

Measuring BEPS: MNEs vs. comparable non-MNEs method

Italian case study – conceptual framework

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Introduction – BEPS and aggressive tax planning

- Aggressive tax planning (ATP) by MNEs is a set of practices aimed at exploiting mismatches and loopholes in the international tax framework to reduce the overall tax burden
- Boundaries of ATP definition (from EU Commission, 2017)



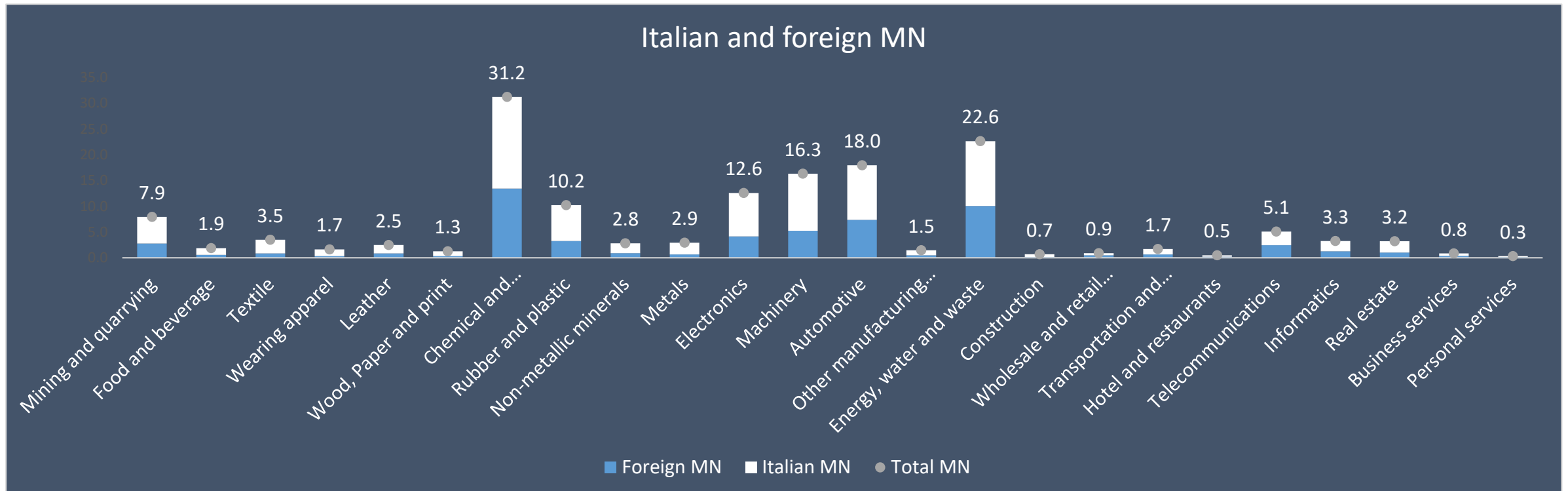
- Base Erosion and Profit Shifting (BEPS) is included in ATP strategies and can have three main channels:
 - BEPS via interest payment (debt management – financial assets)
 - BEPS via royalty payment (intangible management – non-financial assets)
 - BEPS via strategic transfer pricing (goods/services)

