Online Appendix for The Surprisingly Swift Decline of U.S. Manufacturing Employment

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Abstract

This online appendix contains detailed explanations of data creation as well as additional empirical results referenced in the main text.

A Anecdotal Evidence

A.1 U.S. Discussions of PNTR and Uncertainty

This section lists anecdotes from media reports, Congressional testimony and other government sources describing firms' uncertainty over China's temporary NTR status, and connecting this uncertainty to an unwillingness to invest in establishing closer ties with Chinese firms. They also suggest that uncertainty can have a chilling effect on investment even if the probability of rescinding NTR is small, given the high costs of reverting to a situation where China does not have NTR status. Anecdotes are displayed chronologically by source.

1. *Rowley (1993):*

   (a) "'The persistent threat of MFN withdrawal does little more than create an unstable and excessively risky environment for U.S. companies considering trade and investment in China, and leaves China's booming economy to our competitors,' more than 340 such firms and groups said in a letter to [President] Clinton May 12... The firms range from AT&T, Coca-Cola, General Motors, Kellogg and the First National Bank of Chicago to IBM, Boeing, McDonnell Douglas, Caterpillar and the National Wheat Growers Association."

2. *United States General Accounting Office (1994):*

   (a) "U.S. government and private sector officials cited uncertainty surrounding the annual renewal of China's most-favored-nation trade status as the single most important issue affecting U.S. trade relations with China."

(b) "A primary concern for the 5 U.S. business associations and 15 large corporations GAO contacted was China's most-favored-nation trade status. According to these business associations and companies, the uncertainty over whether the U.S. government will withdraw or place further conditions on the renewal of China's most-favored-nation trade status affects the ability of U.S. companies to do business in China (see pp. 43-5). Some U.S. companies and business associations told GAO that uncertainty about the renewal of China's most-favored-nation status makes long-term planning difficult and contributes to tensions in U.S.-China trade relationships."

(c) "The great majority of the U.S. business associations and companies we in Business Relationships contacted told us that the annual uncertainty surrounding China's MFN status potentially hinders their business activities in China. In a May 1993 letter to the President, 316 U.S. corporations and trade associations represented by the Business Coalition for U.S.-China Trade jointly expressed their view that "the persistent threat of MFN withdrawal does little more than create an unstable and excessively risky environment for U.S. companies considering trade and investment in China, and leaves China's booming economy to our competitors." According to one U.S. company executive we spoke with, this uncertainly precludes long-term business deals and makes strategic planning difficult. The annual MFN review process may also be a negative factor for U.S. companies in securing financing for business transactions in China from the international lending community, according to a recent report prepared by over 20 leading U.S. firms in the electric power and fossil fuel industry. The U.S.-China Business Council and the National Association of Manufacturers affirmed the importance of a stable commercial environment for business planning and stressed that the need to make a politically charged decision about China's MFN status every spring creates an annual crisis for business people and diplomats alike."

(d) "In addition, the uncertainty created by the annual MFN renewal process for China causes great concern for U.S. companies that are attempting to forge long-term business relationships in China."

(e) "However, certain U.S. government policies designed to address concerns about China's human rights, trade, and weapons proliferation practices may prevent U.S. companies from being able to more fully realize the business opportunities associated with China's economic growth and development. For example, the confidence of U.S. companies in their ability to do business in China is affected by their uncertainty over whether the US. government will renew China's MFN trade status, according to U.S. business associations and companies."

3. *Pearce (1996):* "We view the imposition conditions upon the renewal of MFN as virtually synonymous with outright revocation. Conditionality [sic] mean uncertainty. We cannot plan and run our businesses if we are wondering whether our most important source of supply is about to disappear. Without continuity and certainty of supply, American toy companies also cannot plan to take advantage of the growing Chinese market."

4. *Milosh (1997):* "Any annual review process introduces uncertainty, weakening the ability of U.S. traders and investors to make long-run plans, and saddles U.S./China trade and investment with a risk factor cost not faced by our international competitors."

5. *Cohen (1997):* "The uncertain framework of our current bilateral commercial relationship with China stands in the way of achieving greater access for U.S. trade and investment in China and the Asia-Pacific Region. . . For more than 15 years, as U.S. Business has tried to expand its trade and investment ties to China, it has had to live with the knowledge that its exports and investments were in perpetual jeopardy due to the annual Jackson-Vanick review."

6. *Knowlton (2000):* "U.S. companies expect to benefit from billions of dollars in new business and an end to years of uncertainty in which they had put off major decisions about investing in China."

7. *St. Maxens (2000):* "The fact that the United States does not accord China permanent NTR status creates uncertainty for America's toy companies and exposes them to unwelcome risk. While the risk that the United States would withdraw NTR status from China may be small, if it did occur the consequences would be catastrophic for U.S. toy companies given the 70 percent non-MFN U.S. rate of duty applicable to toys. As a result, Mattel strongly supports congressional approval of legislation granting permanent NTR status to China upon its WTO accession."

8. *National Retail Federation (2000):*

   (a) "For years, the annual NTR renewal process has created instability in the U.S.–China relationship. This ongoing instability has hampered opportunities to export to, import from, and invest in China. Although Congress has granted China annual NTR continuously since 1980, the cycle of annual renewals and the uncertainty associated with the process result in costly disruptions that hurt both American consumers and U.S. businesses alike."

(b) "The uncertainty of the annual NTR renewal is particularly disruptive for U.S. retailers, which typically place orders for Chinese products 18 months prior to delivery. China offers American consumers many value-priced goods such as clothing, footwear, consumer electronics and toys, as well as products like silk apparel that are simply not available from other manufacturers in the United States. The continuing uncertainty of China's NTR status forces retailers to gamble. Should they pay other suppliers more to buy the goods they would have gotten from China, which would, in turn, force them to pass the higher prices on to their customers? Or should they risk the uncertainty of sourcing from China, hoping that NTR will continue, so they can realize cost savings which are passed on to their customers? In either case, the uncertainty is reflected in higher product prices for American families."

