Tax Evasion and the Minimum Wage: Evidence from Hungary

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Dániel Prinz (Harvard University)
László Sándor (University of Luxembourg)
November 2020
Can tax evasion around the minimum wage be a rationale for substantial taxation of minimum wage earners?
“In a model with extensive labor supply responses only, a binding minimum wage associated with a positive tax rate on minimum wage earnings is second-best Pareto inefficient.”

— Lee and Saez (2012)
But It Is Taxed in Most Developed Countries

Source: OECD FOCUS on Minimum wages after the crisis: Making them pay (May 2015)
This Paper

• Leverage a tax reform in Hungary that increased audit threat for wages below a specific level (double minimum wage)
• Exploit detailed administrative data: track employment, earnings, benefit uptake, worker and firm characteristics
• Examine impact of reform on reported earnings and formal employment
• Estimate extent of underreporting at the minimum wage
• Examine overall fiscal impact of minimum wage taxation policy
• Develop a model of tax evasion around the minimum wage
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   • Incentives: Allingham and Sandmo (1972); Ulyssea (2020)
   • Causal impact of enforcement strategies: Slemrod (2019)
   • Random audits: Bérgolo et al. (2017); Kleven et al. (2011)
   • Paper trail: Pomeranz (2015); Naritomi (2019); Best (2014); Kleven, Kreiner and Saez (2016)
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2. New evidence on tax evasion at the minimum wage
   • Elek, Köllő, Reizer and Szabó (2012); Reizer (2011); Tonin (2011)

3. Discuss theory of minimum wage taxation in the presence of underreporting
   • Lee and Saez (2012); Lavecchia (2020)
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Between September 2006 and December 2010, employers had to pay social security contributions based on the double of minimum wage. They could request exemptions for lower wages through a separate form. Threat of audit for companies below this threshold. (Higher minimum wage for skilled jobs introduced in 2006)
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Background: Hungarian Double Minimum Wage Reform

- Between September 2006 and December 2010, employers had to pay social security contributions based on the double of minimum wage.
- They could request exemptions for lower wages through a separate form.
- Threat of audit for companies below this threshold.
Between September 2006 and December 2010, employers had to pay social security contributions based on the double of minimum wage. They could request exemptions for lower wages through a separate form. Threat of audit for companies below this threshold. (Higher minimum wage for skilled jobs introduced in 2006.)
Data and Sample

• Use administrative data from Hungary
• Covers 2003-2011
• 50% sample of 2003 population aged 5-74 (with odd DOB)
• Links employment, tax, pension, health, labor, etc.
• Use data for a representative month (March)
• Restrict to sample aged 18-65
• Drop cases where an individual has more than one job
• Use age, gender, labor market status, wages, types of social security benefits received, classification of occupation, location (observed in 2003), firm size, firm ownership (domestic or foreign)
• Don’t observe hours
• Separate private sector employees, public sector employees, self-employed
Evidence on Tax Evasion and Reporting Response
Evidence of Bunching: Private Sector Employees

M: the minimum wage,
G: the guaranteed minimum,
D: double the minimum.
Evidence of Bunching: Self-Employed

M: the minimum wage,
G: the guaranteed minimum,
D: double the minimum.
Evidence of Bunching: Public Sector Employees

M: the minimum wage,
G: the guaranteed minimum,
D: double the minimum.
Monthly Earnings, March 2005 (Thousand HUF)

Monthly Earnings, March 2003 (Thousand HUF)

16.783
15.626
14.468
13.311
12.153
10.996
9.8387
8.6813
7.5239
6.3665
5.2091
4.0517
2.8943
1.7369
.57952

M: the minimum wage.
Transitions: Private Sector Employees 2005 → 2007

M: the minimum wage,
G: the guaranteed minimum,
D: double the minimum.
Transitions: Self-Employed 2003 → 2005

Monthly Earnings, March 2005 (Thousand HUF)

Monthly Earnings, March 2003 (Thousand HUF)

