Assessing the Impact of Trade Liberalization on Import-Competing Industries in the Appalachian Region [*]

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Executive Summary:

Appalachian manufacturing will face significant pressure from import competition over the near and medium term and will face significantly larger adjustments than the rest of the US. The challenges faced by Appalachia are the result of a number of related factors.

First, the share of manufacturing imports from low-wage countries like China and India has grown significantly over the past 30 years and especially rapidly in the last ten years. These low-wage imports are concentrated in relatively labor-intensive industries such as apparel and footwear and are relatively absent in capital-intensive, technology-intensive sectors such as transportation.

Second, the arrival of low-wage imports in a sector is associated with a higher probability of manufacturing plant closure as well as lower employment and output growth. Within industries, the lowest-wage, most labor-intensive plants face the greatest threat due to imports from these low-wage countries.

Third, Appalachian manufacturing employment and output are concentrated in industries facing high exposure to imports from low-wage countries. Within industries, plants in the Appalachian region are less skill-intensive and less productive than elsewhere in the US. Appalachian manufacturing is therefore more exposed to the effects of imports from low-wage countries.

Fourth, in addition to being more exposed, direct measures of the impact of low-wage competition on employment growth and plant failure show a more pronounced effect of low-wage competition on Appalachian plants than on plants elsewhere in the US. Plants in the Appalachian region have higher shutdown probabilities and lower employment growth when facing low-wage imports than do firms in the rest of the US.

Fifth, low-wage import shares are forecast to increase rapidly in the next decade. By 2011, low-wage countries are predicted to account for 24 percent of all US imports, up from 15 percent in 1991. More importantly, the increase will be greatest in low-wage, labor-intensive industries, precisely those sectors that are over-represented in the Appalachian region. And, while tariffs and transportation costs are not expected to undergo substantial changes in the medium term, the next decade will bring continued pressure on firms in labor-intensive industries and on firms with a labor-intensive product mix in all industries. Developments in trade policy are unlikely to dramatically alter these forecasts.

Sixth, Appalachian manufacturing industries also exhibit lower levels of firm entry and exit than the US as a whole. These lower transition rates suggest that Appalachian manufacturing might be slower to adjust their product mix in response to international pressure, compounding the challenges posed by increasing import competition.

The combination of these factors presents significant challenges to Appalachian manufacturing and policy-makers in the region.

I. Introduction:

US manufacturing has undergone significant restructuring over the past 40 years. Relative to other sectors of the economy, it has shrunk substantially. Employment has declined from 26% of all workers in 1960 to 14% in 2000, while manufacturing output as a share of GDP has fallen from 27% to 16%. At the same time, significant reallocation has occurred across industries within manufacturing, primarily from less skill- and capital-intensive industries to more skill- and capital-intensive industries.

These changes are consistent with the implications of comparative advantage. As US trade barriers have fallen, low-wage countries like China and India have begun exporting to the US many of the more labor-intensive products, such as apparel and footwear, which were formerly produced domestically.

Recent empirical work by Bernard et al. (2004b, 2005) documents the steady rise in the share of US imports originating from low-wage countries and the implications of this trend for US manufacturing plants. They find that low-wage import shares are highest, and have grown fastest, in relatively labor-intensive industries. They also find that the probability of plant survival as well as employment and output growth are lower for plants in industries where low-wage country import presence is high. Quantitatively, they show that a 10 percentage point increase in the share of imports from low-wage countries in an industry is associated with a 3.3 percentage point increase in the probability of plant death and a 1.3 percentage point decline in year-on-year plant employment growth rates. They also demonstrate that plants that change their product mix enough to switch industries tend to move toward industries with lower exposure to low-wage country competition.

In this study we use this methodology to assess the impact of low-wage country competition on Appalachian manufacturing. We find Appalachian manufacturing plants to be biased towards labor-intensive production relative to manufacturing plants in the rest of the US. We also find that Appalachian plants within industries are more labor-intensive and less productive than manufacturing plants outside Appalachia, signaling the likelihood that their product mix within industries is more labor-intensive and that their production methods are less efficient. In addition to being more exposed to low-wage

import competition, the response of plants in Appalachia to import competition is greater than elsewhere in the US. For Appalachian manufacturing plants, we find that low-wage competition has reduced the probability of plant survival and lowered employment growth among surviving plants and this response is more pronounced than in the rest of the US. However, at the same time, firm characteristics play a larger role in offsetting the deleterious effects of low-wage competition in Appalachia. Skill-intensive and capital-intensive firms are more likely to survive and grow in the Appalachian region even in the face of increasing low-wage import exposure.

Our results are also consistent with those of Jensen (1998) in finding that wages in Appalachia, both skilled and unskilled, are lower than they are in the rest of the United States. These differences are driven by two biases, namely that Appalachian plants are concentrated in labor-intensive industries and, within industries, they are more labor-intensive than non-Appalachian plants.

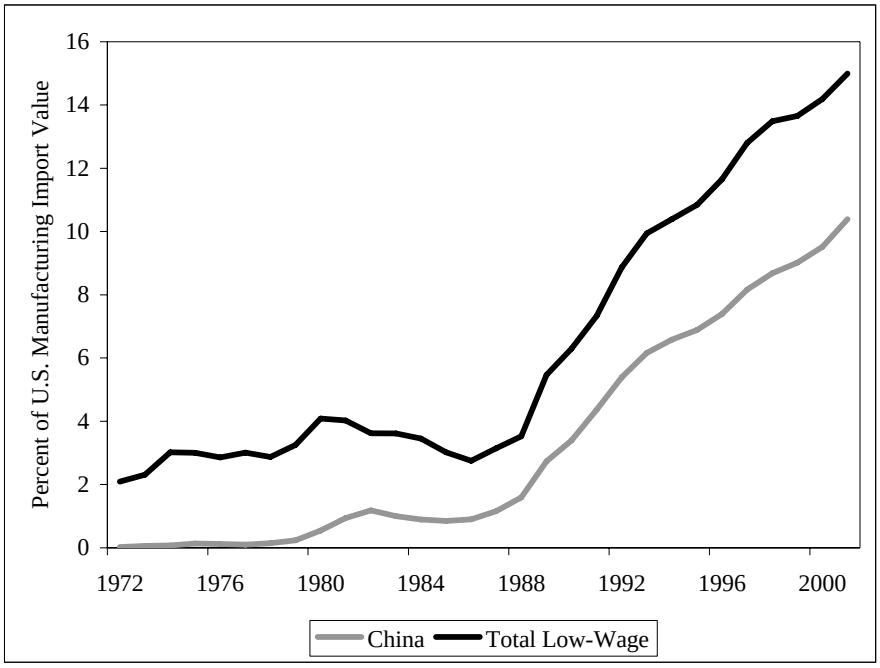
The remainder of this report is structured as follows. Section II outlines the measures we use to assess low-wage country competition. Section III compares Appalachian manufacturing plants to those of the rest of the United States. Section IV describes our methodology for estimating the impact of low-wage country competition on Appalachia as well as the plant-level US manufacturing data we exploit. Section V develops a forecast for import competition over the next decade and VI discusses scenarios for Appalachian exposure to low-wage country import competition going forward.

II. Measuring Import Competition

II.A. Share of Imports from Low-Wage Countries[1]

US imports of goods and services have increased rapidly over the past 20 years from $319B in 1981 to $1,437B in 2001 (2000$), accounting for 6.0% of GDP in 1981 and 14.6% in 2001. Even as total imports have increased faster than GDP, imports originating in low-wage countries have grown more rapidly than overall imports. As illustrated in Figure 1, the share of US imports from the world's poorest countries – i.e. those whose per capita GDP is less than 5 percent of the US level, increased sharply in the mid-1980s, rising from 4% in 1981 to 15% in 2001.

Figure 1: Share of US Imports from Low-Wage Countries and China, 1972 to 2001



Notes: The figure displays share of US imports originating in low-wage countries, i.e. countries with less than 5 percent of US per capita GDP. The figure also displays share of imports originating in China, which is classified as low wage throughout the sample period.

[1] This section draws on material originally presented in Bernard et al. (2004a) and Bernard et al. (2004b).

In this study we use the share of imports from low-wage countries to examine the link between US manufacturing plant outcomes and international trade. This measure of exposure to international competition differs from traditional measures, including import penetration and import price indexes, by focusing on *where* imports originate rather than on their level. This alternate focus is necessary because the intra- and inter-industry reallocation implied by the factor proportions framework of international trade is a function of trade between countries with very different relative endowments. A key implication of the factor proportions trade model is that the goods produced in a country are a function of its relative endowments. In an open world trading system, relatively capital- and skill-abundant countries like the US are expected to produce a more capital- and skill-intensive mix of industries than relatively labor-abundant countries like China. For example the US produces pharmaceuticals and China produces t-shirts.[2] For the US, imports from China are expected to have a larger impact on manufacturing than imports from countries like Germany whose relative capital intensity and technology intensity is similar to those in the US. As a result, the measure of the share of imports from low-wage countries provides a strong signal about which US industries are most exposed to trade with low-wage countries.[3]

Formally, we define an industry's exposure to imports originating in low-wage countries in a given year as the *value share* of imports from low wage countries (or VSH_{it}), as:

$$VSH_{it} = (Imports_{it,Low\ Wage} / Imports_{it,Total})$$

where $Imports_{it,Low\ Wage}$ and $Imports_{it,Total\ Imports}$ are the value of imports from low-wage countries and all countries, respectively. VSH is bounded by zero and unity, with VSH=1 indicating that all of an industry's import value originates in low-wage countries.

[2] Relative endowments of factors rather than absolute quantities drive differences in production across countries. For example, Belgium produces goods that are similar to those produced in the US while Cambodia produces products similar to those produced in China even though Belgium and Cambodia are much smaller than the US or China.

[3] A number of factors, including tariff barriers, non-tariff barriers and transportation costs can induce heterogeneity of exposure, even across industries of similar labor intensity.

We classify a country as low-wage in year t if its per capita GDP is less than 5 percent of US per capita GDP.[4] This method of classification is practical because per capita GDP data are available for a much larger sample of countries than other measures of relative development, e.g., manufacturing wages. Our cutoff captures an average of 50 countries per year. Table 1 lists the set of countries classified as low wage by this screen in every year of the sample period. This set includes China and India as well as relatively small exporters such as Haiti. Using data and concordances compiled by Feenstra (1996) and Feenstra et al. (2002), we are able to compute VSH for 385 of 459 four-digit SIC (SIC4) manufacturing industries. These industries encompass 88 percent of manufacturing employment and 91 percent of manufacturing value.

We choose a 5 percent cutoff to classify countries as low wage for several reasons. Most important, it represents the world's most labor-abundant cohort of countries and therefore the set of countries most likely to have an effect on US manufacturing plants according to the factor proportions framework. Second, though this cohort of countries is responsible for a relatively small level of exports, it accounts for a relatively significant share of US import growth over time.[5] Among countries with less than 30 percent of US GDP per capita, the cohort of countries below the 5 percent cutoff experienced the largest increase in import share, by far, between 1972 and 1992. Finally, the set of countries defined by this cutoff is relatively stable in terms of countries entering and leaving the set over the sample period we consider.[6]

Table 2 summarizes VSH by two-digit SIC manufacturing industry and year. The final row of the table reports VSH for US manufacturing as a whole. Across all

[4] We compare countries to the US in terms of dollar-denominated per capita GDP. We do not make purchasing power parity (PPP) adjustments to the GDP values because for countries with such low levels of income, the use of PPP-adjusted per capita GDP sharply limits the number of available countries and years due to a lack of data.

[5] Even a low level of imports from low-wage countries can play a significant role in US manufacturing outcomes. The key consideration is whether or not imports from low-wage countries overlap with goods produced in the US (Leamer 1999). It is precisely the effect of such overlap that we investigate in this paper.

[6] In sensitivity analyses not reported here, we obtain similar results when using cutoffs of 10 and 15 percent.

manufacturing, VSH increases from 2 percent in 1972 to 15 percent in 2001, with much of this increase occurring in the most recent years.

Table 1: Low-Wage US Trading Partners

Albania	Ghana	Niger
Angola	Guinea	Nigeria
Bangladesh	Guinea-Bissau	Pakistan
Benin	Guyana	Papua New Guinea
Bolivia	Haiti	Philippines
Burkina	Honduras	Rwanda
Burundi	India	Senegal
Cambodia	Indonesia	Sierra Leone
Cameroon	Ivory Coast	Sri Lanka
Central African Republic	Kenya	Sudan
Chad	Laos	Suriname
China (Mainland)	Madagascar	Syrian Arab Republic
Comoros	Malawi	Tanzania
Congo	Mali	Togo
Congo, Rep.	Mauritania	Uganda
Djibouti	Mongolia	Vietnam
Egypt	Morocco	Yemen Arab Republic
Equatorial Guinea	Mozambique	Zambia
Ethiopia	Nepal	Zimbabwe
Gambia	Nicaragua	

Notes: Countries are classified as low wage if their mean real per capita GDP is less than 5% of the U.S. level between 1972 and 2001.

The rows of Table 2 reveal that VSH varies substantially across both industries and time. VSH is higher and increases more rapidly among generally labor-intensive industries like Apparel, Textiles and Leather. In 2001, Transportation faced almost no low-wage competition (1%) while the Apparel industry was heavily exposed (41%). This contrasts sharply with the situation in 1972 when both sectors saw few imports from the world's poorest economies. The different experiences of these two industries reflects their disproportionate dependence on labor: capital- and skill- intensive sectors like Transportation are exposed to far less competition from countries like China than labor-intensive industries like Apparel. This link between industry characteristics and low-wage country competition adheres to the well-known theory of comparative advantage. This theory states simply that countries specialize production according to their available

resources. Low-wage countries like China have a distinct advantage in producing labor-intensive goods. Countries like the US, on the other hand, more profitably manufacture products relying on capital and skill.