Introduction – BEPS and IFFs

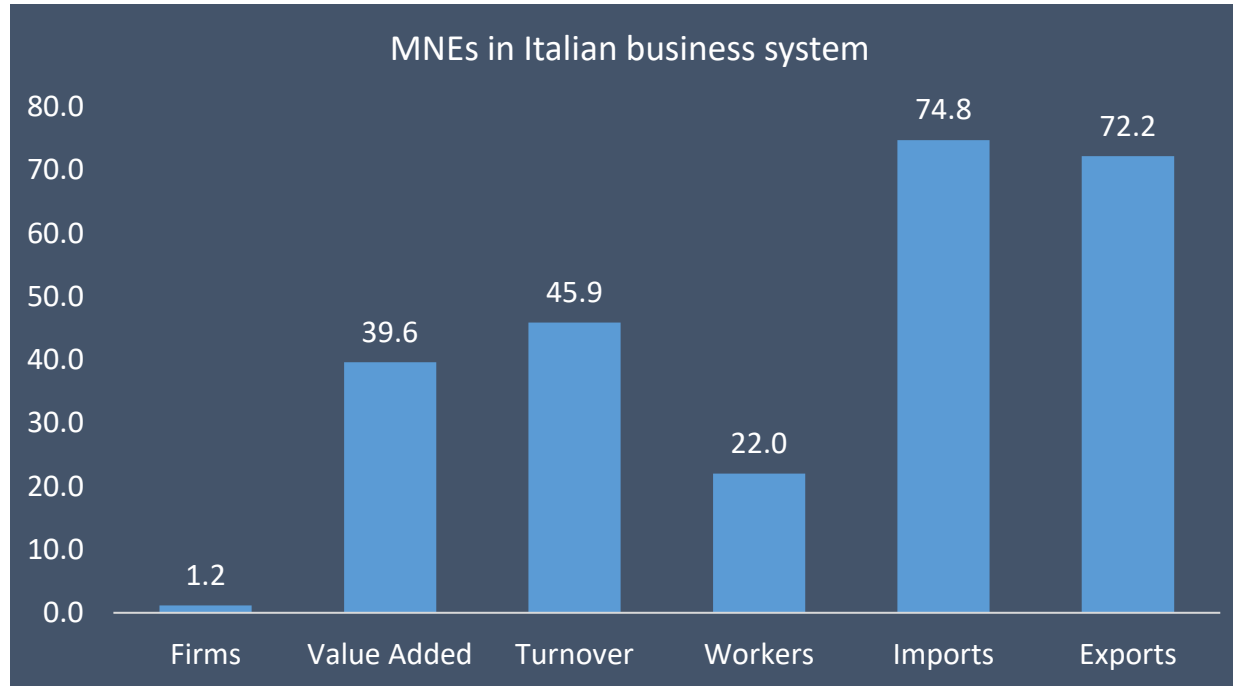
- According with UNCTAD/UNODC definition, BEPS is included in the set of practices that are considered as generating Illicit Financial Flows (IFFs)
- SDG target 16.4 claims for *significantly reduce illicit financial and arms flows by 2030*
- SDG indicator 16.4.1 should monitor *total value of inward and outward illicit financial flows (in current United States dollars)*
- Measuring BEPS represents a part of this more comprehensive task
- MNEs vs. comparable non-MNEs is a method to estimate the amount of BEPS in a given country (either BEPS generating or BEPS collecting, i.e. considering either outward or inward IFFs)
- Differently from model based approaches, the method is bottom-up and measures BEPS starting from microdata
- Differently from other bottom-up approaches (proportionary apportionment, indicator of misalignment profits), the method exploits only the information about domestic enterprise, which is generally available for NSOs

MNEs in Italy (2019)

- Italian business system is composed of about 4.4 mln units, 140K are internationalised (imports and/or exports)
- 44,367 units are in MN groups:
 - 17,718 MNEs in multinational groups foreign headquarters in 114 countries
 - 26,649 MNEs in multinational groups with foreign affiliates in 125 countries

