Sustainability of the taxation systems: 
Empirical evaluation

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Motivation

Europe 2020 Strategy

...to deliver new – qualitative growth to Europe

• Smart
• Inclusive
• Sustainable

What is the role of the tax policy?

Taxing for „growth“ instead of „sustainable growth“ created sustainability gaps in taxation systems.
Motivation

Sustainability gaps:
1. High and increasing weight of labour taxes
2. Decreasing importance of Pigovian taxes
3. Intense tax competition including profit shifting
4. Tax compliance and tax fraud
5. Decreasing progressivity of tax systems

New challenges for tax policy makers – to close the sustainability gaps.
Motivation

New challenges provide new dynamics for tax harmonization initiatives not only in Europe, but also around the World.

Politically acceptable initiative leading to a kind of harmonization in the area of taxation policy:

The Call for **Sustainable Tax Systems in the EU countries**
Objectives

We propose a **general concept of tax system sustainability**.

We develop a **model for evaluation and measurement of sustainability** of the tax system applicable across the EU countries.
Literature

A lack of literature focusing on tax system sustainability


• **Multi-dimensional view of sustainability.** Brundtland (1987), McKenzie (2004), Talbert, Cobb and Slatery (2006), Stiglitz, Sen and Fitousi (2009),

• **Taxation policy and tax system sustainability**

...
Literature

Taxation policy and tax system sustainability ...

...?

Literature usually mentions the role of taxes in keeping fiscal sustainability. Thompson (2002), Shick (2005), Merola and Sutherland (2013)

..or it deals with issues of fair taxation, equality in taxation. Stahel (2013), Beck (2015), Ooghe and Peichel (2015),.
Definition of tax system sustainability

Due to lack of literature, original definition of sustainability of the tax system is needed.

• Based on current generation’s priorities (set in Europe 2020)
• Based on contemporary literature on sustainability.

The sustainable tax system of a country – the tax system comprising of tax tools and tax-related legislative measures, which contribute in sufficient extent to sustainability of economic, social, environmental and institutional dimensions. Such system supports meeting the needs of present generation without limiting the future ones in the before mentioned areas.
Interactions between the tax system and dimensions (pillars)
Empirical strategy

1. **Conceptual definition** of Tax system sustainability (TSS)
2. **Technical definition** of TSS for the model allowing its application
3. Definition of **dimensions, policy areas, tax tools** and tax-related legislative measures contributing to sustainability in each dimension. **Evaluation questions** formulation.
4. Collecting data, application of the model
5. Evaluation and identification **sustainable, strongly sustainable and unsustainable** dimensions regarding evaluated tax system
6. Estimation of the (total) **Tax Sustainability Index** based on partial dimensions’ indices of sustainability
7. Identification of **policy areas**, which contribute to sustainability in deficient extent (or not at all)
8. Validation of the index
Economic sustainability

Let \( \omega_1 \) be the maximal number of tax tools contributing to sustainability in the economic dimension. If at least \( \omega_1/3 \) acts are applied in a particular economy, then its tax system is \textit{economically sustainable}. \((s1)\)

The limit of \( \omega_1/3 \) reflects the assumption of unsustainability being the result of \textit{serious tax system failure}.

Hence, only in case that less than one third of all possible instruments are applied the \textit{non-sustainable} situation occurs.
Social, environmental and institutional sustainability

Let $\omega_2$, $\omega_3$, and $\omega_4$, respectively, be the maximal number of tax tools supporting sustainable social, environmental and institutional dimensions.

If at least $\omega_2 / 3$, $\omega_3 / 3$ and $\omega_4 / 3$ measures, respectively, are applied in a particular economy, then its tax system is **socially, environmentally and institutionally sustainable**, respectively.

(s2)
Strong sustainability

If at least 2/3 $\omega_1$, 2/3 $\omega_2$, 2/3 $\omega_3$ and 2/3 $\omega_4$ measures, respectively, are applied in a particular economy, then its tax system is **economically, socially, environmentally and institutionally strongly sustainable**, respectively.