Table 2: US Exposure to Low-Wage Country Competition by Industry, 1972 to 2001

	Percent of Imports from Low-Wage Countries			
Industry	1972	1981	1991	2001
20 Food	11	11	8	8
21 Tobacco	28	11	5	22
22 Textile	25	21	19	22
23 Apparel	3	15	30	41
24 Lumber	4	8	12	10
25 Furniture	1	7	7	33
26 Paper	0	0	1	7
27 Printing	0	1	4	19
28 Chemicals	2	7	3	4
29 Petroleum	1	8	5	7
30 Rubber and Plastic	0	1	19	30
31 Leather	2	5	28	61
32 Stone	1	2	7	22
33 Primary Metal	1	4	3	6
34 Fabricated Metal	1	2	6	17
35 Industrial Machinery	0	1	1	12
36 Electronic	0	2	7	18
37 Transportation	0	0	0	1
38 Instruments	0	1	3	9
39 Miscellaneous	3	7	25	43
All Manufacturing	2	4	7	15

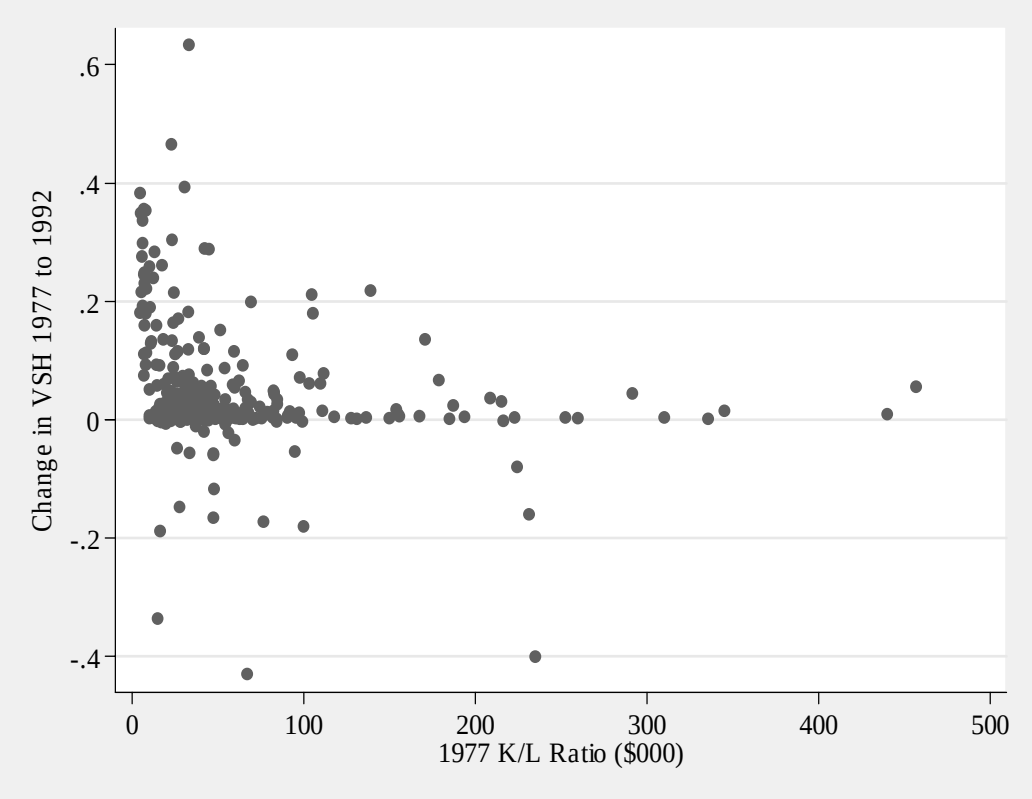
NOTE: Each cell reports the percent of industry imports originating in countries with less than 5% of U.S. per capita GDP.

Figure 2 reinforces this message by plotting the change in four-digit SIC industries' VSH between 1977 and 1992 against their capital intensity in 1977. While there is substantial variation in the change of low-wage import shares, the biggest increases in VSH are concentrated in industries with the lowest capital intensities, as predicted by the theory.

The growing exposure gap within manufacturing indicates that not every industry is heading toward the same fate. Between 1981 and 2001, for example, Leather Goods experienced the largest increase in exposure to low-wage competition, as the low-wage import share grew from 5% to 61%. Other industries with large rises include Apparel,

Plastic & Rubber Products (e.g. gaskets, hoses, and pipes), and Miscellaneous Products (which includes toys). In contrast, Transportation, Chemicals, and Instruments and Controls experienced much more muted increases in exposure, such that the low-wage import share was still in the single digits by 2001. As we discuss in further detail below, a critical factor in determining the level of exposure to low-wage competition that an industry will face is the level of technological sophistication. High-wage, capital-using, and skill-intensive industries will continue to be exposed to lower import shares from low-wage countries than low-wage, labor-intensive industries.

Figure 2: Change in Import Shares from Low-wage Countries over 1977-1992 compared to initial Capital Intensity, by Industry



The changes in low-wage import shares noted in Table 2 are related to changes in industry employment. This relationship is evident from comparing the last column of Table 3, which reports employment changes across industries between 1972 and 2001, with the results in Table 2. Overall, US manufacturing employment declined 8 percent

between 1972 and 2001. This aggregate loss, however, obscures the fact that some industries (e.g. Industrial Machinery, Instruments) have grown substantially even as others (e.g. Apparel, Textiles) have declined.

Table 3: US Manufacturing Employment, 1972-2001

	Employment (000)				Change
Industry	1972	1981	1991	2001	72-01
20 Food	1,745	1,671	1,667	1,691	-3
21 Tobacco	75	70	49	34	-55
22 Textile	986	823	670	478	-52
23 Apparel	1,383	1,244	1,006	566	-59
24 Lumber	740	680	675	786	6
25 Furniture	483	464	475	520	8
26 Paper	679	681	688	634	-7
27 Printing	1,094	1,266	1,536	1,491	36
28 Chemicals	1,009	1,109	1,076	1,022	1
29 Petroleum	195	214	160	126	-35
30 Rubber and Plastic	667	772	862	958	44
31 Leather	296	238	124	60	-80
32 Stone	645	606	522	571	-11
33 Primary Metal	1,173	1,122	723	656	-44
34 Fabricated Metal	1,541	1,586	1,355	1,483	-4
35 Industrial Machinery	1,909	2,521	2,000	2,011	5
36 Electronic	1,535	1,774	1,591	1,631	6
37 Transportation	1,777	1,879	1,890	1,760	-1
38 Instruments	786	1,041	974	839	7
39 Miscellaneous	433	408	366	380	-12
All Manufacturing	19,151	20,169	18,409	17,697	-8

Notes: Employment data from the U.S. Burea of Labor Statistics. Shaded industries have positive growth between 1972 and 2001.

More direct evidence of the relationship between low-wage import shares and employment is reported in Table 4. This table indicates the average industry employment growth rate for industries that faced the lowest and highest levels of low-wage import competition between 1972 and 2001. Industries that faced the highest levels of low-wage import competition experienced an average net employment loss of over 12% per decade. Industries that faced the lowest levels of low-wage competition actually saw their employment rise by 2.3% in each ten-year interval, even as employment in all of manufacturing was declining. Real output growth exhibits a similar pattern. Industries

with the lowest exposure increased their real output by 15% in each ten-year period (roughly 1.5% per year). Output from industries experiencing the least competition from low-wage countries, however, grew more than twice as fast: 38.7% in each ten-year interval or roughly 3.9% per year.

Table 4: Consequences of Low-Wage Country Competition

Initial Exposure to Low-Wage Country Imports	Average Decade-Long Change in Employment 1972-2001	Average Decade-Long Change in Real Output 1972-2001
Low Exposure	2.3%	38.7%
Middle Exposure	-4.4%	32.4%
High Exposure	-12.8%	15.0%

Notes: Industry exposure to low-wage country imports is classified as low, middle or high according to the level of exposure to low-wage imports at the beginning of each decade. Industry classification as well as average employment, real output and real export growth are across two-digit SIC industries. Employment data are from the US Bureau of Labor Statistics (www.bls.gov) and output data are from the NBER Productivity Database (www.nber.org). Decades are 1972 to 1982, 1982 to 1992 and 1992 to 2001. Output is deflated by shipment price indexes from the NBER dataset. Data on low-wage country import exposure are unavailable after 2001 and data on real output are unavailable after 1996. As a result, averages for the final decade for each series are scaled up appropriately.

Below, we outline a methodology for assessing the plant-level impact of exposure to imports from low-wage countries. Before doing that, however, we describe two other important measures of the level of international competition faced by US manufacturing plants, tariffs and freight costs.

II.B. Ad Valorem Tariff and Transportation Rates

This section describes the behavior US tariff and freight costs across industries and time. We control for these costs in our analysis, in addition to VSH, in order to capture international competition from all US trading partners. While VSH focuses on

competition with countries like China, tariff and freight costs measure competitive effects from all trading partners, whether or not their wages are low.

We use estimates of industry-year *ad valorem* tariff (t_{it}) and freight and insurance (f_{it}) rates assembled in Bernard et al. (2003). These estimates are computed from product-level US import data complied by Feenstra et al (2003). The tariff or freight rate for industry i is the weighted average rate across all products in i, using the import values from all source countries as weights. The *ad valorem* tariff rate is therefore duties collected ($duties_{it}$) relative to the Free-On-Board customs value of imports (fob_{it}),

$$f_{it} = duties_{it} / fob_{it}$$

Similarly, the *ad valorem* freight rate is the markup of the Customs-Insurance-Freight value (cif_{it}) over fob_{it} relative to fob_{it},

$$f_{it} = cif_{it} / fob_{it} - 1$$

Estimated tariff and freight rates by two-digit SIC industry and year are displayed in Table 5. [7] Tariff rates vary substantially across industries and generally decline with time. They are higher in labor-intensive industries like Apparel and lower in capital-intensive sectors like Paper. Over the entire period, tariffs decline by more than one quarter in thirteen of twenty industries. The pace of these declines, however, varies substantially across industries.

Freight costs are highest among industries producing goods with a low value-to-weight ratio, including Stone, Lumber, Furniture, and Food. Freight costs also generally decline with time, though the pattern of declines is decidedly more mixed than it is with tariffs.

[7] Data on the tariff and freight measures for all 337 (SIC4) industries and years is available at http://www.som.yale.edu/faculty/pks4/sub_international.htm.

Table 5: Weighted Average US *Ad Valorem* Tariff and Freight Costs

	Tariff Rate (d_{it}) (Percent)						Freight Rate (f_{it}) (Percent)					
Two-Digit SIC Industry	1977	1982	1987	1992	1997	2001	1977	1982	1987	1992	1997	2001
20 Food	6.8	3.9	4.7	3.6	1.9	2.0	10.0	9.6	8.5	7.7	6.4	5.9
21 Tobacco	12.9	11.6	12.0	11.6	1.3	3.2	5.2	6.2	4.2	2.8	2.1	2.7
22 Textile	15.1	13.8	10.8	10.8	8.0	6.5	8.9	6.9	6.2	5.0	4.2	4.8
23 Apparel	24.7	23.6	18.5	15.3	12.1	11.6	9.9	6.9	7.4	5.4	3.9	4.3
24 Lumber	3.2	2.5	2.0	1.3	0.6	0.5	12.8	6.2	6.1	8.6	5.7	5.6
25 Furniture	5.8	4.9	3.4	3.4	0.7	0.1	9.3	8.5	8.9	9.2	5.3	8.0
26 Paper	0.6	0.6	0.6	0.5	0.4	0.3	3.4	2.1	3.4	5.6	4.9	5.1
27 Printing	1.6	1.1	0.5	0.8	0.5	0.4	6.8	5.4	4.9	5.1	4.3	4.9
28 Chemicals	1.3	1.3	2.4	4.3	1.9	1.3	5.7	4.4	6.6	4.5	3.6	3.1
29 Petroleum	0.7	0.3	1.0	0.9	0.5	0.6	5.5	4.2	7.5	7.8	6.5	6.5
30 Rubber	6.1	7.2	4.8	6.5	4.5	4.0	8.8	5.7	6.4	6.0	4.8	5.7
31 Leather	1.4	9.2	9.3	11.1	10.1	10.8	10.8	6.8	6.0	5.1	4.2	5.3
32 Stone	10.2	9.0	5.8	7.4	4.2	3.6	11.3	7.1	7.5	8.8	8.5	10.8
33 Primary Metal	4.3	3.5	2.7	2.8	1.6	1.1	6.6	5.3	5.0	5.3	4.3	4.5
34 Fabricated Metal	4.2	6.3	4.2	4.3	2.5	1.9	6.3	5.5	4.9	4.4	3.6	4.4
35 Industrial Machinery	0.1	4.2	2.6	2.2	0.9	0.5	4.0	3.4	3.4	2.4	2.0	2.3
36 Electronic	0.2	5.1	3.5	3.2	1.4	0.9	3.9	2.8	3.0	2.1	1.6	2.0
37 Transportation	0.1	1.5	2.2	2.4	1.2	1.2	4.3	3.0	3.6	2.8	1.5	1.7
38 Instruments	5.9	6.0	4.3	4.8	2.3	1.4	3.0	2.5	2.5	2.3	1.9	1.8
39 Miscellaneous	9.9	6.0	4.7	4.4	1.5	1.3	5.3	3.8	4.4	4.0	3.2	4.3
Average	3.1	4.0	3.9	4.5	2.4	2.1	6.0	4.4	4.8	4.0	3.0	3.3

Notes: The table summarizes *ad valorem* tariff, freight and total trade costs across two-digit SIC industries. Costs for each two-digit industry are weighted averages of the underlying four-digit industries employed in our empirical analysis, using US import values as weights. The final row is the weighted average of all manufacturing industries included in our analysis.

