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# The effects of import competition on worker health☆

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ABSTRACT

Occupational health is an important determinant of workers' welfare. Existing mechanisms and evidence from the international trade and occupational safety literatures combine to predict that import competition impacts work place injuries, especially at small firms that are most affected by foreign imports. We examine this prediction with novel data on injuries at US manufacturers using Chinese import growth in 1996–2007 as a shock to competition. The data show that injury rates in the competing US industries increase over the short to medium run, particularly at smaller establishments. Back-of-the-envelope calculations show that injury risk increases by 13% at the smallest establishments, the equivalent of a 1% to 2% reduction in workers' wages.



## 1. Introduction

Health and injury outcomes are important to workers and firms. Estimates reveal that in 2007 US firms and workers saw as many as 9 M occupational injuries and illnesses, 60,000 of which were fatal, that resulted in about $250B in costs to workers, firms and taxpayers (Leigh, 2011). Injury rates at US manufacturers are among the highest of any industry.[1] These same firms and workers also continue to see significant import competition from low cost markets, China in particular, which has important wage and employment effects. Labor standards, health and safety conditions are an important part of the employment contract, but have not been examined in the face of trade liberalizations or import competition. In this paper we ask if import competition from foreign markets affects injuries and worker health in US firms.

The link between import competition and worker injuries is supported by the intersection of evidence from the respective literatures. Import competition impacts firm survival (Pierce and Schott, forthcoming; Bloom et al., 2016; Bernard et al., 2006a, 2006b; Pavcnik, 2002), labor markets (Autor et al., 2013), and firm investments in new technology (Bustos, 2011; Ederington and McCalman, 2008). Literature on occupational safety and health (OSH) shows that injuries are determined by the relative priority the firm places on safety aside other goals like output (Zohar, 2000, 2002), technology upgrading and investments (Ruser and Butler, 2009), and labor market conditions (Probst and Brubaker, 2001). Together, the bodies of literature suggest that foreign competition will impact occupational injuries and worker welfare by affecting the firms' incentives related to output and safety. Welfare evaluations based on wages alone miss this effect of trade on workers' welfare.[2]

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[1] According to the Bureau of Labor Statistics estimates, there were 4.6 injury and illness cases per 100 workers in manufacturing in 2012, compared to 3.8 in natural resources and mining and 3.7 in construction.

[2] We do not estimate or compute general equilibrium welfare effects due to injuries. These computations will depend on whether firms face the true costs of their actions. Pouliakas and Theodossiou (2013) discuss information asymmetry, transaction costs, ineffective collective bargaining, and several other reasons why the social cost of injuries exceeds the private costs to firms and workers.

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We combine plant-level panel data on injuries and illnesses at US manufacturers from the Occupational Safety and Health Administration (OSHA) with an industry and time varying measure of Chinese import competition, adapted from recent work by Autor et al. (2013). We apply differencing, fixed-effect and instrumental variable strategies to identify the causal effect of trade liberalization and supply-driven import shocks on injury and illness rates at competing domestic plants.

The estimates show that import competition has significant consequences for worker injuries. Import competition raises injury rates for all but the largest plants. The effect is greatest for the smallest plants. Looking at 5-year log differences, the estimated elasticity of injury rates with respect to Chinese supply shocks is about 0.107 at the smallest decile of plants ($p < 0.01$) and 0.085 at the median ($p < 0.05$). Moving an industry from the 25th to the 75th percentile of Chinese import growth increases injury rates by about 12% at the smallest decile of plants in the industry and 10% at the median.

Estimates from the value of statistical life and injury literature show that the increases in injury risk resulting from Chinese import shocks are important in magnitude and are equivalent to wage decreases of approximately 0.4–1.6%.[3] For comparison, Arkolakis et al. (2012) discuss gains in real income due to trade liberalization of 1.4%. If variable trade costs are eliminated, Melitz and Redding (2015) find a welfare effect of 17%. We estimate that Chinese supply shocks in the US were responsible for between 62,000 and 90,000 injuries and illnesses annually during 2001–2007, about 7% of all cases in manufacturing, implying an annual cost to worker welfare between $2.2 and $9 billion each year.

