline) to a group made up of the remaining 13 industries.⁷ The six high job loss industry groups made up 23% of total manufacturing sector employment in 1997 and accounted for 57% of the total decline of 3.3 million jobs in manufacturing employment between 1997 and 2003.

Chart 4 shows that for the six high job loss industry groups the average share of foreign-sourced inputs in total manufactured inputs in 2002 was 26.1% versus 18.5% for the low job loss industry groups.⁸ This preliminary analysis is consistent with the view that high levels of outsourcing activity by U.S. industries is related to high rates of job loss in those industries.

We also used the Pearson correlation procedure to test for the relationship between job loss and our measure of outsourcing activity for the 19 industry groups. We found a strong negative relationship between the level of outsourcing in an industry group and changes in the employment level in that group. The correlation coefficient for the relationship between the changes in the employment level (measured as the percentage change in the employment between 1997 and 2003) and the average share of foreign-

sourced inputs in total manufactured inputs in 2002 was significant at the 0.01 level (2-tailed), with a correlation coefficient of -0.601 and significance of 0.007.

**Chart 4: Manufacturing job loss 1997-2003
and foreign outsourcing**
Average share of imports in total manufacturing inputs, 2002



The six industries in the 'high job loss' group are: computer/electronic products; apparel/leather products; machinery; textiles; primary metals; and electrical equipment/appliances/components. The remaining fourteen industries make up the 'low job loss' group.

Conclusion

Our new figures show that foreign outsourcing, as measured by the importation of manufacturing inputs, has gone up significantly throughout U.S. manufacturing since 1987, and has accelerated in many manufacturing industries in the last five years. Moreover, outsourcing has been highest in those industries that have seen the largest job losses in recent years.

Of course, significantly more research must be done to understand the reasons for this increase in outsourcing and to clearly assess the relationship between employment and outsourcing. Still, these data suggest that outsourcing might have contributed significantly to employment losses in U.S. manufacturing in the last several years.

Appendix

Calculating Outsourcing

The imported share of intermediate manufactured goods for an industry is calculated as shown below.

Use of imported intermediate goods by industry i:

$$\sum_{c=1}^n \text{Imported Inputs}_{ic} = \sum_{c=1}^n (\text{Input}_{ic} \times [\text{IM}_c / (\text{Output}_c + \text{IM}_c - \text{EX}_c)]),$$

where

Input_{ic} = use of commodity c by industry i;

IM_c = imports of commodity c;