III. Differences Between Appalachian and Rest-of-US Manufacturing Plants

In this section we compare Appalachian manufacturing plants to manufacturing plants in the rest of the United States along four key dimensions:

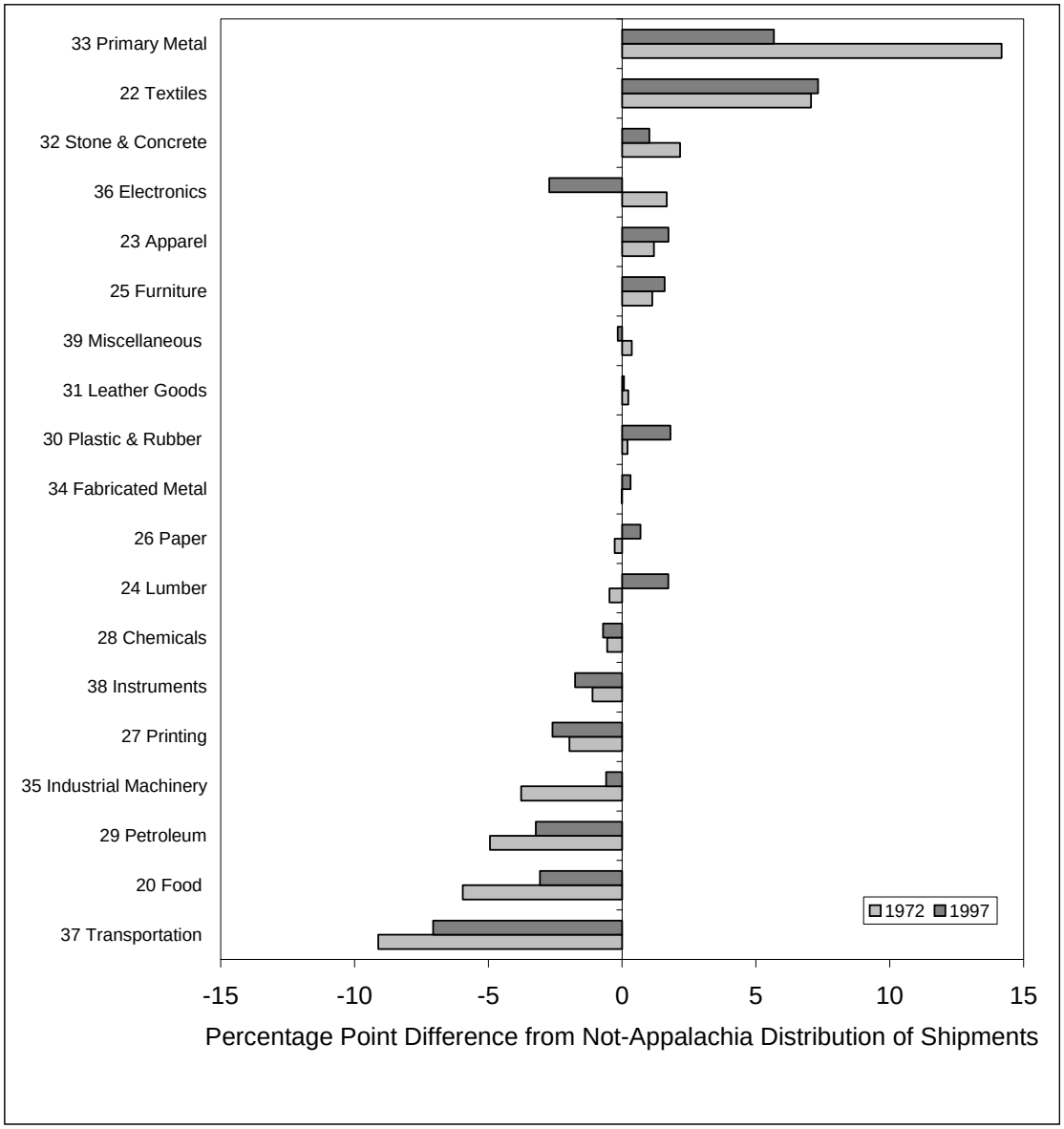
- The distribution of employment across industries
- The distribution of output across industries
- Plant entry and exit rates
- Exposure to international competition

We find Appalachian plants to be more heavily concentrated in labor-intensive industries, and to be more labor-intensive within industries, than manufacturing plants in the rest of the United States. We also find less plant entry and exit across industries in Appalachia. A result of these trends is that Appalachia is relatively more exposed to competition from low-wage countries.

III.A. Distribution of Employment and Output

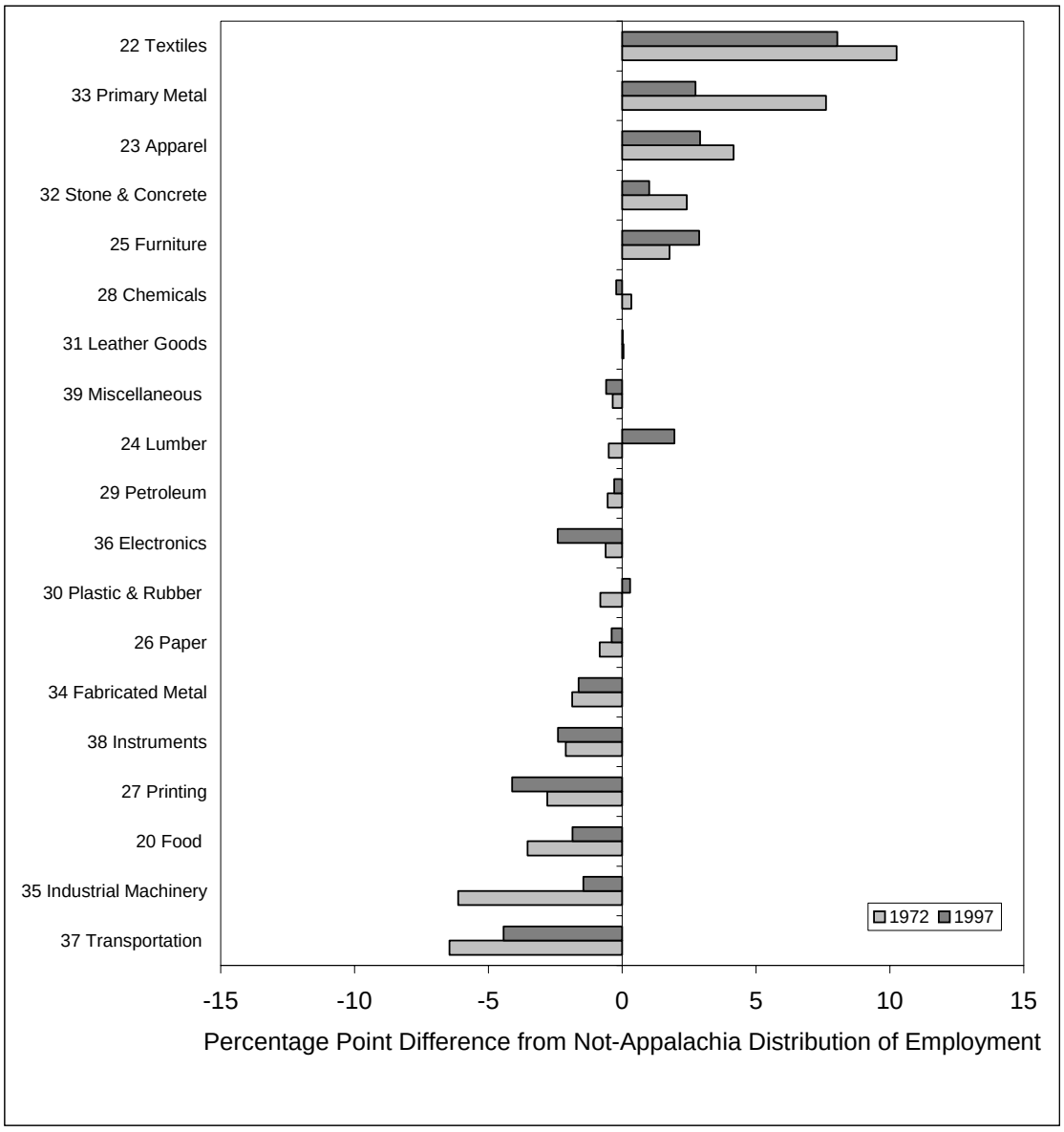
Though the distribution of Appalachian employment and output has become more similar to the rest of the United States over time, it is still biased toward labor-intensive industries and labor-intensive, lower-wage and less productive plants within those industries. Figure 3 and Figure 4 compare the aggregate output and employment of Appalachian manufacturing plants with those of the Rest of the US (ROUS). (These figures are based on the data displayed in Table 6 and Table 7.) Each bar in the figure displays the difference between the share of that industry in Appalachia versus its share in ROUS. The first bars of Figure 3, for example, indicate that Appalachia is more heavily weighted toward Primary Metal production than ROUS, but that this difference has decreased with time. The fact that most bars are shorter in 1997 than in 1992 indicates that Appalachia has converged toward the rest of the country over time.

Figure 3: Relative Distribution of Appalachian Manufacturing Shipments versus Rest of US



Notes: The figure displays the difference between the share of the noted manufacturing industry's shipments in Appalachian versus the rest of U.S. manufacturing. Positive numbers indicate relative greater production in Appalachia. Industries are sorted by 1997 values. Source: Authors' calculations using LRD.

Figure 4: Relative Distribution of Appalachian Manufacturing Employment versus Rest of US



Notes: The figure displays the difference between the share of the noted manufacturing industry's employment in Appalachian versus the rest of U.S. manufacturing. Positive numbers indicate relative greater employment in Appalachia. Industries are sorted by 1997 values. Source: Authors' calculations using LRD.

Table 6: Distribution of Manufacturing Shipments

	Shipments ($ million)				Share of All Manufacturing (Percent)					
	1972		1997		1972			1997		
Industry	ROUS	App	ROUS	App	ROUS	App	Diff	ROUS	App	Diff
20 Food	266	15	427	30	14	8	-6	12	9	-3
22 Textiles	38	17	50	29	2	9	7	1	9	7
23 Apparel	37	6	65	12	2	3	1	2	4	2
24 Lumber	63	5	88	14	3	3	0	3	4	2
25 Furniture	23	4	50	10	1	2	1	1	3	2
26 Paper	77	7	141	16	4	4	0	4	5	1
27 Printing	84	5	188	9	4	3	-2	5	3	-3
28 Chemicals	155	14	359	32	8	8	-1	10	10	-1
29 Petroleum	125	3	166	5	7	2	-5	5	2	-3
30 Plastic & Rubber	45	5	136	19	2	3	0	4	6	2
31 Leather Goods	12	2	9	1	1	1	0	0	0	0
32 Stone & Concrete	51	9	71	10	3	5	2	2	3	1
33 Primary Metal	141	41	151	33	8	22	14	4	10	6
34 Fabricated Metal	127	13	204	20	7	7	0	6	6	0
35 Industrial Machinery	233	16	361	32	12	9	-4	10	10	-1
36 Electronics	81	11	317	21	4	6	2	9	6	-3
37 Transportation	225	5	489	23	12	3	-9	14	7	-7
38 Instruments	42	2	145	8	2	1	-1	4	2	-2
39 Miscellaneous	46	5	44	4	2	3	0	1	1	0

Note: The table displays the distribution of each region's manufacturing shipments, as well as the difference in this distribution across regions, for 1972 and 1997. ROUS refers to rest of the United States while App refers to Appalachia.

Table 7: Distribution of Manufacturing Employment

	Employment (000)				Share of All Manufacturing (Percent)					
	1972		1997		1972			1997		
Industry	ROUS	App	ROUS	App	ROUS	App	Diff	ROUS	App	Diff
20 Food	1,258	99	1,333	125	67	53	-14	39	38	0
22 Textiles	594	255	350	181	32	136	105	10	55	45
23 Apparel	782	172	609	122	42	92	51	18	37	20
24 Lumber	493	54	561	100	26	29	3	16	30	14
25 Furniture	307	70	393	96	16	38	21	11	29	18
26 Paper	488	48	549	58	26	26	-1	16	18	2
27 Printing	739	46	1,307	83	39	25	-15	38	25	-13
28 Chemicals	603	83	712	80	32	44	12	21	24	4
29 Petroleum	121	6	95	6	6	3	-3	3	2	-1
30 Plastic & Rubber	487	48	879	109	26	26	0	25	33	8
31 Leather Goods	175	23	67	8	9	12	3	2	2	1
32 Stone & Concrete	446	99	400	65	24	53	29	12	20	8
33 Primary Metal	841	240	559	113	45	129	84	16	35	18
34 Fabricated Metal	1,154	115	1,341	130	62	62	0	39	40	1
35 Industrial Machinery	1,931	141	1,678	173	103	75	-28	49	53	4
36 Electronics	1,119	133	1,390	122	60	71	11	40	37	-3
37 Transportation	1,225	45	1,427	91	65	24	-42	41	28	-13
38 Instruments	484	25	743	46	26	13	-12	21	14	-8
39 Miscellaneous	351	39	327	28	19	21	2	9	9	-1

Note: The table displays the distribution of each region's manufacturing employment, as well as the difference in this distribution across regions, for 1972 and 1997. ROUS refers to rest of the United States while App refers to Appalachia.

Figures 3 and 4 (and Tables 6 and 7) show that both employment and output in Appalachian manufacturing are concentrated in relatively low wage, labor intensive industries like apparel, textiles, and furniture. This remains true in 1997. Table 8 compares Appalachian to ROUS manufacturing plants across the entire 1972 to 1997 sample period terms of capital and skill intensity as well as wages. Two comparisons are provided for each plant characteristic. The first is an arithmetic average across all plants in the two groups. The second is a weighted average, where plant outputs are used as weights. The shipments-weighted measures indicate that Appalachian plants are less capital and skill intensive and pay lower wages for both skilled (non-production) and unskilled (production) workers. These differences are driven in part by the industry biases displayed in Figure 3 and Figure 4.