Percent

0 200 0 200
Monthly Earnings, March 2003 (Thousand HUF)

M: the minimum wage.
Transitions: Self-Employed 2005 → 2007

Monthly Earnings, March 2007 (Thousand HUF)

- M: the minimum wage,
- G: the guaranteed minimum,
- D: double the minimum.
Transitions: Public Sector Employees 2003 → 2005

Monthly Earnings, March 2005 (Thousand HUF)

Monthly Earnings, March 2003 (Thousand HUF)

M: the minimum wage.
Transitions: Public Sector Employees 2005 → 2007

Monthly Earnings, March 2007 (Thousand HUF)

0 200

Monthly Earnings, March 2005 (Thousand HUF)

M: the minimum wage,
G: the guaranteed minimum,
D: double the minimum.
### Summary of Main Results

<table>
<thead>
<tr>
<th></th>
<th>Private Employee</th>
<th>Self-Employed</th>
<th>Public Employee</th>
</tr>
</thead>
<tbody>
<tr>
<td>MW 2005</td>
<td>19.87%</td>
<td>68.53%</td>
<td>1.13%</td>
</tr>
<tr>
<td>DMW 2005</td>
<td>1.90%</td>
<td>0.32%</td>
<td>2.57%</td>
</tr>
<tr>
<td>MW 2007</td>
<td>5.77%</td>
<td>30.89%</td>
<td>1.14%</td>
</tr>
<tr>
<td>GMW 2007</td>
<td>7.83%</td>
<td>3.83%</td>
<td>0.97%</td>
</tr>
<tr>
<td>DMW 2007</td>
<td>5.39%</td>
<td>16.28%</td>
<td>2.51%</td>
</tr>
<tr>
<td>% MW 2005 → DMW 2007</td>
<td>10.50%</td>
<td>19.16%</td>
<td>2.04%</td>
</tr>
<tr>
<td>N 2005</td>
<td>966,036</td>
<td>112,318</td>
<td>298,381</td>
</tr>
<tr>
<td>N 2007</td>
<td>1,022,801</td>
<td>108,613</td>
<td>285,071</td>
</tr>
</tbody>
</table>

MW (GMW, DMW) earners: the MW (GMW, DMW) plus <5,000 HUF.
Regression Framework

Event study:

$$DMW_{it} = \beta_0 + \sum_{t=2003}^{2011} \beta_{1t} P_{Eit} + \sum_{t=2003}^{2011} \beta_{2t} S_{Eit} + \alpha_E + \tau_t + \varepsilon_{it} \quad (1)$$

where

- $i$ indexes workers
- $P_{Eit}$ is an indicator for private sector employee
- $S_{Eit}$ is an indicator for self-employed
- $\alpha_E$ are sector fixed effects (public sector employee vs private sector employee vs self-employed)
- $\tau_t$ are year fixed effects
3.5% more DMW earners after reform than secular trends in the public sector.
16% more DMW earners after reform than secular trends in the public sector.
Cross-Sectional Anomalies: Gender

Anomalies only in sector allowing evasion and only after revealing reform.
Cross-Sectional Anomalies: Skill-level of Occupation

<table>
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<tr>
<td>1.5</td>
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<td>3.5</td>
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</tr>
</tbody>
</table>

Graph showing the mean skill level across different relative bins for public and private employees in 2005 and 2007.
Cross-Sectional Anomalies: Urban vs. Rural

Share in Budapest

MW
DMW

Relative Bin

Public, 2005
Public, 2007
Private Employees, 2005
Private Employees, 2007
Larger responses correlate with suspected predictors of evasion.
Heterogeneity: Firm Characteristics

By Ownership

By Size

By Industry

Heterogeneity: Firm Quality

Export Share in Revenues Q1
Export Share in Revenues Q2
Export Share in Revenues Q3
Export Share in Revenues Q4
Total Factor Productivity Q1
Total Factor Productivity Q2
Total Factor Productivity Q3
Total Factor Productivity Q4