Differencing and fixed-effect strategies mitigate the effect of unobserved plant, industry and geography specific characteristics. In addition, we tackle several identification problems. First, we consider long and short time differences to distinguish between short- and long-run effects of import competition and injuries. Second, underreporting is a recognized concern with self-reported injury data (Boone et al., 2011; Boone and van Ours, 2006). We estimate the model separately on the rates of injuries by severity and therefore susceptibility to misreporting. Third, it is difficult to identify exogenous trade shocks. In addition to instrumental variable techniques based on Autor et al., we identify import competition by adopting a liberalization in US trade policy towards China as a natural policy experiment according to Pierce and Schott (forthcoming) and examine the implications of global value chains using information in value added and intermediate input trade (Koopman et al., 2014). Finally, an assumption we maintain throughout is that small plants, those with fewer employees, are less productive and supply lower quality products (Melitz, 2003; Antoniades, 2015). Therefore, smaller firms face a greater threat of insolvency from import competition. Holmes and Stevens (2014) provide the alternative. Small plants – and especially those located close to metropolitan areas – produce specialty goods and are therefore shielded from import competition. We show that specialized plants are not driving our results. These robustness exercises also speak to regulatory differences across firms.

Our background section explains why import competition affects injuries in the short and long run and why the effect is heterogeneous across plants. For the short run, we combine results from the literatures on judgment proof firms and international trade to derive a prediction. In short, standard trade models and empirical evidence show that small, less productive firms are negatively affected by import competition and are more likely to drop out of the market (Pavcnik, 2002; Melitz, 2003; Bernard et al., 2006a, b; Pierce and Schott, forthcoming). Because firms are judgment proof, a higher shut-down probability implies that firms are less likely to be responsible for future costs like higher insurance premiums, demand penalties, and productivity losses associated with injuries that happen today. Therefore, at small firms an increase in import competition lowers the expected cost of an injury and leads these firms to operate with greater injury rates. In the long run, regulatory differences and existing equilibrium channels in the trade literature such as worker heterogeneity, technology upgrading, labor market institutions and quality differentiation are potentially associated with work place safety and affect firms across the entire size distribution. We do not have plant-level data to quantify coexisting mechanisms, but taking the measures of import competition as given we examine the effect of quality differentiation, technology upgrading, and worker heterogeneity across broad sectors and industries.

Our empirical exercise is closely related to recent studies on the labor market consequences of Chinese import competition in the US. China's exports to the US increased six-fold between 1996 and 2007, largely as a result of productivity gains associated with China's transition to a market economy and falling trade costs associated with its accession to the WTO in 2001 (Handley and Limão, 2016). This growth in foreign competition has been found to lower firm survival and overall employment in US manufacturing industries (Pierce and Schott, forthcoming) and lower income, employment, and labor force participation in local labor markets that house affected industries (Autor et al., 2013). Our empirical findings add to this literature evidence of non-pecuniary labor market effects on safety, injuries, and health. The results show that the effects of import competition on injuries are an important channel to consider for welfare overall and among workers at small plants in particular.

The rise in Chinese import exposure we study coincides with a period of decline in workplace injuries and illnesses in US manufacturing, which fell from 10.6 cases per 100 full-time workers in 1996 to 5.6 in 2007 (Bureau of Labor Statistics). This trend is due to factors such as workers demanding safer environments, firms investing more in safety, changes in technology,[4] and improvements in safety equipment (Ruser and Butler, 2009). Hummels et al. (2014) present theory that additional hours worked due to greater export opportunities leads to an increase in injuries, consistent with literature on health and safety. They find empirical support for this effect using Danish firm-level data. In contrast, we explain why firms facing import competition tradeoff safety for productivity and how this affects injury rates. This implies that total injuries may increase even if number of workers and number of hours remain fixed.

We also contribute to the literature on the interrelation between international trade and labor standards (see Brown et al., 1996; Brown, 2007). Most studies focus on the developing world.[5] Our theory and evidence show that occupational safety is also an important determinant of welfare in developed economies exposed to shocks in import competition.

The remainder of the paper is organized as follows: in Section 2 we discuss theory and regulatory background relating worker injury rates to firm survival and import competition. We describe our empirical strategy, data, and measurement in Section 3. In Section 4 we present our primary empirical results, and then we discuss the robustness of our findings and alternative explanations. Section 5 concludes.

## 2. Theory and regulatory background

This section motivates the empirical prediction that import competition leads especially small firms to sacrifice workplace safety. To this end, we also discuss several mechanisms and regulatory differences.

[3] Estimates for the value of nonfatal injuries vary across studies but generally range from 75% to 200% of yearly income. See Viscusi (1993) for a survey, and Hersch (1998) and Leeth and Ruser (2003) for later work.

[4] Between 1996 and 2007 US manufacturing employment fell 18.1% while real value added rose 60% as capital intensity increased 46% and output per production-worker hour increased 91% (NBER-CES Manufacturing Industry Database).

[5] In addition to wealth effects, long-run improvements in OSH can also be attributable to an increase in the relative price of labor and technological progress, both in production technology that alters workers exposure to risk and in safety technology (Ruser and Butler, 2009). Trade exposure may accordingly affect standards also through technology diffusion/spillovers from exporters and changes in factor prices, but neither channel seems a strong explanation of the effects among US workers studied here.