Table 8: Average Plant Characteristics, by Region

	Mean		Shipment-Weighted Mean	
Plant Characteristics	Rest of U.S.	Appalachia	Rest of U.S.	Appalachia
Capital Intensity ($000/Worker)	44.69	46.91	161.15	120.40
Skill Intensity (% Employment)	0.29	0.26	0.31	0.25
Annual Salary ($000/year)	30.12	26.26	41.12	34.92
Unskilled Salary ($000/year)	26.34	23.31	36.84	31.83
Skilled Salary ($000/year)	43.81	39.51	53.64	47.63

Notes: The table displays mean manufacturing plant characteristics for plants in Appalachia versus plants in the rest of the United States from 1972 to 1997. Dollar amounts are expressed in constant 2000 dollars. Non-production workers and production worke

They are also due in part to differences across plants *within* industries. Table 9 reports the results comparing plants in Appalachia to plants in the ROUS while controlling for the industry composition differences in the two regions. The results are from a regression by year of a series of plant characteristics on industry specific effects (α_{it} which controls for mean differences across industries) and a dummy indicating whether the plant is located within Appalachia:

$$\text{Characteristic}_{pit} = \alpha_{it} + \beta_t \text{ APPALACHIA} + \varepsilon_{pit}.$$

These regressions show the evolution of Appalachian plant characteristics compared to the ROUS over time. The plant characteristics we examine are capital intensity, skill intensity, total wage, skilled (non-production) worker wage, unskilled (production) worker wage and an estimate of plants' total factor productivity.[8]

Overall, the results in Table 9 indicate that, within-industries, Appalachian plants are more labor intensive and pay lower wages than non-Appalachian plants. Trends in the coefficients over time, however, indicate that the capital intensity disparity between Appalachian and ROUS plants disappeared by 1997, while the efficiency gap increased. They do not reveal any changes in the overall or by-worker-type wage gaps.

[8] Section IV describes how the plant TFP measures are estimated.

Table 9: Appalachian versus Rest of US Manufacturing Plants

Plant Characteristic	Year	β_{APP}	Std Error	R^2	Observations
Capital Intensity	1972	-0.083 ***	0.007	0.58	138,404
	1977	-0.032 ***	0.007	0.56	146,015
	1982	-0.035 ***	0.007	0.56	162,732
	1987	-0.021 ***	0.007	0.44	171,414
	1992	-0.010	0.008	0.40	170,602
	1997	0.001	0.008	0.30	195,059
Skill Intensity	1972	-0.095 ***	0.006	0.36	138,404
	1977	-0.062 ***	0.005	0.41	146,015
	1982	-0.076 ***	0.005	0.33	162,732
	1987	-0.089 ***	0.005	0.32	171,414
	1992	-0.091 ***	0.005	0.31	170,602
	1997	-0.067 ***	0.005	0.27	199,363
Wage	1972	-0.105 ***	0.003	0.25	138,404
	1977	-0.083 ***	0.003	0.29	146,015
	1982	-0.085 ***	0.003	0.24	162,732
	1987	-0.106 ***	0.003	0.25	171,414
	1992	-0.100 ***	0.003	0.28	170,602
	1997	-0.103 ***	0.003	0.25	199,356
Non-Production Wage	1972	-0.098 ***	0.005	0.06	138,404
	1977	-0.084 ***	0.005	0.09	146,015
	1982	-0.073 ***	0.005	0.07	162,732
	1987	-0.092 ***	0.005	0.10	171,414
	1992	-0.072 ***	0.004	0.14	170,602
	1997	-0.092 ***	0.005	0.11	198,681
Production Wage	1972	-0.095 ***	0.003	0.25	138,404
	1977	-0.077 ***	0.003	0.27	146,015
	1982	-0.079 ***	0.004	0.22	162,732
	1987	-0.096 ***	0.003	0.26	171,414
	1992	-0.096 ***	0.003	0.25	170,602
	1997	-0.091 ***	0.003	0.23	198,054
Productivity	1972	-0.019 ***	0.003	0.00	137,810
	1977	-0.022 ***	0.003	0.00	144,952
	1982	-0.024 ***	0.002	0.00	162,361
	1987	-0.036 ***	0.003	0.00	171,283
	1992	-0.033 ***	0.003	0.00	170,416

Notes: The table reports OLS results of regressing the log of the noted plant characteristic on four-digit SIC industry dummies and a dummy variable for the Appalachian region, by year. Coefficient and standard error refer to the Appalachia dummy. The R-squared and number of plant observations for each regression are also reported. *** indicates statistical significance at the 1% level.

These results suggest that even though plants in Appalachia have closed the gap with the rest of the country in terms of capital-intensity, even within relatively detailed 4-digit SIC industries, plants within Appalachia are less skill-intensive and less productive than plants in the rest of the US.

III.B. Industry Entry and Exit

Consistent with research reported in Jensen (1998) and Foster (2004), we find Appalachian manufacturing to be less dynamic than manufacturing in the rest of the United States. Table 10 documents that Appalachian manufacturing industries experience both lower entry and exit rates than the US as a whole. Appalachian entry rates are lower in 10 of the 19 two-digit SIC industries while exit rates are lower in 17. For example, exit rates in Apparel and Furniture are 8 percentage points and 6 percentage points lower, respectively, in Appalachia than in the ROUS.

These differences in entry and exit rates take on a particular importance in the context of international competition. Lower entry and exit rates signal increased barriers to firm formation and industries that are less able to respond to external shocks. As low-wage countries enter US markets, one path for firms to avoid decline and shutdown is to change product mix and enter new markets. Bernard, Redding and Schott (2004) show that product market entry is higher in dynamic industries, i.e. industries with greater entry and exit rates. Lower firm entry and exit rates in the Appalachian region may inhibit firms' abilities to get out of the way of international competition.

Table 10: Appalachian versus Rest of US Plant Entry and Exit Rates

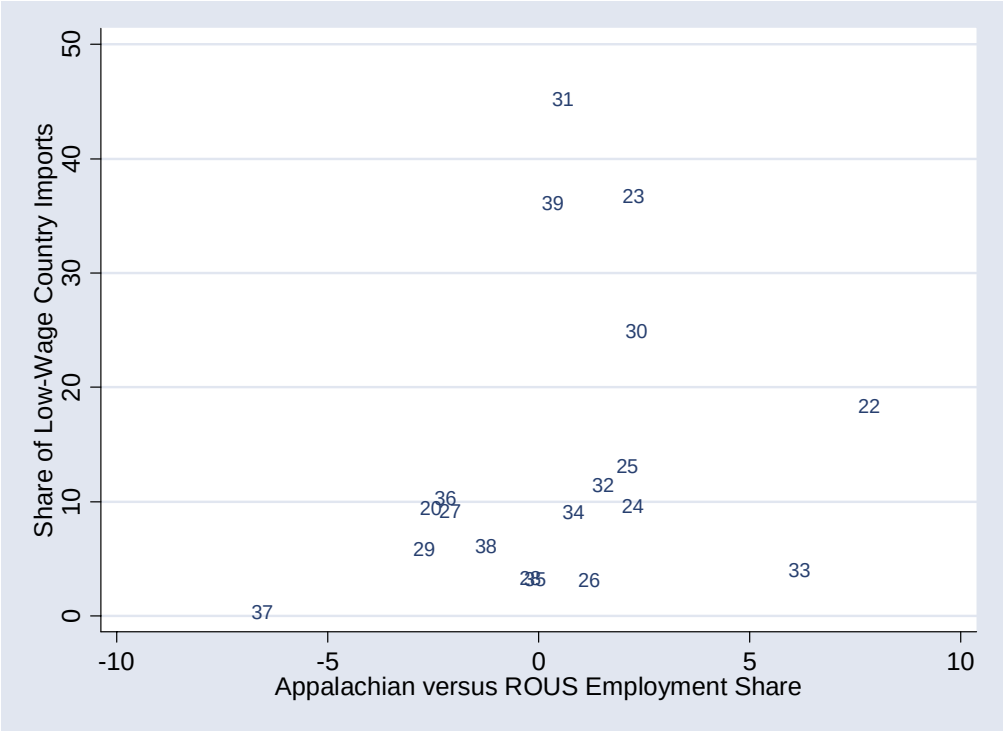
	Entry Rate			Exit Rate		
Industry	Rest of US	Appalachia	Diff	Rest of US	Appalachia	Diff
20 Food	28	26	-2	32	31	-1
22 Textiles	32	29	-3	33	28	-5
23 Apparel	37	34	-3	45	37	-8
24 Lumber	39	41	2	38	35	-3
25 Furniture	41	41	0	38	32	-6
26 Paper	22	26	4	21	20	-1
27 Printing	39	41	1	34	30	-4
28 Chemicals	30	28	-2	28	24	-4
29 Petroleum	30	32	2	30	31	1
30 Plastic & Rubber	32	31	-1	25	19	-6
31 Leather Goods	29	27	-2	42	43	1
32 Stone & Concrete	34	25	-9	31	27	-5
33 Primary Metal	27	26	-2	27	22	-4
34 Fabricated Metal	31	32	1	29	25	-4
35 Industrial Machinery	33	35	3	29	24	-4
36 Electronics	36	34	-2	30	25	-5
37 Transportation	37	38	1	37	31	-5
38 Instruments	41	42	1	31	29	-1
39 Miscellaneous	38	44	6	38	35	-3

Note: The table reports mean plant entry and exit rates, in percent, across four-digit SIC industries and Census years between 1972 and 1997. For each Census year t, the entry rate is the share of new plants between years t and t+5 divided by the average number of plants in those two years. The exit rate is analogously defined for the share of dying plants.

III.C. Exposure to Low-Wage Competition

Appalachia's bias toward more labor-intensive production increases its exposure to competition from low-wage countries. The mechanics of this relationship are depicted in Figure 5, which plots VSH for 1997 against Appalachia's employment bias vis a vis the ROUS by two-digit SIC industry. The labels in the figure are the 2-digit SIC code. (A figure based on output bias looks very similar.) The positive correlation of the points in the figure indicates that Appalachia has relatively more workers in industries with relative high shares of imports originating in low-wage countries.

Figure 5: Appalachia's Excess Concentration in Labor-Intensive Industries and Its Heightened Exposure to Competition from Low-Wage Countries, 1997



Notes: The figure displays a scatter of the percent of industry imports from low-wage countries in 1997 on Appalachian "excess" employment in that industry in that year relative to the rest of the United States (see final column of Table 7).

Table 11 reports the average exposure of Appalachian and ROUS manufacturing plants to various forms of international competition. In addition to being more highly exposed to imports from low-wage countries, Appalachia is *more* exposed to imports from the Asian Tigers (Hong Kong, Korea, Singapore and Taiwan) and *less* exposed to imports from OECD countries. To the extent that the OECD export bundle is more sophisticated than that of either low-wage countries or the Asian Tigers, this reinforces earlier evidence that firms in Appalachia produce a less sophisticated product mix.

Table 11: Average Trade Exposure Across Plants, by Region

	Mean		Shipment-Weighted Mean	
Country Group	Rest of U.S.	Appalachia	Rest of U.S.	Appalachia
Low-Wage Countries	5.02	6.02	4.01	6.42
Tiger Countries	6.07	6.35	4.07	4.67
OECD Countries	71.87	69.63	72.91	70.93
Ad Valorem Tariff Rate	4.08	4.79	3.20	4.95
Ad Valorem Freight Rate	5.62	5.97	5.15	5.54

Notes: The first three rows of the table display mean share of imports from noted countries across plants based on their four-digit SIC industry classification. Low-wage countries are defined as countries with less than 5% of U.S. per capita GDP. Tiger countries are Hong Kong, Korea, Singapore and Taiwan. OECD countries are the 22 members as of 1972 (i.e. excluding recent entrants such as Korea and Mexico). The final two rows in each section report average ad valorem tariff and transport costs. The left panel reports arithmatic means while the right panel reports shipment-weighted means.

The final two rows of Table 11 report the average import tariffs and transport costs weighted by industrial output for Appalachia and ROUS. The industrial mix in the Appalachian region is composed of relatively high-tariff, high transport cost sectors. On an output-weighted basis, tariffs on goods in Appalachia are 1.8 percentage points, or 54 percent, higher than for the rest of the US. These higher levels of protection and transport costs have somewhat insulated industries in the Appalachian region from the pressure of import competition.

However, these pooled numbers hide a faster decline in tariffs for Appalachian industries over time as can be seen in Table 12. In 1977, output-weighted tariff levels were 6.3 percent in Appalachia and 3.6 percent in the ROUS. By 1997, tariffs levels had fallen to 2.4 percent and 1.7 percent in the two regions respectively. Similarly the gap in transport costs narrows over time between the Appalachian region and the ROUS. The more rapid decline in tariffs and transport costs for industries in Appalachia suggests that these traditional barriers to import competition are declining.

Table 12: Import Shares, Tariffs and Transport Costs, 1977-1997

	Rest of United States					Appalachia				
Mean	1977	1982	1987	1992	1997	1977	1982	1987	1992	1997
Low-Wage Countries	2.5	2.9	3.8	5.4	9.2	3.0	4.1	5.2	6.8	9.6
Ad Valorem Tariff Rate	4.9	5.8	4.2	4.0	2.0	6.0	7.0	5.0	4.6	2.2
Ad Valorem Freight Rate	8.2	5.4	5.5	5.3	4.2	8.8	5.8	5.9	5.7	4.5
Shipment-Weighted Mean	1977	1982	1987	1992	1997	1977	1982	1987	1992	1997
Low-Wage Countries	2.5	2.6	3.3	4.2	6.1	5.0	4.1	6.1	6.9	8.8
Ad Valorem Tariff Rate	3.6	4.3	3.5	3.6	1.7	6.3	7.0	5.3	5.0	2.5
Ad Valorem Freight Rate	6.8	5.2	5.4	5.2	3.8	7.4	5.6	5.7	5.5	4.1

Notes: The first row in each section displays the mean share of imports from low-wage countries across plants based on their four-digit SIC industry classification. Low-wage countries are defined as countries with less than 5% of U.S. per capita GDP. The final two rows in each section report average ad valorem tariff and transport costs. Top panel reports arithmatic means while the bottom panel reports shipment-weighted means.

Table 13 highlights differences in low-wage country import shares across regions within Appalachia over time. These numbers highlight the intra-regional differences in exposure to low-wage imports. While Appalachia as a whole has higher exposure to low-wage imports, this is driven entirely by the South region. In 1977, the South region had low wage import shares more than three times higher than the national average or than the Appalachian region as a whole. The North region has consistently had an industry mix that is less exposed to low-wage competition than the ROUS (though the gap is closing) while the low-wage exposure of the Central region has closely tracked that of the ROUS.