By Export  By TFP
Correlation consistent with local salience of the reform (or audit threats and tax morale in general).
"Peer effects" from leave-out means consistent with firm market power and collusion.
Summary: Substantial Tax Evasion Around Minimum Wage

1. Wages in Hungary bunch at the minimum wage
2. When “double minimum wage” rule is introduced, they start bunching at the double minimum wage
3. Interpret as lower bound on tax evaders
4. Degree of bunching decreases over time
5. No bunching after phase-out
6. Largest effect for self-employed, some effect for private employees, no effect for public employees
7. Driven by
   • Construction and trade
   • Small firms
   • Domestic firms
8. Concentrated in firms and regions
Evidence on Formal Employment
Response
Regression Framework

13-month exit rates between Dec of year $t$ and Jan of $t + 2$.
(Spells smooth earnings from October GMW to March in ’06.)

Event study:

$$ Exit_{it} = \beta_0 + \sum_{t=2004}^{2011} \beta_t MW_{it} + \alpha_B + \tau_t + \epsilon_{it} $$

(2)

where

- $i$ indexes workers
- $MW_{it}$ is an indicator for being in the minimum wage bin (vs in the control wage bin)
- $\alpha_B$ are wage bin fixed effects (minimum wage vs control wage bin)
- $\tau_t$ are year fixed effects
Regression Estimates: Private Sector Employees

0.02 0.04 0.06 0.08 Share of Workers Reporting the Minimum Wage vs Other Bin Leaving Formal Employment

Year

2% exit effect irrespective of control group or controls.
Regression Estimates: Public Sector Employees

Share of Workers Reporting the Minimum Wage vs Other Bin Leaving Formal Employment

Year

Relative to Bin 2, No Controls
Relative to Bin 2, With Controls
Relative to Bin 3, No Controls
Relative to Bin 3, With Controls
Relative to Bin 4, No Controls
Relative to Bin 4, With Controls
Heterogeneity: By Gender (Private Employees)

<table>
<thead>
<tr>
<th>Year</th>
<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
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<tr>
<td>2011</td>
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</tbody>
</table>
Concentration: By Firm

Correlation positive only for firms laying off more MW earners than similar colleagues.
Long-Run Effects: The Difference b/w 2005 MW and Higher-Earning Leavers

<table>
<thead>
<tr>
<th>Year</th>
<th>Working</th>
<th>Unemployment Insurance</th>
<th>Out of Labor Force</th>
<th>Other Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
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<td></td>
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</table>

The timelines contrast Jan ’07 leavers by Dec ’05 earning bins.
Formal Argument
Bunching Framework

Jobs with different productivity ($\theta$) set efficiency wages ($w$) and evasion ($e$):

$$\max_{w,e} V(w, e \mid \theta) = f(w \mid \theta) - w - \tau \cdot (w - e)$$

Declared Earnings

$$- \rho \cdot p \cdot \tau \cdot e - g(e)$$

Expected Audit Cost Manipulation Cost

This leads to bunching at thresholds, e.g. if $p$ drops from $p_0$ to $p_1 < p_0$ for $w - e \geq D$

This can easily extend to multiple thresholds, e.g. new bunch at $D$ if stricter enforcement on $[M, D]$.  

(Note: no heterogeneity in evasion costs.)
Under some mild assumptions, our model predicts the following partition of jobs at the bottom of the labor market:

- **Firms making loss at M**
  - $e = 0; w = M; V > 0$
- **Bunching evaders**
  - $w - e = M; e > 0; V > 0$
- **Bunching true min wage employers**
  - $w - e > M; e > 0; V > 0$

The diagram shows the partition of jobs with four thresholds: $\Theta_1$, $\Theta_2$, $\Theta_3$, and $\Theta_4$. The intervals are labeled with conditions for each segment.
Predicted Effects of Stricter Enforcement between M and D

Note that the mass bunching at the new notch need not come from the old.
Then we use the same model to show that enforcement and minimum wages are substitutes for the social planner.