9. *U.S. Trade Deficit Review Commission (2001):* "In the months since the enactment of Permanent Normal Trade Relations (PNTR) legislation with China there has been an escalation of production shifts out of the U.S. and into China. According to our media-tracking data, between October 1, 2000 and April 30, 2001 more than eighty corporations announced their intentions to shift production to China, with the number of announced production shifts increasing each month from two per

month in October to November to nineteen per month by April.“

A.2 Chinese Discussions of PNTR and Uncertainty

This section lists anecdotes from Chinese media describing the effect of PNTR on Chinese industries and firms. Here, we provide the professional translations of the articles. The original Chinese-language quotes are available upon request.

1. *Shanghai Securities News (1999)*: "Secondly, formal agreement has been reached on China's accession to the WTO, and the estimate is that in the next year, China's entry into the WTO will have a very positive role in China's economic development. First of all, this will help to build confidence among investors at home and abroad, especially among United States investors, because currently, China faces the issue every year of maintaining Most Favored Nation trading status."

2. *Jiangxi Paper Industry Co., Ltd. (2000)*: "The process of China's accession to the WTO is drawing to a close. After China joins the WTO, foreign products will participate in competition in the domestic market.... Meanwhile, we can enjoy multilateral Permanent Most Favored Nation status among the Member States of the WTO, so as to actively explore and enter the international market and participate in international economic competition."

A.3 U.S. Discussions of Trade-Induced Technology or Product Upgrading

This section lists excerpts of newspaper articles describing responses by U.S. businesses to greater competition from China after PNTR.

1. *Neikirk (2002)*: "To beat the Chinese and other foreign competitors threatening his business, Bradley and his partner invested several million dollars to double the production capacity of their plastic-part plant, PM Mold, with the latest in robotics and automation equipment. Now, he says he can make twice as many parts – and better ones at that – without adding to his work force, a feat that is driving up productivity as Bradley's small factory increases its output of parts with the same number of workers."

2. *Kirkbride (2001)*: "The transition from United States and European dominance in the residential furniture industry to a worldwide market is a mixed blessing for West Michigan's manufacturers. Kindel Furniture Co. and the John Widdicomb Co., both in Grand Rapids, are thriving by creating ultra high-priced furniture and cultivating a cache of very loyal, very rich followers...'Clearly, they're in a different world in the real high end,'...'They're making a lot of custom pieces, maybe 50 to 200 at a time, not the big runs that Chinese factories produce'."

B Data

B.1 Construction of NTR Gaps

Computation of the NTR gap for each NAICS industry takes four steps. First, NTR gaps are computed at the eight-digit HS level as the difference between the non-NTR and NTR import tariff rates provided by Feenstra, Romalis and Schott (2002). Second, using the concordance developed by Pierce and Schott (2012a), we match all HS import codes used by the United States between 1989 and 2001 to a time-invariant set of eight-digit HS code families. This step ensures that NTR gaps from HS codes added or deleted over time are incorporated in all years for which we may want to compute an NTR gap. Without this step, NTR gaps might be available for a different number of NAICS industries across the years 1989 to 2001 if HS codes matched to certain NAICS industries appear in some years but not others. Third, we match these time consistent HS codes to NAICS industries using a concordance from the U.S. Bureau of Economic Analysis (BEA).[49] Fourth, we compute the NTR gap for each NAICS industry as the average NTR gap across all time-consistent HS codes matched to that NAICS industry. Figure 2 plots the distribution of the 1999 NTR gap across industries.

We calculate the upstream NTR gap for NAICS industry i as the weighted average NTR gap across all industries used to produce i, using the coefficients from the BEA's industry-by-industry total requirements input-output matrix as weights.[50] Likewise, the downstream NTR gap for NAICS industry i is the weighted average NTR gap of all industries supplied by industry i, again

[49] The HS-industry concordance is contained in the file "HSConcord.txt" available at http://www.bea.gov/industry/zip/NDN0317.zip.

[50] The industry-by-industry total requirements table is contained in the file "ndn0310.zip" available at http://www.bea.gov/industry/zip/NDN0310.zip.

using the total requirements table coefficients as weights. In computing both weighted averages, we set the IO weights to zero for up- and downstream industries within industry i's three-digit NAICS sector. We do this in recognition of the fact that U.S. manufacturing establishments often produce clusters of products within the same three-digit NAICS sector (Bernard, Redding and Schott 2010). Plants in industry i are then assigned these up- and downstream NTR Gaps for use in Section 4.4.

Several caveats are worth pointing out. First, these up- and downstream gaps are based on industry-level IO relationships and therefore do not take into account the substantial heterogeneity across plants in the industries from which they source inputs and to which they sell outputs. In particular, some plants may produce inputs that other plants source from an upstream industry. Second, the own, upstream (mean and standard deviation of 0.11 and 0.04) and downstream (0.11, 0.08) gaps are highly related, with correlations of 0.46 and 0.24 for own versus upstream and own versus downstream, respectively. These high correlations may reduce the precision of our estimates by inflating the associated standard errors. Finally, supply chain linkages need not be unidirectional, as it is possible for plants in one industry to both purchase inputs from and sell outputs to plants in another industry.

B.2 Relation of the NTR Gap to Other Industry Attributes

Table A.2 summarizes the relationships between the 1999 NTR gap and other industry-level variables used in our analysis with a series of bi-variate OLS regressions. The industry attributes considered in Table A.2 are: 1990 capital intensity; 1990 skill intensity; Nunn's (2007) measure of contract intensity, defined as the share of intermediate inputs requiring relationship-specific investments in 1997; changes in Chinese import tariffs from 1996 to 2005; changes in the Chinese production subsidies per total sales from 1999 to 2005; the share of Chinese firms eligible to export in 1999; the import-weighted MFA quota fill rate; the share of U.S. workers belonging to a union in 1999; an indicator for industries containing advanced technology products; and the 1999 NTR and non-NTR rates in levels. For reference, the final two rows of the table report the mean and standard deviation of each of these covariates. Construction of the variables used in the table is discussed in detail in Section D.