Table 13: Average Low-Wage Country Exposure by Region and Year

	Average Share Of Imports From Low-Wage Countries				
Geographic Area	1977	1982	1987	1992	1997
Rest of United States	2.5	2.9	3.8	5.4	9.2
Appalachia (Aggregate)	3.0	4.1	5.2	6.8	9.6
North	1.4	1.9	2.8	4.0	6.6
Central	2.4	3.2	4.9	7.8	8.2
South	9.2	6.1	8.6	8.8	10.3

Notes: The table displays weighted average exposure to low-wage country competition, measured via VSH, across plants in each geographical area using outputs as weights. North, central and south refer to sub-regions of Appalachia.

The results from this section demonstrate that traditional barriers to import competition (tariffs and transportation costs) have declined faster for industries concentrated in Appalachia. In addition, low-wage import competition has increased significantly for labor-intensive industries. The composition of the manufacturing sector in Appalachia is concentrated in industries that have experienced the largest increases in low-wage import competition. In addition, plants in Appalachia tend to be less skill-intensive and less productive than plants in the same industry elsewhere in the US. Results documented above suggest that low-wage import competition has a negative impact on employment growth. These results strongly suggest that increased low-wage imports will have a disproportionate effect on the manufacturing sector in the Appalachian region. In the next section, the historical impact of low-wage import competition on manufacturing plant outcomes in Appalachia is investigated.

IV. The Impact of International Competition on Appalachian Manufacturing Plants

This section describes our methodology for estimating how international competition, particularly competition from low-wage countries, affects Appalachian manufacturing plants. We also compare these estimates to the impact of international competition on non-Appalachian manufacturing plants.

IV.A. Data

Manufacturing plant data come from the Longitudinal Research Database (LRD), a linked version of the Censuses of Manufactures (CM) collected by the US Bureau of the Census. The sampling unit for the Census is a manufacturing establishment, or plant, and the sampling frame in each Census year includes detailed information on inputs, output, and products on all establishments. Regression analysis covers plant outcomes for four panels: 1977 to 1982, 1982 to 1987, 1987 to 1992, and 1992 to 1997.

From the Census, we construct plant characteristics including the total value of shipments, total employment, total capital stock (K, the book value of machinery, equipment, and buildings) and the quantity of and the wages paid to non-production (N) and production (P) workers in each Census year. Plant output is recorded at the four-digit SIC level of aggregation, which is our definition of industry. Plant failure (alternately plant death or plant shutdown) is defined as the cessation of operations of the plant and represents a 'true' death, i.e. plants that merely change owners between Census years remain in the sample.

In constructing our sample, we make several modifications to the basic data. First, while the LRD does contain limited information on very small plants (so-called Administrative records), we do not include these records in this study due to the lack of information on inputs other than total employment. Second, we drop any industry whose products are categorized as 'not elsewhere classified' because these 'industries' are typically catch all categories for relatively heterogeneous products. In practice, this corresponds to any industry whose four-digit code ends in '9'. This reduces the number of industries in the sample to 337. Finally, we drop any manufacturing establishment that

does not report one of the required input or output measures. We are left with roughly 443,000 observations encompassing roughly 245,000 plants in the four panels.

As suggested in our analysis above, two input intensities can be observed in the LRD. Plant capital intensity is measured as the log of the ratio of plant capital stock to plant production workers. Skill intensity is harder to measure as there is relatively little information in the LRD on the characteristics of the workforce. We measure plant skill intensity as the non-production worker wage bill to production worker wage bill.

Beyond the detailed input and output data available on the LRD that enable us to characterize the input intensities and productivity of individual plants, the LRD also contains detailed, county level location information for each plant. The county level information allows us to reliably identify all plants in the Appalachian Regional Commission region.

It is possible for firms to survive exposure to low-wage countries via productivity improvements. As a result, we control for plant total factor productivity (TFP) in our empirical analysis. As is well known, accurately measuring a plant's multi-factor productivity is quite difficult, and we are constrained here in our choice of productivity measures because we have only single observations for many of the establishments in our sample. We measure TFP as the residual of a five-input production function for each industry and year, where the inputs are two types of capital, two types of labor and purchased inputs. By construction the measure is mean zero for each industry in each period. We recognize this procedure's inability to control for the co-movement of markups and productivity, or the co-movements of variable inputs and productivity. We note that our reported results are robust to using plant TFP estimates generated from Bartelsman et al. (2000) industry cost shares. We also note that the relationship we find between plant outcomes and exposure to low-wage countries is robust to omitting TFP from all specifications.

IV.B Model

We relate plant outcomes between years t and t + 5 are related to a set of plant characteristics, the average import share of low-wage countries in the preceding five

years, and interactions of plant input intensities and productivity with the measures of trade costs and low-wage competition,

$$\text{Outcome}_{t:t+5,p} = f(Z_{pt}, G_{it}, X_{ipt}).$$

where outcomes are plant shutdowns and employment growth. Z_{pt} is a vector of plant characteristics at time t, G_{it} is a vector of industry-level measures of globalization, and X_{ipt} is a vector of interactions between plant characteristics and industry globalization measures. We relate the levels of plant and industry characteristics in year t to changes in plant outcomes across Census years t to t+5 to mitigate the endogeneity of contemporaneous behavior and plant characteristics.

We consider two types of plant outcomes. The first is plant death, which we estimate via probit. The additional plant outcome we consider is the change in plant employment, which we estimate by OLS. We measure plant employment growth using log differences which limits our sample to surviving plants. Because we cannot observe the characteristics of plants prior to their birth, we are unable to include birth observations in our empirical specifications above.

Our set of plant characteristics encompasses log total employment, age, log TFP, log capital intensity, and the non-production worker to production worker wage bill ratio. We use the wage bill ratio in our regressions rather than the percent of skilled workers in employment reported above to account for unobserved skill variation across plants and regions (Bernard, Redding and Schott 2005). Our inclusion of controls for plant size (total employment) and plant age is motivated by the empirical work of Dunne et al. (1988, 1989) and subsequent theoretical models by Hopenhayn (1992a,b), Olley and Pakes (1996) and others. The specification also includes time fixed effects, industry or plant fixed effects are also added to some specifications. Plant output is deflated with industry shipment deflators available in the NBER Productivity Database compiled by Bartelsman et al. (2000).

IV.C Results

Estimation results presented in Table 14 demonstrate that manufacturing plants in the Appalachian region are more responsive to low-wage imports than plants elsewhere in the country. The coefficient on VSH in the plant shutdowns specification (without including the interaction of VSH with plant characteristics) is about double the coefficient on VSH for the rest of the country, 0.279 compared to 0.138. The implication of these results is that a 10-percentage point increase in VSH is associated with an increase in the probability of plant shutdown by about 1.96 percentage points in Appalachia (the average probability of a plant closing is about 25 percent). The increase in probability of plant closure associated with a 10-percentage point increase in VSH in the ROUS is only 1.09 percentage points. These results suggest that plants in Appalachia have significantly larger shutdown responses to changes in low-wage import shares than plants elsewhere in the country.

When the interaction term is included, the difference is smaller. In examining the interaction between plant characteristics and VSH, capital intensity mitigates the impact of low-wage import competition. Plants that have higher capital intensity relative to other plants in their industry are more likely to survive in both the ROUS and Appalachia. In Appalachia, plants that pay a higher share of wages to non-production (skilled) workers are also statistically significantly less likely to shutdown.

The employment growth specifications also demonstrate low-wage import shares have a greater impact on plants in Appalachia than elsewhere in the country. The coefficient on VSH for the Appalachian sample, in both specifications, is more than double the rest of US coefficient, -0.053 compared to –0.019 in the specification without the plant characteristic interactions. This suggests a significantly greater employment response to low-wage import competition in Appalachia than in the rest of the US. A 10-percentage point increase in VSH in Appalachia is associated with a decrease in annualized employment growth by 1.39 percentage points; in the ROUS the marginal impact is 0.19 percentage points. These results indicate that the employment response is significantly larger at plants in Appalachia than elsewhere in the country.

When VSH is interacted with plant characteristics, in Appalachia plants with higher capital intensity and higher skill have relatively higher employment growth, unlike in the rest of the US. This suggests that in Appalachia, these plant characteristics mitigate the employment growth impact of higher low-wage import shares.

Table 14: Effects of Low-Wage Country Import Exposure

Independent Variables	Plant Death$_{t,t+5}$	Plant Death$_{t,t+5}$	Plant Death$_{t,t+5}$	Plant Death$_{t,t+5}$	ΔEmp$_{t,t+5}$	ΔEmp$_{t,t+5}$	ΔEmp$_{t,t+5}$	ΔEmp$_{t,t+5}$
log(Employment$_{pt}$)	-0.053 ***	-0.064 ***	-0.054 ***	-0.064 ***	-0.016 ***	-0.018 ***	-0.016 ***	-0.018 ***
	(0.001)	(0.002)	(0.001)	(0.002)	(0.000)	(0.001)	(0.000)	(0.001)
Age$_{pt}$	-0.004 ***	-0.003 ***	-0.004 ***	-0.003 ***	-0.001 ***	-0.001 ***	-0.001 ***	-0.001 ***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
log(TFP$_{pt}$)	-0.071 ***	-0.070 ***	-0.069 ***	-0.078 ***	0.037 ***	0.032 ***	0.038 ***	0.033 ***
	(0.002)	(0.008)	(0.003)	(0.009)	(0.001)	(0.003)	(0.001)	(0.003)
log(K/P$_{pt}$)	-0.009 ***	-0.013 ***	-0.006 ***	-0.012 ***	0.020 ***	0.022 ***	0.020 ***	0.021 ***
	(0.001)	(0.003)	(0.001)	(0.003)	(0.000)	(0.001)	(0.000)	(0.001)
log(N/P Wagebill Ratio$_{pt}$)	0.000	0.000	0.000	0.002 ***	0.000	0.000	0.000	-0.001 ***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Low Wage Value Share (VSH$_{it}$)	0.138 ***	0.279 ***	0.356 ***	0.400 **	-0.019 **	-0.053 **	-0.035 ***	-0.114 ***
	(0.022)	(0.057)	(0.034)	(0.081)	(0.009)	(0.021)	(0.016)	(0.035)
x log(TFP$_{pt}$)			-0.039	0.097			-0.027 **	-0.012
			(0.028)	(0.064)			(0.014)	(0.027)
x log(K/P$_{pt}$)			-0.079 ***	-0.044 **			0.007	0.020 ***
			(0.009)	(0.022)			(0.004)	(0.009)
x N/P Wagebill Ratio$_{pt}$			0.002	-0.006 **			-0.005	0.004 ***
			(0.004)	(0.002)			(0.004)	(0.001)
Sample	Rest of U.S.	Appalachia	Rest of U.S.	Appalachia	Rest of U.S.	Appalachia	Rest of U.S.	Appalachia
Industry Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	391,632	36,257	391,632	36,257	294,357	28,316	294,357	28,316
Log Likelihood or R^2	-202,133	-17,405	-202,092	-17,399	0.06	0.09	0.06	0.09

Notes: The table reports probit results on the full set of plants (first four columns) and OLS regressions for survivors only (second four columns). VSH is the share of U.S. import value originating in countries with less than 5% of U.S. per capita GDP. Final four control variables are interactions with VSH. Regressions cover four panels: 1977-82, 1982-87, 1987-92 and 1992-97. Coefficients for the regression constant and dummy variables are suppressed. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

In Table 15, we expand our base specification to include industry-level measures of tariff and transport costs. In the probits on plant death, the low-wage import shares and their interactions are unchanged in sign, significance, and magnitude. Even controlling for tariff and transports costs, low wage imports increase the probability of plant death while more capital and skill-intensive plants in the Appalachian region are less likely to close when facing low-wage imports.

Tariffs and transport costs are themselves both economically and statistically significant. Higher tariffs and higher transport costs reduce the probability of plant

shutdown and have much larger effects for plants in the Appalachian region than for those in the ROUS.

The results for surviving plant employment growth are again robust to the inclusion of the additional trade measures. Employment growth is lower in the face of low-wage competition and the effect is larger in the Appalachian region. Again within industries, high-skill and capital-intensive plants are able to offset some of the effects of low-wage imports. Tariffs and transport costs themselves are positively associated with employment growth and their effects are strongest in Appalachia.

Table 15: Effects of Tariffs, Transport Costs, and Low Wage Import Exposure

Independent Variables	Plant Death$_{t:t+5}$	Plant Death$_{t:t+5}$	ΔEmp$_{t:t+5}$	ΔEmp$_{t:t+5}$
log(Employment$_{pt}$)	-0.051 ***	-0.059 ***	-0.015 ***	-0.017 ***
	(0.001)	(0.003)	(0.000)	(0.001)
Age$_{pt}$	-0.004 ***	-0.003 ***	-0.001 ***	-0.001 ***
	(0.000)	(0.000)	(0.000)	(0.000)
log(TFP$_{pt}$)	-0.072 ***	-0.075 ***	0.039 ***	0.034 ***
	(0.003)	(0.010)	(0.001)	(0.003)
log(K/P$_{pt}$)	-0.006 ***	-0.014 ***	0.020 ***	0.021 ***
	(0.001)	(0.003)	(0.000)	(0.001)
log(N/P Wagebill Ratio$_{pt}$)	0.000	0.002 **	0.000	-0.001 ***
	(0.000)	(0.001)	(0.000)	(0.000)
Low Wage Value Share (VSH$_{it}$)	0.375 ***	0.365 **	-0.060 ***	-0.109 ***
	(0.041)	(0.098)	(0.019)	(0.039)
x log(TFP$_{pt}$)	-0.016	0.103	-0.025 *	-0.022
	(0.030)	(0.068)	(0.015)	(0.027)
x log(K/P$_{pt}$)	-0.100 ***	-0.062 **	0.013 ***	0.023 **
	(0.011)	(0.026)	(0.005)	(0.010)
x N/P Wagebill Ratio$_{pt}$	0.004	-0.006 **	-0.004	0.004 ***
	(0.004)	(0.003)	(0.004)	(0.001)
Ad Valorem Tariff Rates	-0.231 ***	-0.776 ***	0.208 ***	0.347 ***
	(0.070)	(0.209)	(0.028)	(0.071)
Transportation Costs	-0.244 ***	-0.356 **	0.251 ***	0.251 ***
	(0.061)	(0.173)	(0.022)	(0.059)
Sample	Rest of U.S.	Appalachia	Rest of U.S.	Appalachia
Industry Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	305,259	27,970	226,850	21,751
Log Likelihood or R^2	-160,978	-13,620	0.06	0.08

Notes: The table reports probit results on the full set of plants (first two columns) and OLS results for survivors only (columns 3 and 4). VSH is the share of U.S. import value originating in countries with less than 5% of U.S. per capita GDP. Final four control variables are interactions with VSH. Regressions cover four panels: 1977-82, 1982-87, 1987-92 and 1992-97. Coefficients for the regression constant and dummy variables are suppressed. ***, ** and * indicate statistical significance at the 1%, 5% and 10% levels, respectively.

