Assessing and Improving Working Conditions at Global Supply Chain Factories

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Today’s Agenda

1. Key indicators for suppliers’ code compliance
   - Study 1: Which Chinese supplier factories exhibit better health & safety code compliance? [work in progress]

2. Improving suppliers’ code compliance
   - Study 2: how do external pressures (work accidents, labor strikes) influence factories’ code compliance in China? [work in progress]

   - Study 3: When are social audits especially likely to improve working conditions in global supply chains [work in progress]
Which Chinese supplier factories exhibit better health and safety code compliance?

 qq Why China?

 ✓ As of 2015, China remains the largest manufacturer in the world (The Economist 2015).
 ✓ Weak labor law enforcement

 qq Why health and safety?

 ✓ Wages, working hours, child labor, environment, etc. are contentious.
 ✓ Workplace health and safety is a common concern: regulators/ workers/ brands/suppliers
   • Severe potential consequence: Over the past decade, factory accidents killed an average of 200 deaths every day based on statistics publicized by China’s State Administration of Work Safety.

Data

4,148 audits of 3,021 factories in 143 cities in 24 out of 31 provinces in Mainland China from 2014 to 2015

Health and safety checklist:

- General Work Facility (10)
- Emergency Preparedness (18)
- Occupational Injury (8)
- Machine Safety (11)
- Safety Hazards (10)
- Chemical and Hazardous Materials (14)
- Dormitory and Canteen (19)
Our sample: Distribution of audited factories in China

Our sample: audits by industry (N=4,148 of 3,021 factories)

<table>
<thead>
<tr>
<th>Industry</th>
<th>Number of Factories</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hardlines and Housewares</td>
<td>1114</td>
<td>21%</td>
</tr>
<tr>
<td>Apparel</td>
<td>669</td>
<td>13%</td>
</tr>
<tr>
<td>Electronics</td>
<td>337</td>
<td>10%</td>
</tr>
<tr>
<td>Textiles</td>
<td>254</td>
<td>7%</td>
</tr>
<tr>
<td>Personal Use Items</td>
<td>250</td>
<td>5%</td>
</tr>
<tr>
<td>Toys</td>
<td>248</td>
<td>9%</td>
</tr>
<tr>
<td>Accessories</td>
<td>243</td>
<td>5%</td>
</tr>
<tr>
<td>Footwear</td>
<td>170</td>
<td>4%</td>
</tr>
<tr>
<td>Sports and Outdoor Equipment</td>
<td>133</td>
<td>3%</td>
</tr>
<tr>
<td>Automotive</td>
<td>128</td>
<td>2%</td>
</tr>
<tr>
<td>Paper products</td>
<td>113</td>
<td>2%</td>
</tr>
<tr>
<td>Food</td>
<td>113</td>
<td>2%</td>
</tr>
<tr>
<td>Other Industries</td>
<td>376</td>
<td>7%</td>
</tr>
</tbody>
</table>

Preliminary
Health and safety code compliance scores

Scores: Mean = 76.5  SD = 18.2  MIN = 12  MAX = 100

Summary Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health and safety score</td>
<td>76.5</td>
<td>18.2</td>
<td>12</td>
<td>100</td>
</tr>
<tr>
<td>Factory age</td>
<td>10.8</td>
<td>6</td>
<td>1</td>
<td>59</td>
</tr>
<tr>
<td>Size (Total employees)</td>
<td>321</td>
<td>626</td>
<td>4</td>
<td>13500</td>
</tr>
<tr>
<td>Piece-rate payment</td>
<td>0.13</td>
<td>0.34</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Use sub-contractor(s)</td>
<td>0.16</td>
<td>0.36</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Workers’ union</td>
<td>0.25</td>
<td>0.43</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Certification</td>
<td>0.15</td>
<td>0.35</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Percentage of female employees</td>
<td>0.57</td>
<td>0.17</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>GDP per capita of the province (USD)</td>
<td>9945</td>
<td>1810</td>
<td>3507</td>
<td>15940</td>
</tr>
<tr>
<td>GDP growth of the province (%)</td>
<td>8.48</td>
<td>0.9</td>
<td>4.9</td>
<td>12.5</td>
</tr>
<tr>
<td>Population of the province (in 1,000,000)</td>
<td>79.4</td>
<td>28.0</td>
<td>9.0</td>
<td>107.2</td>
</tr>
</tbody>
</table>

N=4,148 of 3,021 factories
The Analysis

Examines differences between “comparable” factories.