As indicated in the table, the 1999 NTR gap has negative and statistically significant relationships with capital intensity, union membership, changes in Chinese tariff rates and changes in Chinese production subsidies. It has positive and statistically significant associations with contract intensity, the share of Chinese firms eligible to export under Chinese licensing constraints, industries' exposure to the MFA, and the indicator for advanced technology. The share of variation in the NTR gap explained by each of these regressors is generally low, and does not exceed 0.23 (for capital intensity).

B.3 Creating Time-Consistent Industry Codes and a "Constant Manufacturing" Sample

As noted in the main text, we use the algorithm developed in Pierce and Schott (2012a) to create time-consistent industry codes over which employment changes can be analyzed. This algorithm creates "families" of four-digit SIC and six-digit NAICS codes that group related SIC and NAICS categories together over the transition from SIC to NAICS in 1997 and subsequent NAICS revisions in 2002 and 2007. For example, if a SIC code splits into several

NAICS codes between 1997 and 2002, the SIC code and its NAICS "children" would be grouped into the same family.

Given this process, it is easy to see that some families can grow to be quite large. For this reason, we have created several concordances that limit the inclusion of children that do not account for some threshold level of their parents' activity. This is possible because the SIC to NAICS concordance provided by Becker, Gray and Marvakov (2013) provides the share of each parent (child) industry that is allocated to its children (parent). These limits create a tradeoff. Lower thresholds generate a larger number of families with more closely related underlying SIC and NAICS codes. Higher thresholds lead to a smaller number of families, most of which are likely to include both manufacturing and non-manufacturing codes.

In all of the results contained in the main text, we use a threshold of 50 percent to create families.[51] This threshold works as follows. First, sort all children industries j that match to parent industries i in descending order according to their importance in value terms to parent industry i. Keep all children matches j until the cumulative share of value explained exceeds 50 percent. In most cases, a single child j accounts for the overwhelming majority of parent $i's$ overall value. These families yield time-consistent industry codes for all U.S. manufacturing industries.

To create the constant manufacturing sample, we exclude any families that contain either a SIC or NAICS code that is ever classified outside manufacturing. In addition, as described in section 1.2 above, we exclude any establishments that are ever classified in a family outside the constant manufacturing

[51] However, we note that the main results can also be generated using the standard NAICS definitions in Becker, Gray and Marvakov (2013) or using the beta version of the time-consistent LBD NAICS codes created by Teresa Fort and Shawn Klimek, indicating that the results are not driven by our definition of industry families.

sample.

Figure A.1 displays annual employment in our "constant" manufacturing sample against the manufacturing employment series available publicly from the U.S. Bureau of Labor Statistics.[52] As expected, given the procedure outlined above, the "constant" manufacturing sample accounts for less employment than the BLS series. Despite this level difference, the LBD exhibits a similarly stark drop in employment after 2000.[53]

B.4 Total Factor Productivity

We follow Foster et al. (2008) in measuring TFP as the log of deflated revenue minus the log of inputs, weighted by the average cost share for each input at the industry level. Inputs encompass the cost of materials, production employment, non-production employment and the book value of capital. Both revenue and inputs are deflated using price indexes available in Becker, Gray and Marvakov (2013).

[52] Series CEU3000000001, available at www.bls.gov. As the BLS series is NAICS-based, employment for industries that were reclassified out of manufacturing in the change from SIC to NAICS are not included. As noted above, our sample is SIC-NAICS-based, meaning that we also drop NAICS industries not classified as manufacturing under the SIC. For further detail on construction of the BLS series, see Morisi (2003).

[53] As indicated by the roughly sideways movement of manufacturing employment from mid-1960s through 2000, the share of manufacturing employment in total private employment was declining for some time prior to PNTR, a trend discussed in Edwards and Lawrence (2013).

C U.S. Trade Policy Towards China

C.1 Statutory U.S. Import Tariffs

As noted in the main text, we use the *ad valorem* equivalent NTR and non-NTR tariff rates from Feenstra, Romalis and Schott (2002) to compute the NTR gaps by industry and year. This section describes the distribution of NTR and non-NTR tariff rates by eight-digit HS tariff line and year.

Non-NTR tariff rates, which can contain *ad valorem*, specific and "other" components – exhibit little change from 1989 to 2001. Indeed, 92 percent of the 13,700 unique tariff lines that appear in the Feenstra, Romalis and Schott (2002) dataset exhibit no change in their underlying "ad valorem" component over the years for which they are used. Even fewer tariff lines – 55 and 2, respectively – exhibit changes to their "specific" or "other" components. Furthermore, we find that more than 95 percent of the changes to the "ad valorem" component of the non-NTR rates occur in 1996, indicating they likely are related to changes triggered by the revision of HS codes in that year. For further information, Pierce and Schott (2012a) provide a detailed discussion of these changes.

NTR tariff rates exhibit greater variation over time than non-NTR tariff rates. Of the 13,700 tariff lines used during the 1989 to 2001 period, 6,127, 1,164 and 11 exhibit variation in their underlying "ad valorem," "specific" and "other" components, respectively, during this period. These changes generally are implemented from 1995 to 1999, indicating they are related to the tariff reductions negotiated during the Uruguay Round of the GATT.

C.2 Annual Renewals of NTR Status

The U.S. House of Representatives considered legislation to overturn the Presidential waiver on Chinese import tariffs every year from 1990 to 2001. Table A.1 records the share of votes against renewal during these years.

D Alternate Explanations

This section discusses a range of potential alternate explanations for the decline in U.S. manufacturing after 2000, as well as the data gathered to control for them in our regressions.