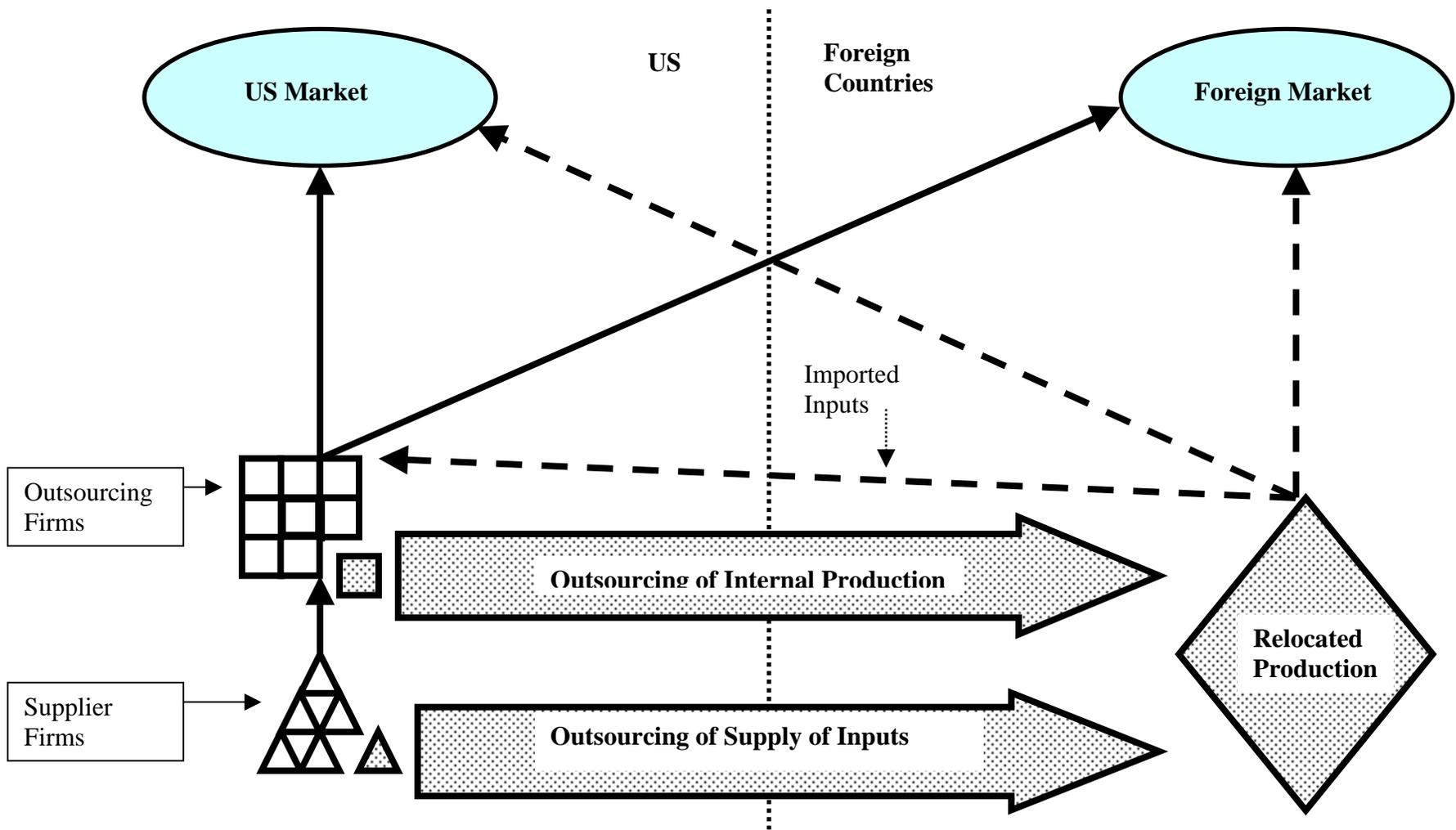
Output_c = domestic output of commodity c;

EX_c = exports of commodity c.

The share of imported goods in total intermediate manufacturing goods for an industry is:

$$(\sum_{c=1}^n \text{Imported Inputs}_{ic}) / (\sum_{c=1}^n \text{Total Inputs}_{ic}).$$

Chart A1: Relocation of production by outsourcing U.S. firms



The outsourcing of production by U.S. firms

	US Production of Goods/Services: Internal to Outsourcing Firm		Outsourcing of US Production
	US Production of Intermediate Goods/Services: External to Outsourcing Firm		Foreign Production: Relocated from US
	Sales from Domestic Production		Sales from Foreign Production

Table A.1: Employment change in U.S. manufacturing industries, 1997-2003

	<i>Change, thousands</i>	<i>Change, percent</i>
All manufacturing	-3,270.0	-18.6%
Apparel and leather and allied products	-426.7	-55.7%
Textile mills and textile product mills	-235.8	-36.2%
Primary metals	-180.5	-28.0%
Computer and electronic products	-510.8	-27.7%
Machinery	-377.2	-24.9%
Electrical equipment, appliances, and components	-138.8	-23.6%
Other transportation equipment	-149.7	-19.0%
Paper products	-119.3	-19.0%
Printing and related support activities	-156.7	-19.0%
Petroleum and coal products	-25.4	-18.5%
Fabricated metal products	-256.7	-14.8%
Plastics and rubber products	-135.8	-14.4%
Motor vehicles, bodies and trailers, and parts	-157.5	-12.3%
Wood products	-66.3	-11.0%
Miscellaneous manufacturing	-78.2	-10.7%
Chemical products	-95.2	-9.6%
Furniture and related products	-56.5	-9.0%
Nonmetallic mineral products	-40.1	-7.6%
Food and beverage and tobacco products	-63.3	-3.6%