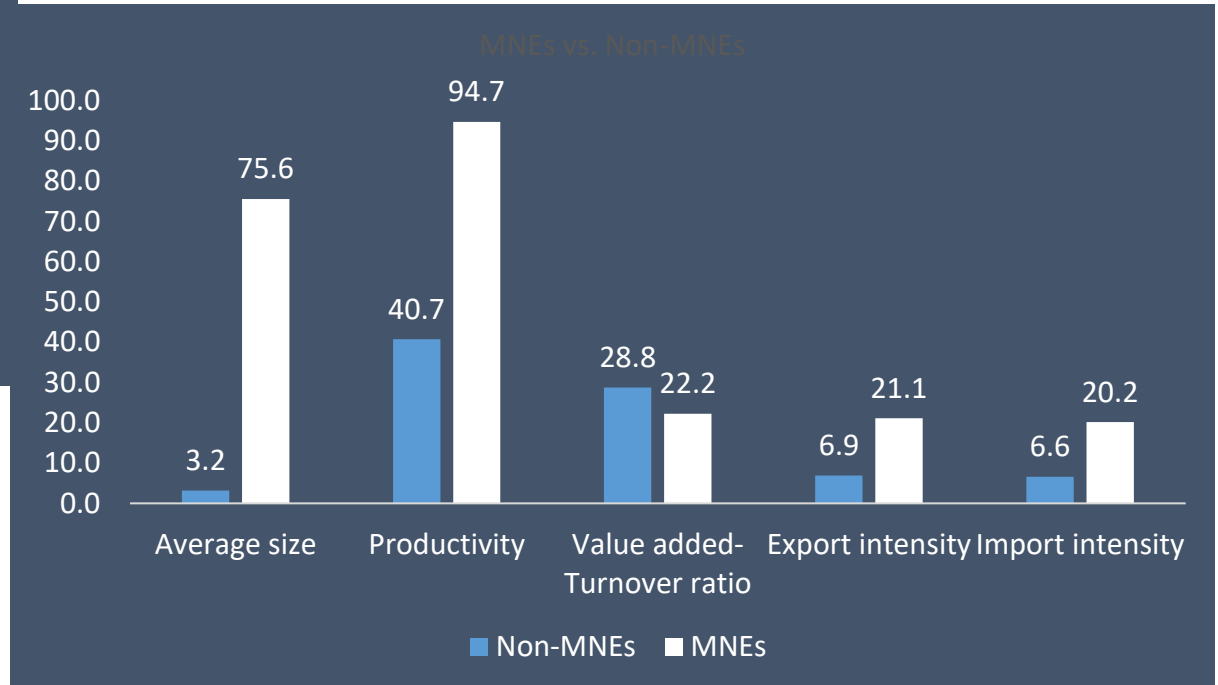


MNEs in Italy



- Impact of Italian MNEs on main macro-economic aggregates

- Comparison between Italian MNEs and non-MNEs



MNE vs. comparable non-MNE method – Data source

- The database for the analysis is composed of three informative sources:
 - The archive **Frame-SBS**, which includes the information about the structure and economic variables for the whole set of 4.4 millions of firms
 - The archive **COE-TEC** (Integrated International Trade Database), which includes the information about imports and exports (by product and origin/destination country) for the whole set of firms
 - The archive **ASIA-Groups** (Italian version of European EGR), which includes the information about firms involved in domestic and foreign groups
- For each unit in the business system, the final database reports comprehensive information about:
 - The economic and organizational structure
 - The characteristics of its inclusion in the network of international trade
 - If applies, the positioning within MNE groups

MNE vs. comparable non-MNE method – Overview

- MNE vs. comparable non-MNE method is composed by three phases:
 1. The **identification** of the either BEPS generating (outward IFFs) or BEPS collecting (inward IFFs) nature of the country (OECD's dashboard approach of BEPS indicators)
 2. The **selection** of tax avoiding (TA) units among MNEs
 - Italian MNEs are evaluated in order to define if they are suspected of tax avoiding behaviour based on the comparison between MNEs and a control group consisting of (comparable) non-MNEs
 3. The **correction** of profits for TA MNEs
 - The EBIT-to-turnover ratio of TA units is adjusted exploiting the selection model in order to compare the economic results of TA MNEs vs. the one of non-TA MNEs

MNE vs. comparable non-MNE method – Identification

- The identification of the typology of countries can be done using different indicators (see also Statistics Canada, *Indicators of profit shifting by multinational enterprises operating in Canada, 2019*):
 - Mismatch between outward FDI and GDP of countries with favourable corporate income tax
 - Mismatch between assets, employment and sales for countries with favourable corporate income tax
 - High profit rates of low-taxed affiliates of MNEs
 - High profit rates of MNE affiliates in lower-tax locations
 - Effective tax rates of MNEs relative to non-MNEs with similar characteristics