D.1 Shocks to U.S. Comparative Disadvantage Industries

As documented in appendix Table A.2, NTR gaps are negatively related to industry capital intensity, with that attribute explaining 23 percent of the variation in the NTR gap across industries. Assuming the U.S. has a comparative disadvantage *vis a vis* China in the production of labor-intensive goods, an alternate explanation of the results in Section 2 is a post-2000 decline in the U.S. competitiveness of labor-intensive industries for some reason unrelated to PNTR, e.g. a general movement towards offshoring perhaps encouraged by the 2001 recession, or a positive productivity shock in China.[54]

We account for this explanation by including interactions of the post-PNTR dummy variable with industries' 1990 capital and skill intensity. As 1990 does not correspond to a Census year, we measure capital and skill intensity as the ratio of the real book value of capital (K) and the number of non-production

[54] See also section Section E below.

workers (NP) to total industry employment, respectively, using data from Becker, Gray and Marvakov (2013). Because employment is the denominator in these ratios, they enter equation 2 as time-invariant values in the initial year of the period of analysis rather than time-varying industry attributes.

As indicated in column 3 of Table 1 in the main text, the coefficient on the skill intensity interaction is positive and statistically significant, indicating that more skill intensive industries had higher relative levels of employment in the post-PNTR period. In contrast, the coefficient on the capital intensity interaction is not statistically significant.

D.2 Changes in Chinese Policy

As part of its accession to the WTO, China agreed to ease formal and informal restrictions on foreign investment, reduce import barriers, and eliminate export licensing requirements and production subsidies (WTO 2001). These WTO-related reforms, like PNTR, may have influenced both manufacturing employment in the United States and China-U.S. trade. We discuss each of these Chinese policy changes in turn.

Barriers to Investment: In joining the WTO, China agreed to treat foreign enterprises no less favorably than domestic firms. This reduction in barriers to investment may have reduced the fixed and variable costs associated with offshoring, providing U.S. firms with a greater incentive to relocate some or all of their production to China. As direct evidence of these reforms is unavailable, we examine whether U.S. employment losses are concentrated in industries most likely to benefit from changes in the institutional environment, i.e., industries in which relationship specificity in contracting over inputs is more important.

To account for this potential relationship, we add to the baseline regression an interaction of a post-PNTR dummy and Nunn's (2007) measure of industries' contract intensity, which rises with the share of intermediate inputs requiring relationship-specific investment.[55] We expect a negative point estimate: assuming investment in China became easier after WTO accession, it should have the largest impact on U.S. employment in industries where relationship-specific contracting is more important. As indicated in column 3 of Table 1 in the main text, the relationship is negative but statistically insignificant in the baseline specification.

Tariff Barriers: China reduced import tariffs on a number of products both before and after its accession to the WTO. Reductions in Chinese import tariffs might be expected to boost U.S. exports to China and thereby raise U.S. employment. On the other hand, by lowering the cost of foreign inputs and thereby making China a more attractive location for manufacturing, they may have had the opposite effect.

Brandt et al. (2012) report Chinese import tariffs by eight-digit Chinese HS code for 1996 to 2005, though data for some HS codes are missing. We aggregate these tariffs up to the six-digit HS level and then from the six-digit HS level to U.S. NAICS codes using concordances developed by Pierce and Schott (2012b). For each U.S. industry-year, this aggregation is the simple average of the tariffs of the six-digit HS codes encompassed by the industry. We then calculate the change in Chinese import tariff rates over the maximum span for which tariffs are available – 1996 to 2005 – and refer to this variable as the change in Chinese import tariffs. This change in tariff rates is then interacted with the post-PNTR dummy and included in the baseline specification.

[55] These data are available from Nunn's website at http://scholar.harvard.edu/nunn/pages/data-0.

As shown in column 3 of Table 1 in the main text, this variable has a negative and statistically significant relationship with employment in the baseline specification, indicating that reductions in Chinese import tariffs are associated with relative employment gains for US producers in the post-PNTR period.

Production Subsidies: Some have argued that the rapid expansion of China's manufacturing sector was driven by subsidies, which may affect some industries more than others (Haley and Haley 2013). We use data from the Annual Report of Industrial Enterprise Statistics compiled by China's National Bureau of Statistics (NBS), which reports the subsidies provided to responding firms.[56] Following Girma et al. (2009) and Aghion et al. (2015) we use the variable "subsidy" in this dataset to compute subsidy per sales ratios for each four-digit China Industry Classification (CIC) and year. We then concord the CICs to ISIC and then U.S. SIC industries using concordances provided by Dean and Lovely (2010).

We include the interaction of the industry-level change in the subsidy-per-sales ratio with an indicator for the post-PNTR period in the baseline specification. As indicated in column 3 of Table 1 in the main text, we find a statistically insignificant relationship between this covariate and employment in the baseline specification.

Some suspect China of subsidizing a reallocation of production towards products with higher levels of technology, which we measure using an indicator that picks out industries identified by the U.S. Census Bureau as containing products with "advanced technology," as described in sub-section D.4. As

[56] The NBS data encompass a census of state-owned enterprises (SOEs) and a survey of all non-SOEs with annual sales above 5 million Renminbi (~$600,000). The version of the NBS dataset available to us from Khandelwal, Schott and Wei (2013) spans the period 1998 to 2005.

indicated in column 3 of Table 1 in the main text, we find a statistically insignificant relationship between this covariate and employment in the baseline specification.

Export Licensing: As discussed in detail in Bai, Krishna and Ma (2015), China agreed to phase out export licensing requirements by 2003. Because export licenses had formerly been more difficult to obtain in some industries than others, their removal may have led to a surge in Chinese exports and subsequent decline in U.S. manufacturing employment in the industries where licensing was most binding.[57] Bai, Krishna and Ma (2015) reports the share of Chinese producers in each four-digit CIC industry that were eligible to export in 1999. We concord these shares to ISIC and then U.S. SIC industries using concordances provided by Dean and Lovely (2010) and the United Nations, available at http://unstats.un.org/unsd/cr/registry/regot.asp.

We then include in the baseline regression an interaction of a post-PNTR indicator with the share of firms eligible for export licenses in 1999 from Bai, Krishna and Ma (2015). As indicated in column 3 of Table 1 in the main text, this coefficient is statistically insignificant.