Note: *The division between strong and weak sustainability is rather technical. Our approach is different from Dasgupta (2004, 2007) and Davies (2013) who attribute strong and weak sustainability to the use of natural capital.*
Tax system sustainability

The tax system is *sustainable* if

(1) it is sustainable at least in 3 out of 4 dimensions (economic, social, environmental and institutional) according to Definitions \((s1)\) and \((s2)\), and

(2) at least 1/3 out of the total number \(\omega_1 + \omega_2 + \omega_3 + \omega_4\) of tax tools and legislative measures are applied.
### Evaluation of sustainability in dimensions (extract)

<table>
<thead>
<tr>
<th>Economic Dimension</th>
<th>Policy areas</th>
<th>Tax System Tools</th>
<th>Evaluation questions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Smart growth potential</strong> (smart growth, knowledge driven growth, productivity, innovation activities, production factors)</td>
<td>Tax tools for support of innovation activities</td>
<td>Does the tax system provide special treatment of R&amp;D costs?</td>
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<td>Does the tax system provide patent boxes regime (i.e. preferential taxation for intellectual property rights)?</td>
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<td>Does the tax system provide any type of tax incentives for innovations?</td>
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<td></td>
<td></td>
<td>Tax tools for support of knowledge driven growth</td>
<td>Does corporate tax system provide possibility to deduct donations to educational institutions from the tax base?</td>
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<tr>
<td></td>
<td><strong>Sustainable Consumption</strong> (household final consumption expenditure, better quality of life, minimising use of natural resources, decreasing of emission of waste and pollution)</td>
<td>Tax tools influencing sustainable consumption of households</td>
<td>…</td>
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</table>
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**Descriptive sustainability criteria**

The answer to each question is quantified by value $h$ as follows:

**Binary answers**

- $h = 1$ for answer with positive effects on tax system,
- $h = 0$ for the opposite case.

**Numeric answer** with value $c$ from the interval $[a, b]$, the higher value the better

$$h = (c-a)/(b-a).$$

**Numeric answer** with value $c$ from the interval $[a, b]$, the lower value the better

$$h = 1-(c-a)/(b-a).$$
Criteria weights

We assume that particular measures may differ in their importance, i.e. different measures should be assigned by differing weights in our calculations.

- **Scenario A** (equal weights of all measures): All the measures are taken equally important.
- **Scenario B** (equal weights of small groups of measures): The related measures are clustered into small groups; all small groups are taken equally important.
- **Scenario C** (equal weights of larger groups): Small groups of measures are clustered into larger groups, larger groups are taken equally important.
- **Scenario D** (equal weights of larger groups, no small groups): We consider only larger groups without internal structure, larger groups are equally important.
Economic Sustainability Index

Let $\omega$ is the maximal number of tax-related legislative measures that can be applied and $h_i (0 \leq h_i \leq 1, \ i = 1, \ldots, \omega_1)$ is a number quantifying the extent to which the positive effects of the measure $i$ is applied in the system.

Denote $n$ number of small groups of related measures, $a_j$ the number of measures within a small group $j (j=1,\ldots,n)$ and $h_j^g = h_i$, where $i = \gamma + \sum_{a=0}^{j-1} \alpha_a$ with $a_0=0$.

Denote $N$ number of large groups of related measures, $b_k$ the number of measures within a large group $k (k=1,\ldots,N)$ and $h_k^g = h_i$, where $i = \gamma + \sum_{a=0}^{k-1} \alpha_a$ with $a_0=0$.

Denote $m_k$ number of small groups in the large group $k$ and denote $\sigma_k^\delta = \frac{\sum_{\gamma=1}^{\omega_j} h_j^\gamma}{\alpha_j}$, where $j = d + (k-1)m_k$. 
Economic Sustainability Index

Economic sustainability enumerated according to scenario A, B, C and D is defined as

\[ \text{ECSI}(A) = \frac{\sum_{i=1}^{\omega_1} h_i}{\omega_1}, \]

\[ \text{ECSI}(B) = \frac{1}{n} \sum_{j=1}^{n} \frac{\sum_{\gamma=1}^{\alpha_j} h_j}{\alpha_j}, \]

\[ \text{ECSI}(C) = \frac{1}{N} \sum_{k=1}^{N} \frac{\sum_{\delta=1}^{m_k} \sigma_k}{m_k}, \]

\[ \text{ECSI}(D) = \frac{1}{N} \sum_{k=1}^{N} \frac{\sum_{\gamma=1}^{\beta_k} h_k}{\beta_k}. \]
Tax Sustainability Index

Tax sustainability index TASI is defined as

$$TASI = \frac{(ECSI+SOSI+ENSI+INSI)}{4},$$

where we have chosen one particular scenario for enumerating all sustainability indexes.
# Tax System Sustainability Index: The Case of the Czech Republic