MNE vs. comparable non-MNE method – Selection

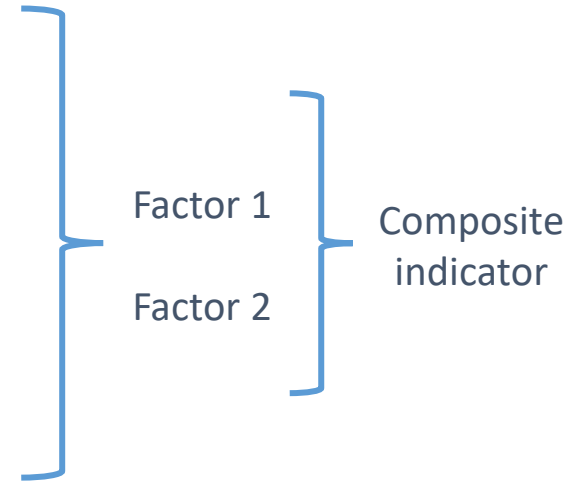
- The phase of **selection** is composed of three steps:
 - For each MNE unit, a control group of domestic firms is defined using propensity score matching
 - For each pair MNE unit-control group, a comparison in terms of profit share is used to define a proxy variable, which stresses possible abnormal behaviours by MNEs (between comparison)
 - ROC analysis is used to define the final clustering between tax avoiding (TA) and non tax-avoiding (NTA) units starting from the proxy variable (within comparison)

MNE vs. comparable non-MNE method – Selection

- The control group for each MNE is defined using Propensity Score Matching
- This allows to define the n domestic units that are more similar to each MNE based on the following set of characteristics:
 - **Region** (Nuts 2)
 - **Industry** (3-digits Nace)
 - **Size class**
 - Per capita turnover
 - Persons employed
 - Share of goods and services on total costs
 - Export-to-turnover ratio
 - Import-to-cost ratio
 - Share of salaries on total costs
 - Share of services on turnover
- For each pair MNE unit-control group, a **proxy of suspect** of TA is given by the following condition:
 - **Suspect = 1**
if ebit-to-turnover ratio for the MNE unit is lower than the average of the control group
 - **Suspect = 0**
if ebit-to-turnover ratio for the MNE unit is greater or equal to the average of the control group

MNE vs. comparable non-MNE method – Selection

- For MNE units, in order to refine the classification a ROC analysis is carried out using a composite indicator that takes into account a set of variables relating to the structure of costs and revenues, and the tax differential with other countries:
 - Ebit-to-turnover ratio
 - Value added-to-turnover ratio
 - R&D spending
 - Share of royalties on total costs
 - Average taxation on productive income in foreign countries
 - Share of salaries on total costs
 - Share of services on total costs
 - Export-to-turnover ratio
 - Import-to-costs ratio
- These variables should correct the proxy by considering other aspects of the generation of profits
- In this context, ROC analysis allows to define a cut-off over the value of the **composite indicator**, which permits to cluster MNEs into TA and non-TA, adjusting the classification derived from the proxy variable



MNE vs. comparable non-MNE method – Selection

- For each stratum, the composite indicator for the i -th MNEs (I_i) is built by using a factor analysis on the whole set of selected characteristics, and then aggregating the first two factors using the relative share of explained variance as weight:

$$I_i = \omega_1 \left(\sum_j \gamma_{j,1} x_{j,i} \right) + \omega_2 \left(\sum_j \gamma_{j,2} x_{j,i} \right)$$

Here, $\gamma_{j,1}$ and $\gamma_{j,2}$ are the loadings of the j -th variable in factors 1 and 2, $x_{j,i}$ is the value of the j -th variable for the i -th observation, and ω_1 and ω_2 are weights in term of explained variance

- Using the proxy of suspect and the composite indicator, the following logit model can be run:

$$Prob (Proxy = 1|C)_i = \Lambda(\alpha C)_i$$

MNE vs. comparable non-MNE method – Selection

- The ROC analysis can be traced back to classification problems in which classifiers can give the four possible outcomes shown in the **confusion matrix**. The efficiency of the classifier can be measured using two metrics:
- **Sensitivity** measures the ability of the classifier to detect true positives, i.e. $TP / (TP + FN)$;
- **Specificity** measures the ability of the classifier to detect true negatives, i.e. $TN / (TN + FP)$, where it is usually considered in its reciprocal expression (1-Specificity), which measures the correct detection of false positives