The results in this section make two strong points. First the rise of low-wage imports in the overall US import mix has put pressure on plants in terms of their survival and growth. Low-wage imports have contributed to a reallocation across manufacturing industries through its effects on firm performance. Within industries not all plants are equally affected by low-wage imports, those that employ a more skilled workforce or use

capital intensively have been able to avoid some of the competition from low-wage countries.

Second, the effects of low-wage imports have been greater for plants within the Appalachian region both in terms of the level of exposure they face and the response to that exposure. For comparable low-wage import share, Appalachian plants show higher probabilities of closure and lower employment growth for survivors. However, within-industries skill and capital-intensity play a larger role in insulating Appalachian plants from low-wage imports.

The results above suggest that Appalachian manufacturing is more exposed to low-wage import shares and has a greater response to low-wage competition than the rest of the US. We now turn our focus to the expected trends of these international factors in the future and the likely responses by firms and industries in the US manufacturing sector as a whole and in the Appalachian region in particular.

V. The Future Evolution of Low-Wage Imports, Tariff and Transportation Costs

Given the important influences of low-wage country import shares, tariffs and transports on the path of Appalachian manufacturing, it is useful to examine how they will evolve in the coming years. We introduce a method for forecasting industry low-wage import shares. To formulate this forecast, we take advantage of the fact that low-wage country product penetration today is a good predictor of low-wage import market share in the future (Bernard et al 2004b). For transport costs, tariffs and other trade policies we discuss likely developments over the next decade.

V.A. Low-Wage Imports Going Forward

Analysis of product-level trade data indicates that low-wage country market entry patterns have been quite consistent over time. Firms from low-wage countries first enter a US industry by selling relatively small amounts of relatively low value products. They next expand the breadth of their offerings to cover most of the products in an industry. Finally, they boost the quantity, and therefore value, of each product. This path of initial entry and subsequent expansion of volume culminates in a dramatic rise in the share of industry imports sourced from low-wage countries. Figure 6 plots both the share of aggregate manufacturing import value imported from low-wage countries as well as the low-wage countries' breadth of product penetration. We define the low-wage countries' product penetration as the share of products in an industry sourced from low-wage countries (referred to as *number share* or NSH which represents the number of products in an industry imported from low wage countries relative to the total number of products imported in an industry).[9] The product penetration can range from zero to one, with one indicating that all of the products in an industry are imported from low-wage countries. Comparison of the two lines in the figure indicates that import value share lags its product penetration by about a decade: the rise in penetration beginning in 1978 is followed by a noticeable rise in value share starting in 1988.

[9] In the US trade data, products are defined according to ten-digit Harmonized System code, known as HS codes. On average, there are 622 products in each of the 20 manufacturing industries listed in Table 16.

Figure 6: Low-Wage Countries First Establish a Beachhead and Later Gain Market Share

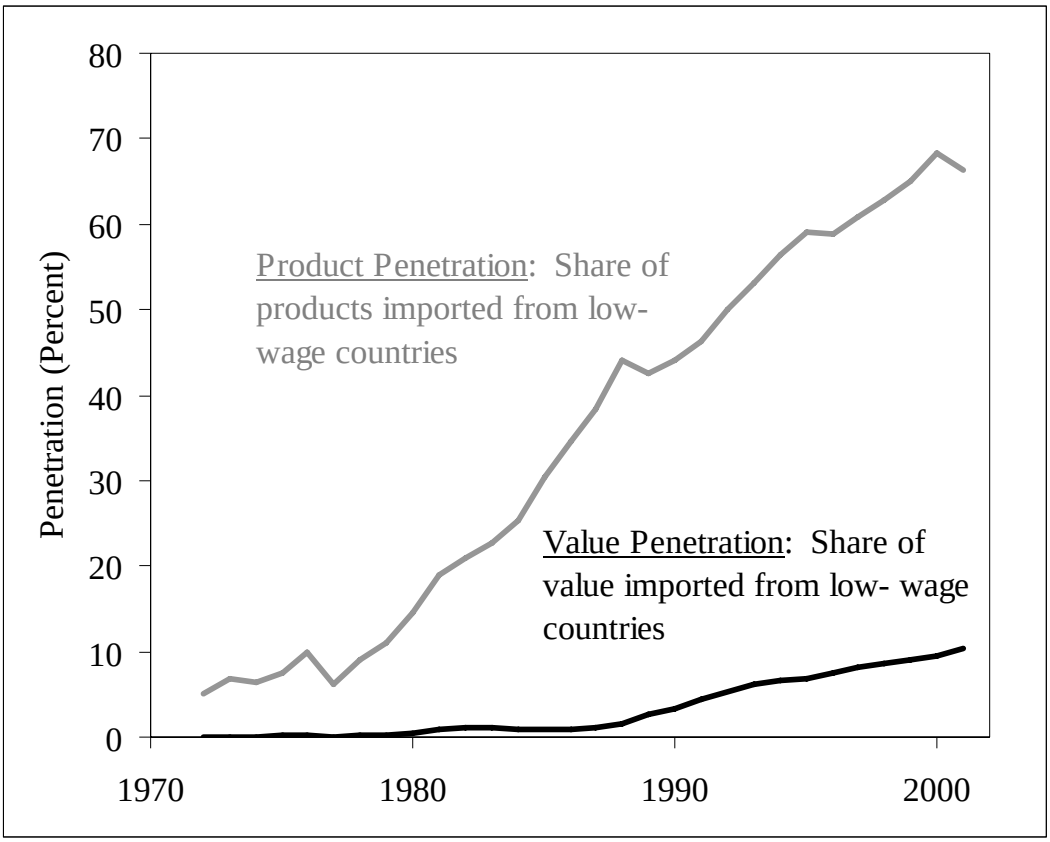


Table 16 reports low-wage country product penetration across industries by decade. Product penetration rises with time and is significantly higher than VSH. Nevertheless, here, too, we find substantial variation across major manufacturing industries, with NSH being high in the same sets of industries as VSH.

Table 16: Share of Industry Products Originating in at Least One Low-Wage Country

Industry	Share of Products Originating in Low-Wage Countries 1972	1981	1991	2001
20 Food	46	49	43	54
21 Tobacco	68	91	78	98
22 Textile	30	48	50	77
23 Apparel	53	75	75	87
24 Lumber	46	48	47	64
25 Furniture	67	78	93	100
26 Paper	8	16	32	69
27 Printing	68	84	87	98
28 Chemicals	13	27	39	70
29 Petroleum	18	37	28	51
30 Rubber and Plastic	26	53	75	94
31 Leather	64	82	94	98
32 Stone	46	62	77	92
33 Primary Metal	12	24	28	63
34 Fabricated Metal	29	54	84	93
35 Industrial Machinery	16	41	63	82
36 Electronic	29	51	85	93
37 Transportation	17	19	28	37
38 Instruments	12	35	60	86
39 Miscellaneous	57	69	89	97
All Manufacturing	25	39	57	73

NOTE: Each cell reports the percent of products in each industry that are imported from at least one low-wage country. Countries are classified low wage if their per capita GDP is less than 5% of U.S. per capita GDP.

We exploit the relationship between NSH and VSH, and the relationship between industry characteristics and VSH, to forecast the level of VSH in 2011. We forecast industries' 2011 exposure to low-wage country competition by combining information on the current (2001) level of competition, the current level of product penetration, and industry capital and skill intensity. We develop forecasts for 382 disaggregate US manufacturing industries.[10] The three elements of our forecast combine to explain 97 percent of the variation in low-wage import shares across industries in 2001. All together,

[10] Results in earlier sections are reported for twenty, two-digit Standard Industry Classification (SIC) industries. In this section we develop estimates for four-digit SIC industries.

each factor has the expected relationship: high competition today is a solid predictor of high competition in ten years; product penetration today is a reliable signal of where low-wage competition will concentrate in the future; and industries that use more capital and skill in production face less competition in ten years.

Our forecast is based upon the following ordinary least squares (OLS) regression,

$$t(VSH_{i,t+10}) = b_0 + b_{1Di,t} + b_2\, NSH_{i,t} + b_3 \log(K/L)_{i,t} + b4\ (N/L)_{i,t} + e_{i,t}$$

where $t(VSH_{i,t+10})$ is a logistic transformation[11] of VSH for industry i in year t+10, $VSH_{i,t}$ is the level of VSH in industry i in year t, $NSH_{i,t}$ is low-wage product penetration in industry i in year t, and $\log(K/L)_{i,t}$ and $(N/L)_{i,t}$ are the log industry capital per labor ratio and share of skilled workers to total employment in industry I in year t. Regression results are reported in Table 17. The first column of the table reports results pooling across ten-year intervals. The pooled results include a time trend. Subsequent columns report the results for each panel separately. Our forecast is based upon the estimates of the final column.

The coefficient estimates have the expected sign in each column. Future VSH is positively related to current levels of VSH and product penetration, and negatively related to industry capital and skill intensity. Interestingly, the importance of capital and skill intensity declines with time, both in magnitude, and, in the case of the final 1991 to 2001 panel, statistical significance. This decline may be a signal that the forces of comparative advantage have largely played themselves out by now.

[11] The logistic transformation is $\log (D_{i,t+10}/(1- D_{i,t+10}))$.

Table 17: Forecasting VSH

	Pooled	1972-1981	1981-1991	1991-2001
Predictors	Low-Wage Country Import Share$_{t+10}$	Low-Wage Country Import Share$_{t+10}$	Low-Wage Country Import Share$_{t+10}$	Low-Wage Country Import Share$_{t+10}$
Initial Import Value Share (VSH_t)	6.73 ***	7.22 ***	6.50 ***	8.08 ***
	0.68	2.03	1.06	0.69
Initial Import Number Share (NSH_t)	2.44 ***	2.84 ***	2.15 ***	2.20 ***
	0.31	0.59	0.41	0.37
Intial Log Capital per Labor Ratio (K/L_t)	-0.41 ***	-0.48 **	-0.63 ***	-0.07
	0.11	0.20	0.13	0.11
Intial Skill Intensity (N/L_t)	-2.32 ***	-3.94 ***	-3.27 ***	-0.17
	0.74	1.25	0.91	0.76
Time Trend	0.77 ***			
	0.10			
Constant	0.77 ***	-3.26 ***	-2.00 ***	-4.17 ***
	0.10	0.82	0.63	0.59
Observations	1115	365	368	382
R-squared	0.45	0.3	0.43	0.51
Correlation of Forecast with Actual		0.78	0.92	0.97

Notes: Cells report OLS regression results on four-digit SIC industries. Dependent variable is a logistic transformation of VSH. Robust standard errors adjusted for industry clustering are reported below coefficients. ***, ** and * signify statistical significance at the 1%, 5% and 10% level.

Using the coefficients estimated above, we produce a forecast of the value share of imports from low-wage countries in 2011. The results are displayed below in Table 18. We predict a 9 percentage point rise in the share of imports from low-wage countries between 2001 and 2011. This forecasted change is higher than that in any ten-year interval over the last 30 years (compare to the bottom row of Table 2). While this aggregate gain is large, it will be distributed unevenly across industries. Indeed, the industries most at risk from future low-wage country import competition employ relatively few workers and are both low-wage and labor-intensive. Table 18 reports our forecast, as well as other characteristics, by industry. In the table, industries are sorted according to their predicted change in low-wage country exposure between 2001 and 2011.

Four sectors – Leather Goods, Apparel, Furniture and Miscellaneous – are forecast to experience increases in low-wage country import shares of more than 20 percentage points by 2011. These industries pay below-average wages and have a small share of US manufacturing employment, yet are relatively important in the Appalachian region.

Table 18: Forecasted Change in US Exposure to Low-Wage Country Imports, 2001 to 2011

	Low-Wage Import Share			Employment	Hourly
Industry	2001	2011	Change	Emp Share	Wage ($)
31 Leather Goods	61	87	26	0.3	10
23 Apparel	41	67	25	3.2	9
25 Furniture	33	57	24	2.9	12
39 Misc (e.g. Toys)	43	65	22	2.1	12
32 Stone & Concrete	22	36	14	3.2	15
34 Fabricated Metal	17	30	13	8.4	14
27 Printing	19	31	13	8.4	15
30 Plastic & Rubber	30	42	12	5.4	13
22 Textiles	22	32	10	2.7	11
36 Electronics	18	28	10	9.2	14
24 Lumber	10	19	8	4.4	12
26 Paper	7	14	7	3.6	16
35 Industrial Machinery	12	19	6	11.4	16
38 Instruments	9	15	6	4.7	15
37 Trans Equip	1	4	3	9.9	19
20 Food	8	11	3	9.6	13
28 Chemicals	4	7	2	5.8	18
33 Primary Metal	6	7	2	3.7	16
29 Petroleum	7	5	-2	0.7	21
All Manufacturing	15	24	9	100.0	14

Notes: Industry identifiers are preceded by their two-digit Standard Industrial Classification (SIC) code. Rows are sorted by forecast change in low-wage country import share between 2001 and 2011 (column 4). The employment share is the fraction of U.S. manufacturing employment in the sector in 2001. The hourly wage is the average nominal hourly wage in the sector in 2001. Employment and wage data are from the U.S. Bureau of Labor statistics available at www.bls.gov.

The combination of concentration in labor-intensive sectors, the relatively large response to low-wage imports in Appalachia, and the forecast for significant growth in

VSH in sectors important in Appalachia suggest that import competition will pose an important challenge to the region.