**Theorem**

\[ \frac{d^2W}{dMdp} < 0, \text{ thus the marginal social value of raising the minimum wage rises when audit probabilities fall. Higher minimum wages are socially optimal in an environment with looser enforcement.} \]
Conclusion
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• Empirical results suggest substantial tax evasion around the minimum wage in Hungary
• Large reporting response to an increase in the audit threat
• But increase in the probability of leaving formal employment
• Implies important trade-off for tax policy
• Higher minimum wage or reporting default might substitute for enforcement
• Could rationalize high and taxed minimum wages
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Thank you!
## Summary Statistics

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<tr>
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<th>Priv Sector Emp Mean</th>
<th>Self-emp Mean</th>
<th>Public Sector Emp Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td>38.45</td>
<td>41.93</td>
<td>42.17</td>
</tr>
<tr>
<td><strong>Share Male</strong></td>
<td>0.56</td>
<td>0.65</td>
<td>0.27</td>
</tr>
<tr>
<td><strong>Monthly Earnings (HUF)</strong></td>
<td>154,780</td>
<td>72,932</td>
<td>191,774</td>
</tr>
<tr>
<td><strong>Education Level</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>0.13</td>
<td></td>
<td>0.14</td>
</tr>
<tr>
<td>Lower Secondary</td>
<td>0.49</td>
<td></td>
<td>0.12</td>
</tr>
<tr>
<td>Upper Secondary</td>
<td>0.26</td>
<td></td>
<td>0.33</td>
</tr>
<tr>
<td>Tertiary</td>
<td>0.12</td>
<td></td>
<td>0.41</td>
</tr>
<tr>
<td><strong>Person-Year Observations</strong></td>
<td>8,946,562</td>
<td>960,638</td>
<td>2,496,331</td>
</tr>
<tr>
<td><strong>Unique Individuals</strong></td>
<td>1,867,828</td>
<td>273,879</td>
<td>506,534</td>
</tr>
</tbody>
</table>
## Summary Statistics of Firm Indicators

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observed Firm Size</td>
<td>427</td>
<td>1,382</td>
<td>28</td>
</tr>
<tr>
<td>Foreign Ownership</td>
<td>0.33</td>
<td>0.47</td>
<td>0</td>
</tr>
<tr>
<td>Export Share of Revenue</td>
<td>0.33</td>
<td>0.39</td>
<td>0.09</td>
</tr>
<tr>
<td>Total Factor Productivity</td>
<td>0.77</td>
<td>1.03</td>
<td>0.77</td>
</tr>
</tbody>
</table>
### Pooled Regression: Reporting Response

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post $\times$ Private Sector Employee</td>
<td>0.023***</td>
<td>0.023***</td>
</tr>
<tr>
<td></td>
<td>[0.001]</td>
<td>[0.001]</td>
</tr>
<tr>
<td>Post $\times$ Self-Employed</td>
<td>0.114***</td>
<td>0.115***</td>
</tr>
<tr>
<td></td>
<td>[0.001]</td>
<td>[0.001]</td>
</tr>
<tr>
<td>Post $\times$ Workers of Public Firms</td>
<td>0.017**</td>
<td>0.017**</td>
</tr>
<tr>
<td></td>
<td>[0.008]</td>
<td>[0.008]</td>
</tr>
<tr>
<td>Controls</td>
<td>(\times)</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>12,385,920</td>
<td>12,328,514</td>
</tr>
</tbody>
</table>

Robust standard errors clustered at the firm level in brackets

*** $p<0.01$, ** $p<0.05$, * $p<0.1$
### Pooled Regression: Reporting Response

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</tr>
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<tr>
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<td>0.022***</td>
<td>0.022***</td>
</tr>
<tr>
<td></td>
<td>[0.002]</td>
<td>[0.002]</td>
</tr>
<tr>
<td>Post × Self-Employed</td>
<td>0.114***</td>
<td>0.115***</td>
</tr>
<tr>
<td></td>
<td>[0.001]</td>
<td>[0.001]</td>
</tr>
<tr>
<td>Controls</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>N</td>
<td>12,333,359</td>
<td>12,276,191</td>
</tr>
</tbody>
</table>