Focusing on:
- Factory size
- Payment scheme
- Employee demographics
- Union status
- Certification

Controlling for:
- Factory industry
- Factory province attributes
  - GDP per capita
  - GDP growth
  - Total population
- Year audit conducted
- Auditor team’s characteristics
  - E.g. experience, knowledge, gender, number of auditors
- Buyers’ country

Use these factors to predict health and safety scores using OLS regression

Preliminary

Size (total employees) of the factory?

- Economies of Scale → more resources to improve working conditions
- Larger factories are more visible → more exposed to regulatory pressure

✓ Preliminary Finding: Larger factories are associated with higher Heath & Safety scores.
**Piece Rate Payment**

- Workers: research show that piece rate workers have higher workplace injuries → performance > safety (Bender et al., 2012)

- Factories: less committed to a long-term relationship with workers, thus invest less in workplace health and safety.

- Is this the case in China?
  - ✓ Anecdotal evidence suggests that factories using piece rate payment have worse working conditions (China Labor Watch, 2016).

**✓ Preliminary Finding:** Factories using piece rate payment have lower Heath & Safety scores.

**Female employees**

- Female employees are more attentive to occupational health and safety issues (Craig and Vodanovich 2003; Frone 1998).

- “Doing gender”: studies find male employees are constrained by societal imperatives for “manly” behavior (e.g. tough, proficient, cool-headed) such that they are less likely to reveal concerns for safety.

**✓ Preliminary Finding:** Factories have higher percentage of female employees have higher health and safety scores.
Local employees vs. migrants

- Theory 1: Local governments have political obligations to protect local citizens’ rights and prioritize local workers’ benefits, therefore factories might have to provide better working conditions to comply with local requirements (Gallagher 2006, 2016).

- Theory 2: Migrant workers are more flexible/mobile than local employees, thus factories might have to provide better working conditions to attract migrant workers.

**Preliminary Finding:**

- Red line - For factories that rely heavily on local workers, we see better conditions the more female the workforce.
- Green line - For factories that rely heavily on migrant workers, conditions don’t seem to vary based on the gender mix of the workers.
**Workers’ Union**

Do unionized factories have better health and safety scores than non-unionized ones?

- Selection
- Empowerment

- U.S. studies: The presence of workers unions is shown to have strong association with workplace safety conditions and employees’ safety consciousness (Gillen et al. 2002; Reilly, Paci, and Holl 1995)

**✓ Preliminary Finding:** Unionized factories have higher Health & Safety scores.

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**Certifications**

<table>
<thead>
<tr>
<th>Type</th>
<th>Specification</th>
<th>Target Industry</th>
<th>Number of factories</th>
<th>Number of industries</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO 9</td>
<td>Quality management</td>
<td>All</td>
<td>&gt;500</td>
<td>&gt;30</td>
</tr>
<tr>
<td>ISO 14</td>
<td>Environmental management</td>
<td>All</td>
<td>&gt;500</td>
<td>20-30</td>
</tr>
<tr>
<td>ICTI</td>
<td>Product, worker, environment etc.</td>
<td>Toy</td>
<td>200-250</td>
<td>10-20</td>
</tr>
<tr>
<td>OHSAS</td>
<td>Occupation health and safety</td>
<td>All</td>
<td>100-150</td>
<td>20-30</td>
</tr>
<tr>
<td>WRAP</td>
<td>Product, worker, environment etc.</td>
<td>Apparel, footwear, and sewn industry</td>
<td>50-100</td>
<td>&lt;10</td>
</tr>
<tr>
<td>SA8000</td>
<td>Social accountability</td>
<td>All</td>
<td>50-100</td>
<td>10-20</td>
</tr>
<tr>
<td>ISO/TS</td>
<td>Quality management</td>
<td>Automobile</td>
<td>&lt;50</td>
<td>&lt;10</td>
</tr>
<tr>
<td>BSCI</td>
<td>Social compliance</td>
<td>All</td>
<td>&lt;50</td>
<td>&lt;10</td>
</tr>
<tr>
<td>GSV</td>
<td>Secure trade flows, protect against terrorist acts, and to combat illegal trafficking.</td>
<td>All</td>
<td>&lt;50</td>
<td>10-20</td>
</tr>
</tbody>
</table>
Certifications

- To get certified, factories have to meet certain labor standards
- Upon certification, factories are subject to monitoring/inspection

**Preliminary Finding:** Certified factories are associated with higher Heath & Safety scores.

**Summary: preliminary results**

Factories have better health and safety code compliance when they...