Notes

¹ Two estimates of the effects of the impact of outsourcing on employment have received attention recently. First, reports produced by the Forrester Research consulting firm in 2003 and 2004 have projected job loss in service industries over the next decade as the result of outsourcing. However, the lead author of the Forrester Research reports has described them in press interviews as based on “a very rough and gross calculation” and “educated guesses”. The second recent estimates on the effect of outsourcing on jobs have come from the addition of a new question added this year to the Bureau of Labor Statistics’ (BLS) Mass Layoffs Survey. This question asked firms carrying out layoffs of more than fifty workers whether these layoffs were the result of relocating production to foreign sites. The estimates of job loss related to outsourcing derived from the BLS’s Mass Layoffs Survey have significant limitations - most notably, the Survey only covers a small fraction of all job losses each quarter.

² Outsourcing of production internal to the firm may involve a transfer of the firm’s domestic operations to a foreign affiliate or, alternatively, the replacement of an intermediate stage internal to its domestic production process with the import of inputs from an unaffiliated foreign producer. On the other hand, outsourcing of production external to the firm involves shifting purchases of intermediate goods/services from domestic suppliers to foreign suppliers who may or may not be affiliated with the outsourcing US firm. The outsourcing of production that is internal to firms will increase imports of both intermediate and final goods/services into the US as well as displace US exports to foreign markets, while the outsourcing of production external to firms will increase the US import of intermediate goods/services. (Chart A1 in the Appendix presents a graphical representation of the relocation of production by outsourcing US firms and its effects on the flow of domestic and foreign goods/services.)

³ Other researchers have measured imported input shares in production to create an indicator of outsourcing for years prior to the mid-1990s, most notably in several studies by Robert Feenstra and Gordon Hanson (see, for example, Robert Feenstra and Gordon Hanson, (1996) “Global Production Sharing and Rising Inequality: A Survey of Trade and Wages,” NBER Working Paper 8372).

⁴ There are possible sources of increasing imported inputs in US production that are not associated with outsourcing activities by US firms. First, if foreign firms set up production in US sites, they are likely to use intermediate goods shipped from their home countries or other foreign suppliers. Its possible that these activities would increase the shares of imported inputs in US production without any new outsourcing activity by US firms. Second, technical change that results in production more intensive in foreign goods may also lead to increases in the import share of inputs. Finally, a rise in the relative price of imported versus domestic inputs could show up as a rise in the share of imported inputs without actually representing a shift in the location of production abroad. In future work, we will test the size of some of these effects but we assume for now that these effects are small compared to the effect of outsourcing activity.

⁵ A basic assumption of this method of calculating the imported inputs share is that the import share of the commodity when it is used as an intermediate good in each particular industry is the same as the import share of the commodity in the economy as a whole (as calculated from the I/O accounts).

⁶ Because firms may use intermediate goods produced in other industry groups, some outsourcing that is external to the firm (i.e., shifting the purchase of inputs from domestic to foreign suppliers) may not directly impact production or employment levels in the outsourcing firm's own industry group. In these initial tests of the job loss effect of outsourcing, we look for the same-industry effects of the outsourcing activities of US manufacturing firms. We expect there to be same-industry employment effects from all outsourcing that is internal to firms and for a substantial part of outsourcing that is external to outsourcing firms.

⁷ The six industries in the highest job loss group (with their 1997 – 2002 employment declines in parentheses) are: Computer/Electronic Products (27.7%); Apparel/Leather Products (55.7%); Machinery (24.9%); Textiles (36.2%); Primary Metals (28.0%), and Electrical equipment/ Appliances/ Components (23.6%). To test whether it is appropriate to split the sample in this way, we carried out an analysis of variance procedure (ANOVA). This procedure tested if the average rate of job loss in the top six job loss industries was significantly different from the average for the remaining 14 groups. There is a significant difference in job loss rates between the two groupings with $F = 26.276$, significant at the 0.01 level.

⁸ An ANOVA procedure indicated that the average share of imported inputs for the high job loss group is significantly different from the average for the low job loss group with $F = 8.623$, significant at the 0.01 level.