Robust standard errors clustered at the firm level in brackets

*** p<0.01, ** p<0.05, * p<0.1
### Heterogeneity: By Gender

<table>
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<th>Female</th>
<th>Male</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>0.06</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>0.05</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>0.03</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>0.04</td>
<td></td>
</tr>
</tbody>
</table>

The diagram shows the share of workers reporting the double minimum wage by gender from 2003 to 2011. The line graph indicates a generally decreasing trend for both genders, with a peak in 2007 for male workers.
Heterogeneity: By Education

Share of Workers Reporting the Double Minimum Wage

Year
Primary
Lower Secondary
Upper Secondary
Tertiary

2003
2004
2005
2006
2007
2008
2009
2010
2011
Heterogeneity: By Ownership

<table>
<thead>
<tr>
<th>Year</th>
<th>Domestic</th>
<th>Foreign</th>
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</thead>
<tbody>
<tr>
<td>2003</td>
<td></td>
<td>0.03</td>
</tr>
<tr>
<td>2004</td>
<td></td>
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<td></td>
<td>0.02</td>
</tr>
<tr>
<td>2009</td>
<td></td>
<td>0.01</td>
</tr>
<tr>
<td>2010</td>
<td></td>
<td>0.01</td>
</tr>
<tr>
<td>2011</td>
<td></td>
<td>0.01</td>
</tr>
</tbody>
</table>
Heterogeneity: By Export Share in Revenues

Share of Workers Reporting the Double Minimum Wage

Year Q1 Q2 Q3 Q4
2003 0.02 0.03 0.04 0.05
2006 0.02 0.03 0.04 0.05
### Regression Estimates: Private Sector Employees

<table>
<thead>
<tr>
<th>Reference bin:</th>
<th>(1) Bin 8</th>
<th>(2) Bin 8</th>
<th>(3) Bin 9</th>
<th>(4) Bin 9</th>
<th>(5) Bin 10</th>
<th>(6) Bin 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007 × MW</td>
<td>0.031***</td>
<td>0.032***</td>
<td>0.029***</td>
<td>0.030***</td>
<td>0.025**</td>
<td>0.026**</td>
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<tr>
<td></td>
<td>[0.003]</td>
<td>[0.003]</td>
<td>[0.003]</td>
<td>[0.003]</td>
<td>[0.003]</td>
<td>[0.003]</td>
</tr>
<tr>
<td>Controls</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td></td>
<td>×</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>1397225</td>
<td>1387777</td>
<td>1351921</td>
<td>1342823</td>
<td>1322537</td>
<td>1313606</td>
</tr>
</tbody>
</table>
### Regression Estimates: Public Sector Employees

<table>
<thead>
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<th>(2) Bin 8</th>
<th>(3) Bin 9</th>
<th>(4) Bin 9</th>
<th>(5) Bin 10</th>
<th>(6) Bin 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007 × MW</td>
<td>-0.013</td>
<td>-0.015</td>
<td>-0.014</td>
<td>-0.016</td>
<td>-0.016</td>
<td>-0.018</td>
</tr>
<tr>
<td></td>
<td>[0.014]</td>
<td>[0.012]</td>
<td>[0.014]</td>
<td>[0.012]</td>
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<td>[0.012]</td>
</tr>
<tr>
<td>Controls</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>N</td>
<td>157,904</td>
<td>157,425</td>
<td>151,468</td>
<td>151,061</td>
<td>142,247</td>
<td>141,871</td>
</tr>
</tbody>
</table>

Robust standard errors, clustered at the firm level in brackets

*** p<0.01, ** p<0.05, * p<0.1