D.3 Removal of MFA Textile and Clothing Quotas

During the Uruguay Round of trade negotiations, the United States, the EU and Canada agreed to eliminate quotas on developing country textile and clothing exports in four phases starting in 1995 (Brambilla, Khandelwal and Schott 2009). While the first three phases of quota expirations took place as of January 1 of 1995, 1998 and 2002, imports from China remained under quota until its accession to the WTO. Upon entering the WTO on December 31,

[57] Khandelwal, Schott and Wei (2013) show that the allocation of export licenses in the apparel industry restricted the exports of its most productive producers.

2001, quotas were eliminated on U.S. imports from China of products covered by the first three phases. Quotas on Phase IV products were eliminated on schedule on January 1, 2005. As discussed in Brambilla, Khandelwal and Schott (2009), the distribution of textile and clothing goods across phases was not random: the United States, like other countries, reserved their more import-sensitive product categories for the final phase.

As noted in the main text, we control for expiration of MFA quotas on U.S. imports from China using time-varying measures reflecting the import-weighted fill rates of the quotas, where fill rates are defined as actual divided by allowable imports. These measures capture both the timing of the different phase of quota expirations as well as how restrictive the quotas had been prior to removal.

For the industry-level employment regressions (e.g., Table 1), we construct these measures using ten-digit HS-level (HS10) data from Khandelwal, Schott and Wei (2013) that identify the products covered by the MFA, their phase of quota expiration and their tariff fill rate by year. These HS10 data are then aggregated to industries using the concordance in Pierce and Schott (2012b). For each industry, the measure is set to the import-weighted fill rate of the matching HS10 products in the year prior to tariff removal. For China, these measures are set to zero (i.e., no exposure to MFA quota reductions) prior to 2002. For Phase I, II and III products, beginning in 2002, the measures are set to the import-weighted fill rates observed in 2001. For Phase IV products, beginning in 2005, the measures are set to the import-weighted fill rates observed in 2004. A higher value indicates greater exposure to MFA quota reductions.

As indicated in column 3 of Table 1 in the main text, we find a negative and statistically significant relationship between this variable and employment, indicating that exposure to the elimination of MFA quota restrictions was associated with employment declines. A coarser approach to examining the robustness of our results to quota reductions under the MFA is to drop industries that include HS10 products experiencing quota removal. Here, too, we continue to find that PNTR exerts a negative and significant effect on relative employment.[58]

For the import regressions (Table 4), we measure the MFA with indicators that take the value 1 for years after expiration of the MFA Phase. That is, for imports from subject countries other than China, the MFA measure takes the value 1 starting in 1995 for Phase I products, in 1998 for Phase II products, in 2002 for Phase III products and in 2005 for Phase IV products. For China, the measure takes the value 1 starting in 2002 for Phase I, II and III products and in 2005 for Phase IV products. We also find that the coefficient on the triple differences term in equation 5 remains positive and significant for all four measures of import activity displayed in Table 4 when products subject to the MFA are dropped from the sample.

D.4 Union Resistance

Another explanation for the decline in U.S. manufacturing employment is that all manufacturing firms desired to reduce employment after 2000, but that unions impeded reductions in some industries more than others. We measure union membership using data from the website www.unionstats.com – assembled by Hirsch and Macpherson (2003) – which publishes information on the share of workers that are members of a union by Current Population Survey (CPS) industry classification and year. We match CPS industries to SIC codes

[58] The negative and significant relationship between PNTR and employment is also robust to including a control that captures expiration of MFA quotas for imports from countries other than China.

using the concordances posted at unionstats.com.

As indicated in column 3 of Table 1 in the main text, the coefficient for union membership is statistically insignificant in the baseline specification.

D.5 The IT Boom-Bust

The information technology (IT) sector experienced a well-known boom and bust around the time that PNTR was implemented. It is possible that the employment declines after 2000 were concentrated in IT industries.

The U.S. Census Bureau identifies products – defined at the ten-digit HS level – that contain advanced technology in ten areas: biotech, life sciences, opto-electronics, IT, electronics, flexible manufacturing, advanced materials, aerospace, weapons and nuclear technology. We match these HS codes to NAICS industries using concordances developed by Pierce and Schott (2012b) and define an indicator that takes the value 1 if an industry includes ATP products, and 0 otherwise.[59] We then include in the baseline specification an interaction of a post-PNTR dummy variable and the indicator for ATP products. As noted in column 3 of Table 1 in the main text, the coefficient estimate for this interaction is statistically insignificant in the baseline specification.

D.6 The U.S. NTR Rate

Some of the variation in post- versus pre-PNTR U.S. manufacturing employment growth may be driven by changes to U.S. NTR tariff rates over our sample period. To control for such changes, we include the time-varying NTR rate for each industry in the baseline specification. However, as *ad valorem*

[59] The Census ATP classification can be downloaded from http://www.census.gov/foreign-trade/reference/codes/atp/.

equivalent (AVE) import tariffs are not available from Feenstra, Romalis and Schott (2002) after 2001, we assume these rates are constant after that year. While this assumption appears strong, we note that most of the changes in NTR tariffs driven by the Uruguay round had been implemented by 2001, and that separate analysis of the actual *ad valorem* and specific tariffs in the U.S. tariff schedule (available on the USITC website) indicates few changes to U.S. NTR tariffs between 2001 and 2007.

Moreover, to further investigate the influence of our assumption of constant U.S. AVE U.S. tariff rates after 2001, we estimate our own series of AVE tariff rates following the USITC method as closely as possible. Use of these derived AVE tariffs yields estimates that are very similar to those in the baseline specification, as discussed in Section 2.2 and shown in column seven of Table 2. We prefer the Feenstra, Romalis and Schott (2002) tariff series because they are available for a larger number of industries, in part due to the concordance issues discussed in Section 1.