V.B. Transportation Costs Going Forward

Over the last 30 years, transportation costs have fallen substantially across a broad range of products. However, events in recent years have called into question the perpetuation of such a downward trend in transport costs and might even foreshadow a period of globally higher freight costs. Both the sustained rise in energy prices and, in particular, the huge increase in import demand in China has combined to put upward pressure on transport prices in the short run.[12]

Over longer horizons, reasonable forecasts of freight and insurance costs are relatively flat, however such expectations come complete with large standard deviations. The next decade is likely to see flat transport costs but scenarios with large increases or modest declines are possible.

V.C. Tariffs and the Trade Policy Environment Going Forward

As reported in Table 5, tariffs have decreased significantly over the last 30 years and are currently very low in most sectors. Since tariff changes are typically the by-product of multilateral or bilateral negotiations or under direct political control, we are unable to produce estimates of tariff changes by sector going forward. Instead we consider the prospects of the major ongoing trade negotiations and their likely effect on tariffs and trade openness in general.

[12] See the Beige Book Summary of Commentary on Current Economic Conditions by Federal Reserve District, March 3, 2004 Federal Reserve Board of Governors.

V.C.1 Overall Environment

The current environment – both political and economic – provides limited prospects for additional liberalization in the near-term. On the political side, a wide range of polls suggest that the electorate is evenly split or against further liberalization of trade policies (see Slaughter and Scheve ((2001)). This sentiment is evident in the Congress. The limited political mandate seems to be reflected in narrow and partisan House votes approving Trade Promotion Authority in 2001 and 2002 and increasing partisanship on trade issues in general. The narrow support and voting margins for trade policy increase the ability of special interests to block further liberalization.

On the economic side, the US current account deficit is at historical highs – both in absolute terms and as a share of GDP. High trade deficits typically mitigate against trade liberalization. There is also a broad-based perception that the US dollar is over-valued relative to other currencies. This also tends to increase protectionist pressure (as evidenced by recently proposed legislation and a number of requests from specific industries for special protections from trade with China). The sluggishness in employment growth (and the related debate on outsourcing and jobs) is also likely to dampen enthusiasm for trade liberalization.

In spite of the issues discussed above, the US is currently pursuing a broad array of trade policy initiatives, including the Doha Round in the WTO, the Free Trade Area of the Americas negotiation with other countries in the western hemisphere, and a number of bilateral Free Trade Agreements.

V.C.2 Doha Round in the WTO

The Doha Round of negotiations in the WTO, launched in November 2001 and originally scheduled to be completed in January 2005, is behind schedule. After the failed ministerial meeting in Cancun in 2003, the distance between members' positions particularly between the developing countries and the developed countries on agricultural sector issues was evident. It was not clear (and still is not) that the Doha Round will come to a successful conclusion. To achieve a successful Doha Round, both developing and

developed countries will need to make significant (and difficult) changes in their domestic agricultural programs and agricultural market access. Negotiators worked hard to get the negotiations back on track and in the July 2004 meeting in Geneva, WTO members agreed on new guidelines for the negotiation of global trade reforms in agriculture, manufactured goods, and services. In the meeting, members also agreed to launch new negotiations on trade procedures and customs reform and to delete the other "Singapore issues" on how countries treat foreign direct investment in their countries, how countries manage their competition or anti-trust policy, and the process by which countries governments' procure goods and services.

The ambitious US proposal to eliminate tariffs on industrial goods by 2015 seems unlikely to be accepted, as there is resistance in both the US and in some developing countries. The major developments in the Doha Round are likely to be reducing barriers for agricultural product imports in developing countries and reducing barriers for industrial products and services in developing (particularly middle-income) countries.

The next WTO ministerial in Hong Kong in December 2005 will be key to a successful conclusion of the round. A key milestone in concluding the negotiation is likely to be the expiration of Trade Promotion Authority in June 2007 (assuming it is reauthorized by Congress in 2005). Thus, it is unlikely that the Doha Round will be complete before mid-2007, if at all.

The most likely outcome for tariffs on manufactured products from low-wage countries is a relative absence of change or movement towards reduction. This suggests that there will be little multilateral downward pressure on tariff rates over the medium term.

V.C.3 Free Trade Area of the Americas

Similar to the Doha Round in the WTO, the FTAA negotiations are not proceeding well. The FTAA ministerial meeting in Miami in November 2003 achieved little more than papering over the differences between the negotiators. The prospect of "FTAA-lite," that the Miami meeting suggested, would allow countries to exclude certain sensitive areas from reform. This prospect significantly reduces the prospect of achieving

an ambitious and comprehensive trade reform package. The talks are currently well behind schedule and are likely to proceed in parallel with the Doha Round for the next two years. The FTAA does not present significant promise of additional trade liberalization in the near-term. Even if the FTAA were to come to successful fruition, only Haiti, Honduras, and Nicaragua are low-wage countries by our definition, so it seems unlikely that the FTAA would accelerate the rate of growth in low-wage imports. It is perhaps more likely that preferential access for Central and South America will divert some trade from low-wage Asian countries to higher income Central and South American countries.

V.C.4 Bilateral Free Trade Agreements

In part because of the issues with the Doha Round in the WTO and the difficulties in the FTAA negotiations, the US is pursuing a number of bilateral or regional Free Trade Agreements (FTA).

The US currently has FTAs with Canada, Mexico, Chile, Singapore, Jordan, Israel, Australia, and Morocco. There are three agreements that are subject to ratification, Bahrain, and CAFTA (Costa Rica, Honduras, El Salvador, Guatemala, and Nicaragua and the Dominican Republic). Similar to the FTAA, the current list of FTA agreements and pending agreements include only a small number of low-wage countries (Haiti and Honduras), so it seems unlikely that CAFTA or the other bilaterals would accelerate the rate of growth in low-wage imports.[13] It is perhaps more likely that preferential access for Central and South America will divert some trade from low-wage Asian countries to higher income Central and South American countries.

The US is pursuing negotiations with Colombia, Ecuador, Peru, Panama, Thailand, and the South Africa Customs Union (Botswana, Lesotho, Namibia, South Africa and Swaziland). These countries are not low-wage countries, so these trade agreements, if realized, are unlikely to increase the rate of growth of imports from low-

[13] At this point in time, it is still difficult to predict whether the CAFTA agreement will be ratified by the Congress.

wage countries. They are more likely to divert trade from low-wage countries in the near-term.

V.C.5 Expiration of the Multi-Fiber Arrangement

The other looming development on the trade policy front is the expiration of the Multi-Fiber Arrangement (MFA), which expired in January 2005. The MFA has controlled trade in textiles and apparel for more than 40 years. Many analysts expect that with the expiration of the MFA, a significant share of the world's textile and apparel production will shift to China and other low-wage producers – displacing employment in both developed countries and developing non-Asian countries. Consistent with other analyses, our forecast shows a significant increase in the low-wage country share of textiles and apparel.

There are a number of policy developments that might moderate the growth in low-wage textile and apparel imports – specifically imports from China – including a China-specific Textile Safeguard remedy, regular safeguard measures, and standard anti-dumping measures.[14]

While it is difficult to forecast the reaction of a future US administration, in 2003 the US Department of Commerce imposed a 7.5 percent quota limit on the growth of Chinese bra, knit fabric, dressing gown, and robe imports above the levels reached between September 2002 and September 2003. Current Administration officials have indicated in press interviews that they will consider using the safeguard provisions available to it under the WTO agreement to prevent "market disruption" in other textile and apparel goods.[15] These safeguard and anti-dumping responses are likely to moderate the growth of textile and apparel imports from China.

[14] Hufbauer and Wong (2004) describe the range of policy alternatives the US government has at its disposal to limit the increase in imports from China.
[15] "US May Limit Chinese Imports" by Peter S. Goodman, Washington Post, September 13, 2004.

VI. Going Forward – 3 Scenarios

The results presented above lead to the immediate conclusion that the rise in imports from low wage countries has played a large role in shaping the face of US manufacturing in general and in the Appalachian region in particular over the last 30 years. In this section we present three scenarios for the next decade based on the forecasts of low wage imports and the possible paths for trade policy and transportation costs.

Scenario 1: The Most Likely Path

We start with the scenario that we consider most likely: one of large increase in import shares from low-wage countries, modest tariff reductions for most goods with reactive protection on some specific products, and a general stabilization of freight and transport costs.

The dominant feature of this scenario is the prospect for increasing import shares for low-wage countries. There is little doubt that going forward imports from low-wage countries will continue to rise. Using the results from our model of how low-wage countries enter US markets, we expect to see a significant rise in low-wage import shares over the next decade. However, as in the last three decades, there will be substantial variation by industry in the degree of low-wage import penetration.

In this scenario, sectors that have already had substantial restructuring such as Apparel and Leather will continue to see rapidly rising imports from low-wage countries. In addition, sectors such as Furniture will enter a phase of rapid low-wage import growth and likely find domestic employment and output continuing to fall. These industries have already undergone a substantial round of adjustment to low-wage imports and while their prospects in the US are limited, these industries are relatively small and at a national level the loss of jobs will be relatively muted. However, in regions and communities where the affected industries represent a significant share of employment, there is potential for considerable disruption to local labor markets.

Manufacturing sectors with the highest wages, greatest employment shares, and highest productivity will not be subject to massive imports from low-wage countries. Prospects for domestic production in these industries will be relatively good and some sub-sectors may even expand employment as the reallocation of activity within manufacturing continues, helping to foster continued aggregate productivity gains. For manufacturing as a whole, the employment losses due to low-wage imports will be modest.

In this most likely scenario, the prospects for large changes in tariff rates or freight and transport costs are relatively small. The focus of multilateral trade negotiations is likely to be on areas other than manufacturing and possible bilateral treaties with countries such as Australia will not lead to large increases in import volumes. As a result, we foresee no substantive changes in overall tariff levels. On the other hand, for specific products, such as furniture and apparel, there remains the possibility of reactive tariff-based protection. We see little chance that such events would alter the process of reallocation in the manufacturing sector as a whole.

Scenario 1 in the Appalachian Region

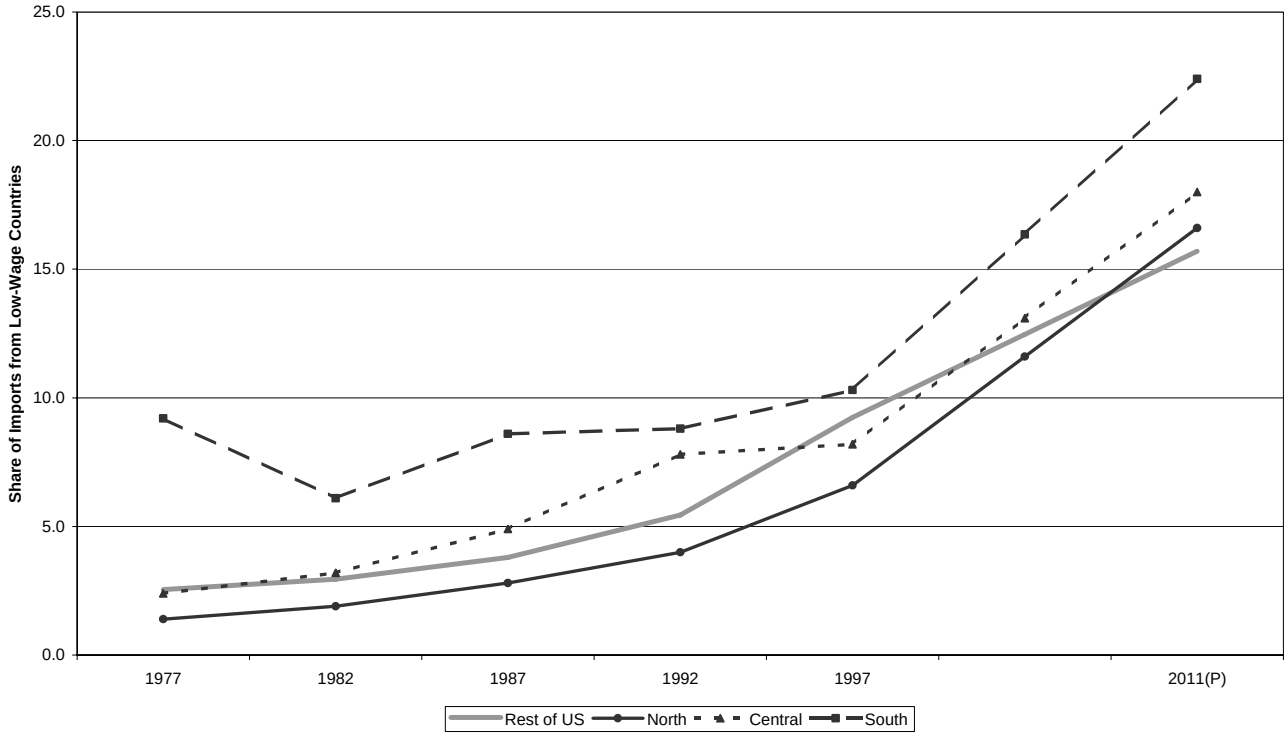
The Appalachian region continues to face higher levels of exposure to low-wage imports, especially in its South region, as shown in Table 13 above. The effects of this increased exposure is exacerbated by the fact that the process of reallocation in the manufacturing sector has been lagging in the Appalachian region and the ability of the region to adjust through changes in firm entry and exit has been lower than that of the country as a whole. These factors combine to yield slightly more pessimistic predictions for the manufacturing sector in the Appalachian region.

Figure 7 shows the historical and forecast low-wage import shares for the sub-regions within the ARC and the rest of the US (the figure uses 1997 shipments as weights for forecast low-wage country import shares). As can be seen in the figure, the low-wage import exposure for the region is increasing faster than the ROUS. Even for the North sub-region, which historically has had lower low-wage import exposure than the ROUS, the forecast for 2011 shows higher exposure than the ROUS. For the Central sub-region

and the South sub-region, the exposure is also increasing faster than in the ROUS, leaving all sub-regions with higher low-wage import share exposure than the ROUS.

The increased exposure, combined with historically greater shutdown and employment responses in Appalachia, suggests that the Appalachian region will face significantly greater adjustment pressures than the ROUS.