- Are larger
- Are not using piece-rate payment
- Have higher percentage of female employees
- Have workers’ unions
- Are certified
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Labor Contention – Worker strikes by year

![Graph showing worker strikes by year](image)
Work Accidents by year

Workers’ strikes

Number of strikes:
- 1 - 10
- 11 - 30
- 31 - 65
- 66 - 150
- 151 - 301

* Provincial Capitals
* Provincial Borders
Country Borders
How do external pressures influence factories’ code compliance?

Potential mechanisms:
- Path A: Regulation pressure
- Path B: Public opinion pressure
- Path C: Workers’ pressure

Labor Strikes +

Work Accidents +

Code Compliance
How do external pressures influence factories’ code compliance?

- Written manual
- Accountable manager
- Manager training
- Seek workers’ feedback
- Self assessment
- Preventative actions

Managerial practices

Labor Strikes

Work Accidents

Code Compliance

Workers’ Union

Managerial practices

Labor Strikes

Work Accidents
How do external pressures influence factories’ code compliance?

Managerial practices

- Written manual
- Accountable manager
- Manager training
- Seek workers’ feedback
- Self assessment
- Preventative actions

Labor Strikes

Work Accidents

Workers’ Union

Code Compliance

Other factory characteristics

Size, Payment scheme, Worker demographics, etc.

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Study 3

Violations recorded in audits decline over subsequent audits

![Graph showing the decline in violations recorded in audits over subsequent audits.]


Study 3

This study examines audits in many countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Audits</th>
<th>Country</th>
<th>Audits</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>6,341</td>
<td>Thailand</td>
<td>41</td>
</tr>
<tr>
<td>USA</td>
<td>631</td>
<td>Brazil</td>
<td>40</td>
</tr>
<tr>
<td>India</td>
<td>288</td>
<td>Malaysia</td>
<td>40</td>
</tr>
<tr>
<td>Vietnam</td>
<td>186</td>
<td>Jordan</td>
<td>36</td>
</tr>
<tr>
<td>Indonesia</td>
<td>141</td>
<td>Peru</td>
<td>35</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>128</td>
<td>Canada</td>
<td>33</td>
</tr>
<tr>
<td>Philippines</td>
<td>121</td>
<td>Italy</td>
<td>30</td>
</tr>
<tr>
<td>Turkey</td>
<td>84</td>
<td>Guatemala</td>
<td>29</td>
</tr>
<tr>
<td>Mexico</td>
<td>77</td>
<td>Egypt</td>
<td>21</td>
</tr>
<tr>
<td>Pakistan</td>
<td>75</td>
<td>Countries with &lt;20 audits</td>
<td>185</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>55</td>
<td></td>
<td></td>
</tr>
<tr>
<td>South Korea</td>
<td>53</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total: 8,670 audits of 4,927 factories

Preliminary
### Study 3

**Industry distribution**

<table>
<thead>
<tr>
<th>Industry</th>
<th>Audits</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Garment</td>
<td>2,895</td>
<td>33%</td>
</tr>
<tr>
<td>Accessories</td>
<td>934</td>
<td>11%</td>
</tr>
<tr>
<td>Electronics</td>
<td>358</td>
<td>4%</td>
</tr>
<tr>
<td>Toys</td>
<td>269</td>
<td>3%</td>
</tr>
<tr>
<td>Furniture</td>
<td>225</td>
<td>3%</td>
</tr>
<tr>
<td>Footwear</td>
<td>191</td>
<td>2%</td>
</tr>
<tr>
<td>Building materials</td>
<td>143</td>
<td>2%</td>
</tr>
<tr>
<td>Paper, printing, and publishing</td>
<td>117</td>
<td>1%</td>
</tr>
<tr>
<td>Metal products</td>
<td>85</td>
<td>1%</td>
</tr>
<tr>
<td>Food, agriculture, beverages</td>
<td>73</td>
<td>1%</td>
</tr>
<tr>
<td>Chemicals and plastics</td>
<td>47</td>
<td>1%</td>
</tr>
<tr>
<td>Services</td>
<td>25</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Unknown (other and missing)</td>
<td>3,308</td>
<td>38%</td>
</tr>
</tbody>
</table>

Total: 8,670 audits of 4,927 factories

---

**Measuring compliance improvement**

Violations ($v_{ir}$) is sum of...