D.7 Non-PNTR-Induced Technical Change

Another explanation for our results is that they are driven by labor-saving technical changes, such as automation, which are spuriously correlated with the NTR gap. While technical change unrelated to PNTR is difficult to measure, several of the variables discussed above – including indicators for advanced technology products (ATP) and measures of industry capital intensity – serve as useful proxies for where it might show up. As indicated in column 3 of Table 1 in the main text, however, coefficient estimates for these variables are statistically insignificant in the baseline specification. Moreover, we show in Section 3 that there is no relationship between the U.S. NTR gap and manufacturing employment in the EU. If labor-saving technological innovations unrelated to PNTR were spuriously correlated with the U.S. NTR gap, their impact also should be manifest in other developed economies.[60]

E Chinese Productivity Growth

We use the firm-level Chinese production data described in Section 1 of this online appendix to investigate the relationship between productivity growth in Chinese industries and the U.S. NTR gap. Following Khandelwal, Schott and Wei (2013), we define the total factor productivity for firm f as $\ln(TFP_f) = \ln(va_f) - \alpha_f \ln(w_f) - (1 - \alpha_f)\ln(k_f)$, where va_f, w_f, and k_f denote firm value added, wages and fixed assets (net of depreciation) and α_f is the firm's share of wages in total value added. Wages are defined as reported firm wages plus employee benefits (unemployment insurance, housing subsidies, pension and medical insurance), and capital is defined as reported capital stock at original purchase price less accumulated depreciation.[61] We aggregate these productivity measures to the industry level by taking weighted averages using firms' employment as weights. Next, we use concordances provided by Brandt et al. (2012) to match HS-level NTR gaps for the United States to the four-digit Chinese Industry Classification (CIC) codes used in the NBS data.

Appendix Table A.3 reports the results of industry-level OLS regressions of Chinese TFP on year fixed effects, industry fixed effects and interactions of year fixed effects and the U.S. NTR gap. Coefficient estimates for all but the interaction terms are suppressed. As indicated in the table, the association

[60] In contrast, we do find evidence for trade-induced technical change that is associated with PNTR, as discussed in Section 4.3 of the main text.

[61] This approach assumes revenue-based TFP reveals variation in physical efficiency, an assumption whose limitations are discussed in Section 4.3 of the main text.

between TFP and the NTR gap is statistically insignificant at conventional levels for all years.

F U.S. and EU Employment Data from UNIDO

Our comparison of the relationship between the NTR gap and manufacturing employment in the United States and the European Union in Section 3 uses data from the United Nations Industrial Development Organization's (UNIDO) INDSTAT 4 database for 1997 to 2005.[62] This database contains information on a number of industry characteristics, including employment, at the four-digit International Standard Industrial Classification (ISIC) Revision 3 level.[63] Manufacturing industries in the ISIC begin with two digit codes from 15 to 37. We exclude industries that begin with 22 from our definition of manufacturing as they include publishing, which was classified as manufacturing under the SIC, but not the NAICS. Our definition of the European Union is based on the current set of 28 EU members, available at europa.eu/about-eu/countries/member-countries. Because of instances of missing data, our sample includes only industry-country pairs for which data are present in every year. Lastly, we note that data for the U.S. are unavailable in 2003.

It does not appear as though the EU data are subject to higher levels of measurement error than the U.S. data. EU members use standardized statistical systems (such as NACE) as part of the European Statistical System

[62] Additional information regarding these data are available at www.unido.org/resources/statistics/statistical-databases/indstat4-2013-edition.html.

[63] As noted in the main text, these industries are more aggregate than the four-digit SIC and six-digit NAICS industries reported in the LBD. To examine the relationship between UNIDO employment and the U.S. NTR gaps, we aggregate the latter from the eight- to the six-digit HS level and then map them to the four-digit ISIC level using publicly available concordances from the World Bank, available at www.wits.worldbank.org/wits/product_concordance.html.

(ESS) to ensure that statistics are comparable across countries and over time, and the ESS coordinates its standardization activities with other international agencies, including the UN.[64] This standardized system should limit country-specific changes in classification systems within the EU. In addition, for EU countries that are members of OECD, UNIDO receives data directly from OECD, which dedicates substantial resources to reporting statistics that are comparable over time and across countries. Since almost all EU countries were members of OECD during the time period we examine (exceptions include Estonia, Slovenia and Romania), this means that almost all of the UNIDO country-level data have passed through OECD's screens.

Nevertheless, we performed additional robustness checks to help rule out the possibility of spurious changes in employment due to industry classification changes in the UNIDO data. First, we re-estimated the triple differences specification while only including EU countries that were OECD members during the period examined, in case the statistics for non-OECD members were less accurate. The coefficient estimates are essentially unchanged by this restriction. Second, in case large swings in employment are indicative of spurious changes driven by industry classification changes, we re-estimate the regression after dropping EU industry-country pairs in which year-over-year employment growth was ever higher than 10 percent in absolute value terms. Again, the results are essentially unchanged by this restriction.

[64] Additional information regarding the ESS is available online at epp.eurostat.ec.europa.eu/portal/page/portal/pgp_ess/about_ess.

G Prior Trends

As noted in the main text, Figure 4 and appendix Table A.4 show that the point estimates for the specification in equation 3 are statistically insignificant at conventional levels until after 2001, at which time they become statistically significant and increasingly negative.

To further examine the possibility of prior trends in the relationship between the NTR gap and U.S. manufacturing employment, we regress manufacturing industry employment growth on the NTR gap for every decade available in the NBER-CES manufacturing industry database starting with 1960. Results are reported in appendix Table A.5. We find that the coefficient on the NTR gap is negative and significant only for the last decade, 2000 to 2009, the period that includes the imposition of PNTR (2009 is the last year in which the data are available). The coefficient on the NTR gap is not statistically significant for the three prior decades, 1970 to 1980, 1980 to 1990, and 1990 to 2000 indicating that the NTR gap was not correlated with pre-PNTR employment trends in the three decades preceding PNTR. The coefficient on the NTR gap is positive and significant for the 1960 to 1970 decade, although the magnitude in terms of absolute value is substantially smaller than that associated with PNTR from 2000 to 2009. One potential explanation for this relationship is that the U.S. withdrew NTR status from all communist countries in the 1950s (and from Cuba in 1962) and, as a result, the NTR gap picks up tariff *increases* during this period. We note that the results in appendix Table A.5 are robust to including controls for industry capital and skill intensity, as well as the full set of time-invariant industry characteristics included in the baseline specification, equation 2.