<table>
<thead>
<tr>
<th>Scenario</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
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</thead>
<tbody>
<tr>
<td>ECSI</td>
<td>0.43</td>
<td>0.45</td>
<td>0.48</td>
<td>0.46</td>
</tr>
<tr>
<td>SOSI</td>
<td>0.58</td>
<td>0.68</td>
<td>0.68</td>
<td>0.68</td>
</tr>
<tr>
<td>ENSI</td>
<td>0.26</td>
<td>0.26</td>
<td>0.26</td>
<td>0.26</td>
</tr>
<tr>
<td>INSI</td>
<td>0.41</td>
<td>0.38</td>
<td>0.38</td>
<td>0.38</td>
</tr>
<tr>
<td>TASI</td>
<td>0.42</td>
<td>0.44</td>
<td>0.45</td>
<td>0.45</td>
</tr>
</tbody>
</table>
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Tax System Sustainability Index: The Case of the Czech Republic (*D scenario*)

![Graph showing sustainability index for economic, social, and environmental aspects of the Czech Republic.](image-url)
Tax System Sustainability Index: The Case of the Czech Republic

- Tax system is sustainable
- **Sufficient** contribution to sustainability of **economic** and **institutional** dimensions.
- **Strong** contribution to sustainability of **social** dimension (employment, social cohesion, demography and population growth)
- **Deficient** contribution to **environmental** dimension
  - **Critical policy areas** identified:
    - *Climate change*
    - *Green innovations*
    - *Renewal energy and recycling*
Validation of Tax Sustainability Index

I. The face validation

II. The validation of compliance with the tax sustainability concept

III. The validation of the tax sustainability threshold and conditions
Validation I: Face validation

- Cluster analysis of EU-28 countries with respect to their tax sustainability in:
  - economic and social pillars
  - environmental and institutional pillars

- Triplets of clusters in good agreements with general EU tax system awareness
Validation II: Validation of compliance with the tax sustainability concept

• Aims to reveal how the economic, social, environmental and institutional composites of the tax system influence long-run functioning of the economy
• Inputs – policy areas (subindexes)
• Responses – social progress index
  - environmental performance index
  - shadow economy
  - global green economy index
  - global opportunity index
Validation II: Simulation results

- 3 scenarios: inputs targeting
  - (A) unsustainable
  - (B) sustainable
  - (C) strongly sust. values

Figures taken from Janová, Hampel, Nerudová: Design and Validation of Tax Sustainability Index, https://doi.org/10.1016/j.ejor.2019.05.003
Validation IIIa: Validation of tax sustainability conditions

• In our definition the professional guess has established tax sustainability conditions:
  1. The tax system is sustainable in the institutional pillar
  2. The tax system is sustainable in at least two of the economic, social and environmental pillars.

• To evaluate whether these are realistic we run extended simulation for alternative conditions:
  a. Our conditions 1. and 2.
  b. At least 3 out of ECSI, SOSI, ENSI, INSI sustainable
  c. At least 2 out of ECSI, SOSI, ENSI, INSI sustainable
Validation IIIa: Validation of tax sustainability conditions - Results

• In each scenario a., b., c. the tax systems generated in simulation were classified as sustainable or unsustainable according to given conditions
• Do the responses differ for sustainable and unsustainable systems? (hypothesis testing, t-test)
• NO for scenario b. and c.
• YES for scenario a.

Only conditions a. guarantees distinguishing between tax systems that improve or not worsen the situation in the economy and those doing the opposite.

Validation III has also confirmed compliance with tax sustainability background, where the institutional pillar forms a necessary platform for desirable functioning of the other three pillars.
Validation IIIb: Validation of tax sustainability thresholds

Why the sustainability threshold is set to 0.33 in our definition?

• We run simulations of the tax systems and responses, where we have distinguish between sustainable and unsustainable tax systems based on alternative thresholds 0.2, 0.3, 0.4, 0.5, 0.6.
• The threshold close to 0.3 appears to be the most relevant with respect to

  • Reasonable ratio of unsustainable cases
  • Sufficient distinction between the response values in sustainable and unsustainable situations
Conclusions

- Conceptual and technical **definitions** of tax system sustainability and its empirical evaluation.
- **Applicable** to EU countries.
- Flexible **modification**: generations‘ priorities, tax tools and legislative measures selection, thresholds for indicating unsustainability

**Policy implications**
Due to its modular construction the model allows to **indicate critical policy areas** and formulate the recommendations for policy of EU Member States in respective dimensions.
Thank you for attention.