Figure 7: Regional Trends in Low-Wage Import Shares



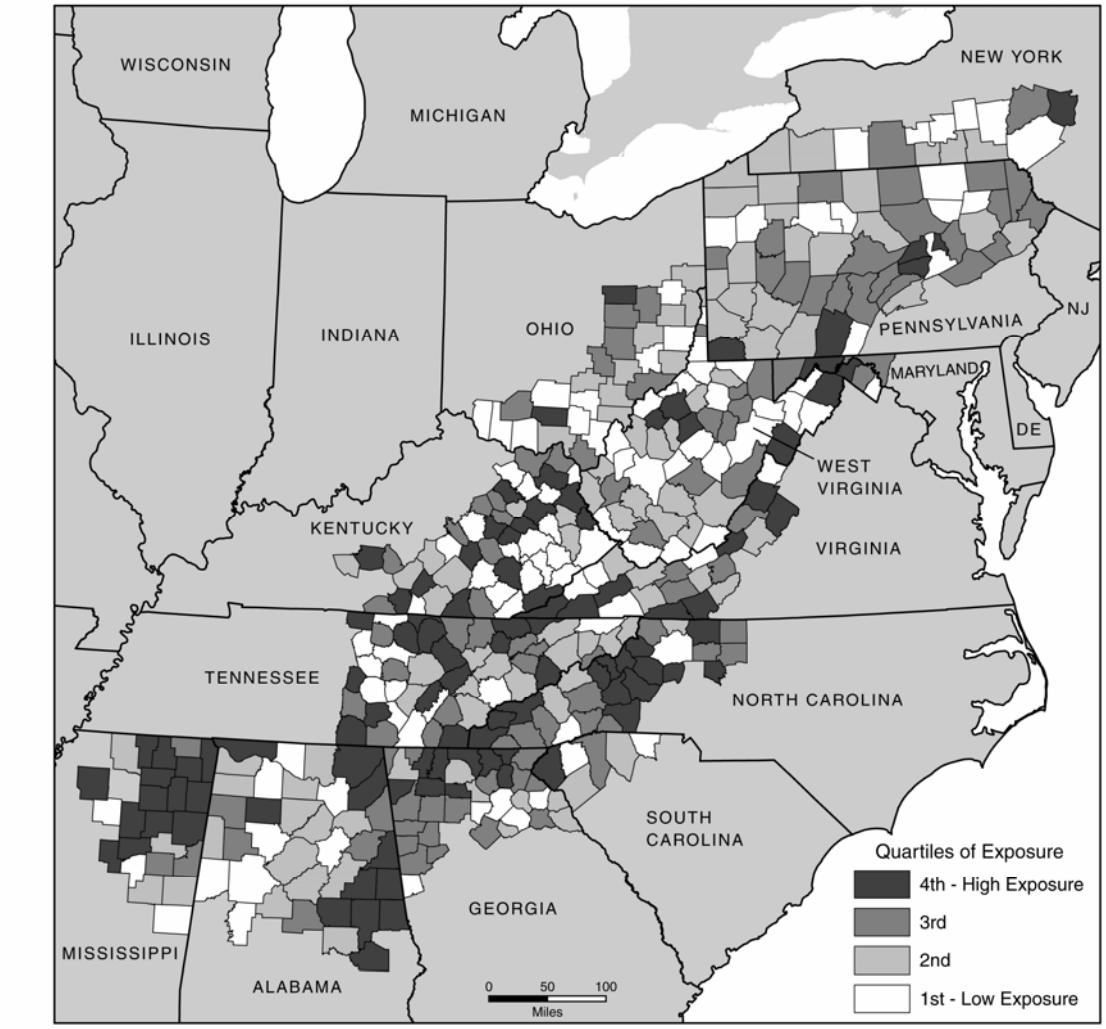
To provide more detail on how much exposure specific communities are likely to face, we produce county level estimates of low-wage exposure in our baseline scenario. We report two measures of exposure to describe the potential challenges. The first is the weighted average of exposure in the manufacturing sector in the county.[16] This map shows how exposed the manufacturing sector is in each county in Appalachia. In this

[16] The estimates are based on the 4-digit SIC forecast developed above weighted by 2002 county level manufacturing employment from the IMPLAN database. Counties are placed into quartiles based on their weighted exposure level.

map, counties with manufacturing employment concentrated in exposed sectors like Apparel and Furniture are ranked as highly exposed. The manufacturing focused results are presented below in Figure 8.

Figure 8: Appalachian Exposure to Manufacturing Imports from Low-Wage Countries

(County Level Manufacturing Sector Exposure)

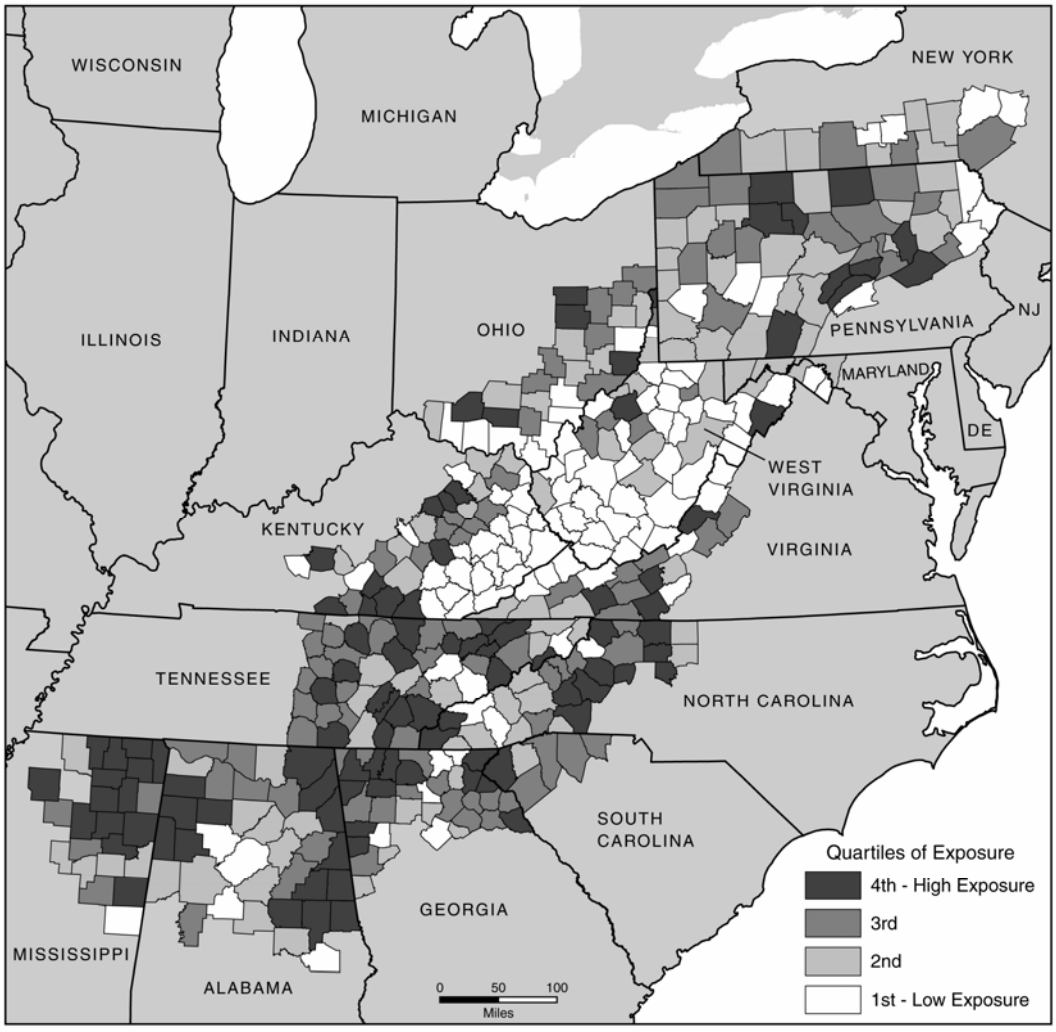


This map shows the projected exposure of the manufacturing sector in the county to imports from low-wage countries.

The second measure weights the manufacturing exposure level by the share of employment in the county that manufacturing represents. Figure 9 shows the overall level of exposure in the county by adjusting the manufacturing sector's exposure by how important manufacturing is in a county. In this map, counties with a significant share of overall employment in the manufacturing sector and with manufacturing employment concentrated in exposed industries are ranked highly exposed. The two measures describe the level of exposure in manufacturing and the overall level of exposure in the county.

Figure 9: Appalachian Exposure to Manufacturing Imports from Low-Wage Countries

(Overall County Level Exposure)



This map shows the projected exposure of the county overall (taking into account the importance of the manufacturing sector in the county) to imports from low-wage

Substantial reallocation away from labor-intensive, low-wage sectors will continue in the region over the next decade. This cross-industry movement will be coupled with continued reallocation within sectors as the relatively capital-poor plants of the region face stiffer direct competition from low-wage country imports. Compounding the problems associated with reallocation is the problem of low firm creation rates across industries in the region.

Scenario 2: Slowing Globalization

The second scenario is one of modest increases in global economic integration characterized by low increases in both import volumes and the share of imports from low-wage countries. In this case, the past trends for all three major factors, low-wage imports, tariffs, and transport costs, are slowed or reversed. Low-wage import shares continue to increase but at a slower pace than in the past decade; tariff rates are unchanged across manufacturing industries; and freight and transport costs rise substantially due to the increased demands of rapidly growing economies such as China. While we consider this scenario to be substantially less likely than scenario 1, it remains a possibility especially as the future of transport costs is highly uncertain and subject to possible demand pressure and supply constraints.

In this view of the global economy over the next decade, the process of reallocation in US manufacturing continues but at a slower pace. The slower pace would have two effects. The slower pace of globalization would provide less pressure on low-wage labor-intensive industries and firms. However, the slowing pace of globalization would also constrain the growth of capital and technology-intensive sectors, dampening output, employment, and productivity growth in these sectors. While slowing globalization might provide some solace for industries that face higher and increasing low-wage import shares, for manufacturing as a whole it would mitigate employment reductions at the expense of lower wage and productivity growth.

Scenario 2 in the Appalachian Region

This scenario of slowing global trade growth would affect the Appalachian Region in one of two different ways. One possibility is that a reduction in the pressure from low-wage countries would allow firms in low-skill, low-wage industries the time to reorganize, possibly by shifting to new products, new industries, and new technologies.

However, given the history of lower firm entry and exit in the region, a more likely long-run outcome would be a perpetuation of the old industrial mix. The ultimate result of such persistence would be a regional manufacturing base that was ill-prepared to transform itself going forward and was even more exposed to dislocation from low-wage imports when the pressure resumed.

Scenario 3: Accelerating Change

In this final scenario, we consider the prospects for US and Appalachian manufacturing if the global economy expands rapidly and allows for even more rapid integration and globalization. The key features of this scenario are dramatic liberalizations in sectors other than manufacturing due to multilateral negotiations, a continued decline in transport costs, and the rapid emergence of other large low-wage countries such as India in the global manufacturing production network. We must emphasize that we see this scenario as the least likely of the three given the current global economic environment.

With these changes, the share of manufactured imports from low-wage countries would increase beyond the 25% predicted by our model. However, the distributional array of such import would not be substantially changed, only the levels would be higher. The consequences for such events on US firms are quite clear. Pressure in low-wage industries and for low-tech, labor-intensive producers in all industries would be magnified, leading to higher exit rates, slower employment growth and greater amounts of product switching.

However, the obverse side of increasing integration and globalization would mean greater world-wide opportunities for export-oriented sectors such as transportation, and

for skill-intensive sectors in general. Overall, we would expect to see substantially higher rates of firm turnover, both entry and exit, in a wide variety of industries. This accelerating reallocation would foster even faster productivity growth.

Scenario 3 in the Appalachian Region

A ramp-up of globalization would have sharp consequences for manufacturing in the Appalachian region. The composition of Appalachian industries means the region is unduly exposed to a rapid increase in low-wage imports. In addition, the preponderance of low-skill, low wage plants means than even in sectors with expansion possibilities, the Appalachian region would see disproportionate numbers of firm failures and problems with employment growth.

Of particular concern is the relatively poor performance in firm creation in the region. Increased globalization and integration place a premium on regions that can rapidly adjust their firm and industry mix, in particular obsolete enterprises must be rapidly replaced by new firms in new sectors. The historical record shows that the Appalachian region is at a disadvantage in this key business performance indicator and would face significant challenges in this scenario.

VII. Summary and Conclusion:

The Appalachian region faces significantly greater challenges from import competition from low-wage countries than the rest of the US. The challenges come from the combination of a number of factors.

First, import shares from low-wage countries are forecast to increase significantly between now and 2011, increasing faster over the period than in any decade over the past 30 years. We develop a forecast of import shares from low-wage countries for 2011 and demonstrate that import shares from low-wage countries are likely to rise, significantly so for labor-intensive industries.

Second, manufacturing activity in Appalachia is concentrated in low-wage, labor-intensive industries that are forecast to experience the greatest increases in low-wage import competition. Further, even within industries, plants within Appalachia are less skill-intensive and less productive. Due to the industrial base in Appalachia, the region overall and all sub-regions are forecast to experience greater increases in low-wage import shares than the rest of the US, with all regions having higher exposure than the ROUS in 2011.

Third, in addition to increased exposure, manufacturing plants in Appalachia have exhibited greater plant shutdown and employment decline responses to low-wage import competition than the rest of the US. We estimate the responses of manufacturing plants in Appalachia and the ROUS to increased low-wage import shares and tariffs and transportation costs. Increased low-wage import shares increase the likelihood of plant shutdown and decrease relative employment growth in Appalachia and the ROUS, with the response being greater in Appalachian than the ROUS.

Fourth, a compounding factor is that Appalachia is less dynamic in terms of plant entry and exit than the rest of the country. As has been documented in other studies, plant entry and exit rates in Appalachia are lower than the ROUS. This lack of dynamism may impede the reallocation process in Appalachia and leave the region exposed to low-wage import competition.

One potentially productive avenue of future research is to examine the sources of the lower entry and exit rates in Appalachia. Given the current manufacturing base and

the forecast for increased low-wage competition, the Region faces the prospect of significant reallocation. Understanding the impediments to the reallocation process in Appalachia and developing policies to facilitate adjustment should be important objectives for policymakers in the Region.

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