H Non-Linear Estimates

Appendix Figure A.2 displays the relationship between predicted employment and the DID terms for the baseline linear versus non-linear specifications estimated in Sections 3.1 and 3.2.2 of the main text.

I Business Cycle Controls

Section 2.2 describes the robustness of the results to various controls for business cycle fluctuations. We note that examining the relationship between PNTR and employment *growth* over long time differences following the two business cycle peaks that occur during our sample period yields similar results, as reported in an earlier version of this paper (Pierce and Schott 2012c). That approach possesses two attractive attributes relative to the baseline specification reported in the main text. First, because there is only one post-PNTR observation and one pre-PNTR observation for each industry, it mitigates the serial correlation problems that can lead to inconsistently estimated standard errors in DID specifications with long time series, as discussed in Bertrand, Duflo and Mullainathan (2004). Second, because the pre-PNTR period is defined to correspond to a similar period in the previous business cycle, it follows Trefler (2004) in providing an implicit control for cyclicality.

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Appendix Tables and Figures

Table A.1: House Votes to Renew China's Temporary NTR Status, 1990-2001

	House Votes to Renew China's Temporary NTR Status		
	Dissaprove	Approve	%Disapprove
1990	247	174	57
1991	223	204	51
1992	258	135	59
1993	105	318	24
1994	75	356	17
1995	107	321	26
1996	141	286	32
1997	173	259	40
1998	166	264	38
1999	170	260	39
2000	147	281	34
2001	169	259	39
Mean	165	260	38

Notes: Table represents annual votes in the U.S. House of Representatives to renew China's NTR status. Total number of possible votes is 435.

	Dependent Variable: 1999 NTR Gap											
Initial ln(K/L)	-0.08 ***											-0.06 ***
	0.01											0.01
Initial ln(NP/L)		-0.05 ***										-0.05 ***
		0.02										0.02
Nunn Contract Intensity			0.16 ***									-0.05
			0.03									0.04
ΔChinese Import Tariffs (1996-05)				-0.10 *								-0.06
				0.06								0.05
ΔChinese Subsidy (1999-05)					-0.08 *							-5.31
					0.04							3.71
Share of Chinese Firms Eligible to Export (1999)						0.22 ***						0.17 ***
						0.05						0.05
MFA							0.812 ***					0.25
							0.234					0.21
Union Membership (1999)								-0.83 ***				-0.57 ***
								0.10				0.10
1{Advanced Technology Products}									0.03			0.02
									0.02			0.02
U.S. NTR Rate (1999)										-0.09		
										0.10		
U.S. Non-NTR Rate (1999)											0.81 ***	
											0.02	
Industries	370	370	370	370	370	370	370	370	370	370	370	370
R-squared	0.23	0.02	0.06	0.01	0.01	0.05	0.03	0.15	0.01	0.00	0.79	0.32
Covariate Mean	11.22	-1.33	0.51	-0.15	0.00	0.50	0.00	0.11	0.13	0.04	0.37	
Covariate Std Dev	0.85	0.41	0.22	0.13	0.00	0.15	0.00	0.07	0.34	0.07	0.16	

Notes: Table reports the results of industry-level OLS regressions of the 1999 NTR gap on industry attributes including: the log of 1990 capital and skill intensity, contract intensity (Nunn 2007), changes in Chinese import tariffs, changes in Chinese production subsidies, changes in Chinese export licensing requirements, MFA exposure, union membership rates, an indicator for whether the industry produces advanced technology products, NTR tariff rate and non-NTR tariff rate. Coefficient for constant is suppressed. Superscripts ***, ** and * represent statistical significance at the 1, 5 and 10 percent levels.

Table A.2: 1999 NTR Gap versus Other Industry Attributes

	$\ln(TFP_{it})$
1{y=1999} x NTR Gap_i	0.208
	0.191
1{y=2000} x NTR Gap_i	0.169
	0.185
1{y=2001} x NTR Gap_i	0.180
	0.248
1{y=2002} x NTR Gap_i	-0.203
	0.252
1{y=2003} x NTR Gap_i	-0.125
	0.245
1{y=2004} x NTR Gap_i	-0.227
	0.193
1{y=2005} x NTR Gap_i	-0.189
	0.202
Observations	3379
R2	0.49
Fixed Effects	i,t

Notes: Table displays the results of a Chinese four-digit CIC industry-year level OLS regression of log TFP in industry (i) in year (t) on year and industry fixed effects as well as interactions of the year fixed effects and the 1999 U.S. NTR gap. The data span 1998 to 2005. Coefficient estimates for all but the interactions are suppressed. Robust standard errors adjusted for clustering at the industry level are displayed below each coefficient. Superscripts ***, ** and * represent statistical significance at the 1, 5 and 10 percent levels.

Table A.3: PNTR and Chinese Productivity Growth

	$\ln(Emp_{it})$	$\ln(Emp_{it})$	$\ln(Emp_{it})$
1{year=1991} x NTR Gap_i	-0.056	-0.050	-0.060
	0.050	0.059	0.047
1{year=1992} x NTR Gap_i	-0.021	-0.031	-0.016
	0.063	0.073	0.075
1{year=1993} x NTR Gap_i	0.011	0.022	0.062
	0.080	0.090	0.085
1{year=1994} x NTR Gap_i	-0.001	0.036	0.083
	0.103	0.109	0.102
1{year=1995} x NTR Gap_i	0.008	0.059	0.072
	0.124	0.132	0.128
1{year=1996} x NTR Gap_i	-0.013	0.068	0.083
	0.142	0.160	0.154
1{year=1997} x NTR Gap_i	-0.034	0.032	0.049
	0.147	0.158	0.154
1{year=1998} x NTR Gap_i	-0.046	0.033	0.031
	0.157	0.174	0.175
1{year=1999} x NTR Gap_i	-0.142	-0.063	-0.071
	0.181	0.197	0.198
1{year=2000} x NTR Gap_i	-0.207	-0.078	-0.082
	0.209	0.219	0.219
1{year=2001} x NTR Gap_i	-0.296	-0.157	-0.149
	0.224	0.245	0.236
1{year=2002} x NTR Gap_i	-0.581 ***	-0.427 *	-0.396 *
	0.246	0.260	0.237
1{year=2003} x NTR Gap_i	-0.691 ***	-0.487 *	-0.447 *
	0.260	0.274	0.241
1{year=2004} x NTR Gap_i	-0.830 ***	-0.652 **	-0.431 **
	0.274	0.287	0.207
1{year=2005} x NTR Gap_i	-0.905 ***	-0.758 ***	-0.536 ***
	0.285	0.296	0.217
1{year=2006} x NTR Gap_i	-0.953 ***	-0.809 ***	-0.601 ***
	0.297	0.315	0.238
1{year=2007} x NTR Gap_i	-1.057 ***	-0.900 ***	-0.682 ***
	0.314	0.339	0.259
Observations	5,700	5,700	5,700
R2	0.98	0.99	0.99
Employment Weighted	Yes	Yes	Yes
Fixed Effects	i,t	i,t	i,t
Other Covariates Included?	No	Yes	Yes