- Child labor (8)
- Forced or compulsory labor (5)
- Working hours (7)
- Occupational health & safety (31)
- Minimum wage (15)
- Disciplinary practices (6)
- Treatment of foreign workers and subcontractors (4)
- Subcontracting (3)

Excluded: canteen, dorms, freedom of association

All coded by the social auditor

Compliance improvement = $\ln \left( \frac{V_{now} + 1}{V_{prior} + 1} \right)$

Less sensitive to outliers than a count

We top code $V$ at 99thile to reduce outlier influence

Interpret log-log as % change

![Graph](image)

<table>
<thead>
<tr>
<th>Mean</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.22</td>
<td>0.86</td>
<td>-3.26</td>
<td>3.26</td>
</tr>
</tbody>
</table>
The Analysis

Predict compliance improvement based on...

Key independent variables
- press freedom index
- announced audit
- max training on audit team (log +1)

Institutional environment
- labor law
- per capita GDP (log)
- supplier NGO density (log)
- FDI inflows

Buyer pressure
- buyer country dummies
- per capita GDP

Potential conflicts of interest (prior & focal)
- audit paid by factory/agent (vs. brand)
- previous auditor

Auditor experience (prior & focal)
- maximum auditor tenure
- maximum auditor age

Auditor gender (prior & focal)
- all female audit team
- mixed gender audit team

Fixed effects for other audit conditions
- industry
- year audit conducted
- factory’s 1st, 2nd, ... 6th audit
- full then re-audit, re- then full, re- then re-

Use these factors to predict compliance improvement using OLS regression.

Study 3

3 factors might predict improvement

#1. A freer press in the supplier’s country

Documenting poor workplace conditions poses a bigger reputation risk (to the supplier and brands) when the information might leak via NGO or worker exposés:
- Supplier’s future business prospects from its current and prospective buyers
- Attracting government attention

Suppliers in such contexts have more to lose if they don’t improve.

H1. Suppliers in countries with greater press freedom will improve more than suppliers elsewhere

Press Freedom Index measures threats to journalists (imprisonment, physical attacks, censorship) each year for each country.

✓ Preliminary finding: Suppliers in countries with greater press freedom improve more than similar suppliers elsewhere.
#2. Cooperative (vs. coercive) monitoring

Prior research predicts that a government regulator’s cooperative approach will be reciprocated with compliance by regulated entities. Pre-announcing audits is one way buyers can exhibit a cooperative approach:

- Exhibits trust because factories could hide problems
- Makes supplier less defensive and more willing to cooperate and comply

H2. Suppliers will improve more when they are subjected to a cooperative monitoring approach (that is, when prior inspection is announced)

✓ Preliminary finding: Suppliers improve more following announced audits, compared to similar suppliers following an unannounced one.

Note: 76% of audits in this sample are announced.

#3. More knowledge transfer from auditors

Safety improved after Cal-OSHA inspections, suggesting inspectors might monitor and teach. Some assert “compliance assistance” improves working conditions:

- Both require auditors to transfer knowledge of problem-solving

What auditor knowledge might improve conditions?

- Identifying code violations and conditions that cause them (in their training)
- Auditors can apply this knowledge to identify root causes and share solutions

H3. Suppliers will improve more following audits by more knowledgeable auditors

✓ Preliminary finding: Compared to those by average auditors, audits by auditors with more training led to more compliance improvement.
Study 3

3 factors might predict improvement

There might be synergies between factors 2 & 3, if improvement is greatest when (a) auditors are more knowledgeable and (b) factories are more willing to cooperate.

H4. Suppliers subject to a cooperative monitoring approach will benefit more from knowledgeable auditors than other suppliers.

Study 3

Summary: When are social audits especially likely to improve working conditions in global supply chains?

1. In countries with more press freedom
2. When prior inspection was announced (cooperative approach)
3. When prior audit team was more knowledgeable (knowledge transfer)
4. And more knowledgeable auditors are more influential in a cooperative context
To obtain these papers, see [www.people.hbs.edu/mtoffel/](http://www.people.hbs.edu/mtoffel/)

**Working conditions in global supply chains**


**Working conditions in the United States**

  - Why safety managers should welcome OSHA inspections: Results from a natural field experiment in California. *The Compass: Newsletter of the American Society of Safety Engineers*, 2014 (link)

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**We welcome your feedback**

1. **Which findings resonate with you?**
2. **Which findings surprise you?**
3. **For future studies, what are the most critical questions about factories/workers that we should research?**

- **Improvement study 2**
  - More knowledgeable auditors
  - Cooperative auditing
  - Press freedom

- **Improvement study 3**
  - Code Compliance
  - Workers' Union
  - Other factory characteristics
  - Strikes & Disputes
  - Work Accidents
  - Managerial practices
We welcome your input and feedback throughout the day

Thank you!