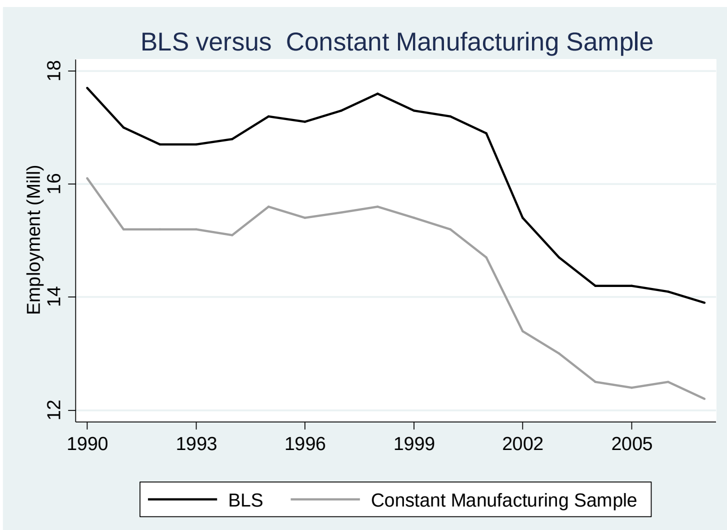
Notes: Each column displays the results of an industry-level OLS generalized difference-in-differences regression of the log employment on industry (i) and year (t) fixed effects, and interactions of year dummies and the NTR Gap. Regression reported in second column includes but does not display interactions of year dummies with industries' 1990 capital and skill intensity. Regression reported in third column also includes but does not display time-varying variables -- MFA exposure, NTR tariff rates, union membership rates -- as well as interactions of year dummies with time-invariant controls including the log of 1990 capital and skill intensity, contract intensity (Nunn 2007), changes in Chinese import tariffs, changes in Chinese production subsidies, changes in Chinese export licensing requirements and an indicator for whether the industry produces advanced technology products. Data span 1990 to 2007. Observations are weighted by 1990 industry employment. Robust standard errors adjusted for clustering at the industry level are displayed below each coefficient. Superscripts ***, ** and * represent statistical significance at the 1, 5 and 10 percent levels. Number of observations has been rounded to nearest thousand due to Census Bureau disclosure avoidance procedures.

Table A.4: PNTR and U.S. Manufacturing Employment (LBD)

	1960-1970	1970-1980	1980-1990	1990-2000	2000-2009
NTR Gap	0.464 ***	0.077	0.059	-0.074	-1.067 ***
	0.092	0.1	0.114	0.117	0.14
Constant	-0.024	0.005	-0.157	-0.033	-0.134
	0.031	0.035	0.04	0.041	0.049
Observations	379	379	379	379	379
R-squared	0.063	0.002	0.001	0.001	0.134

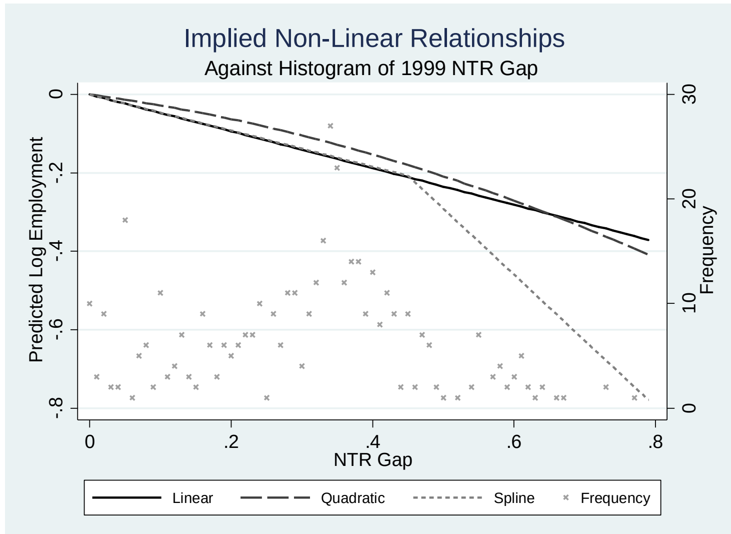
Notes: Table displays results of OLS regressions of industry-level employment growth (log difference) on the NTR Gap for all decades available in the NBER-CES Manufacturing Industry Database. Regressions are weighted by the initial value of industry employment. Superscripts ***, ** and * represent statistical significance at the 1, 5 and 10 percent levels.

Table A.5: PNTR and U.S. Manufacturing Employment by Decade (Public Data)



Notes: Figure compares annual manufacturing employment as of March in the publicly available BLS manufacturing employment series versus the constant manufacturing sample.

Figure A.1: BLS versus Constant Manufacturing Sample



Notes: Figure compares the predicted effect associated with the interaction of the post-PNTR indicator and the NTR gap according to the linear and non-linear specifications displayed in Table 3. These predicted effects are displayed against the histogram of the 1999 NTR gap.

Figure A.2: Implied Impact from Non-Linear Models (LBD)