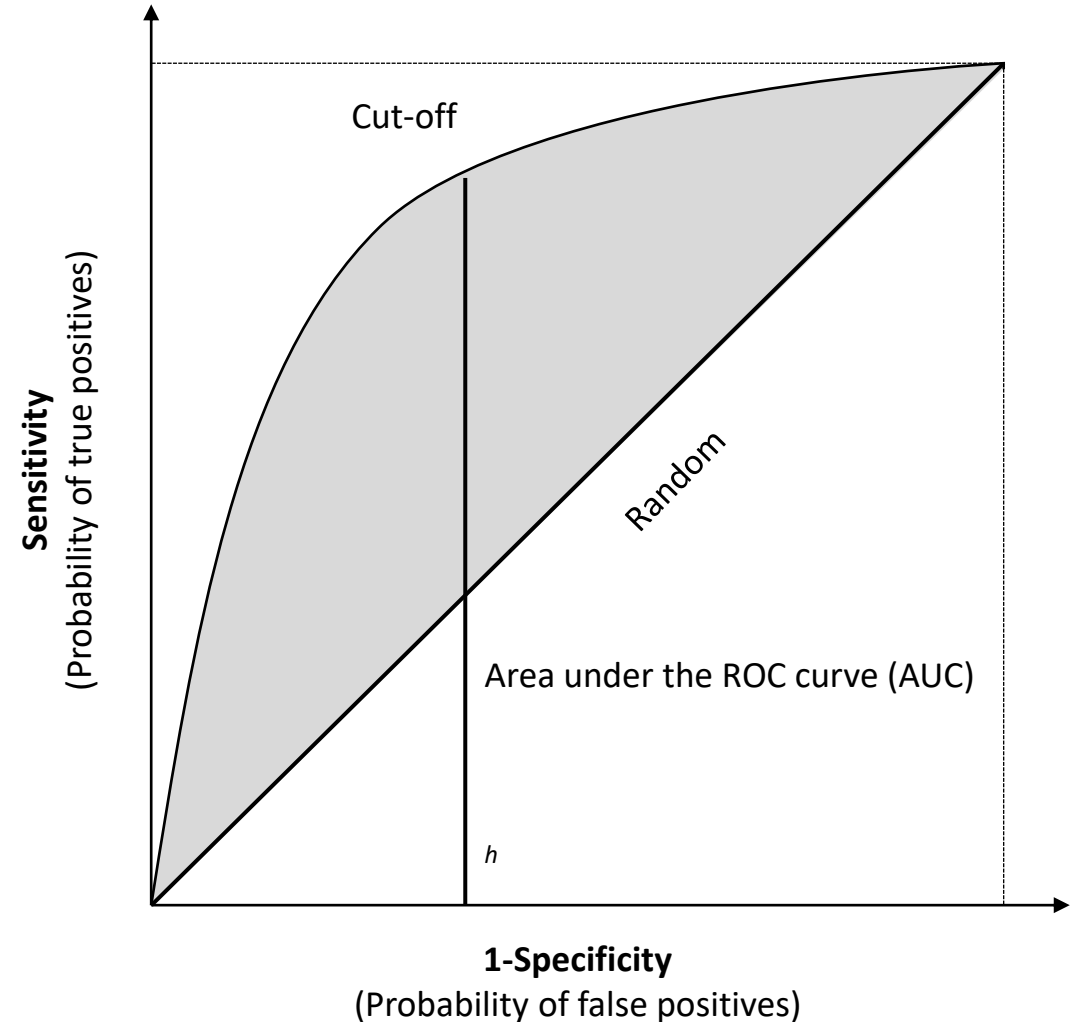
		Estimated classification	
		1	0
True classification	1	<i>TP</i>	<i>FN</i>
	0	<i>FP</i>	<i>TN</i>

MNE vs. comparable non-MNE method – Selection

- Considering a logit model having:
 - a binomial dependent reflecting a given status
 - a classifier represented by a single (even composite) indicator

the distribution of probabilities resulting from the logit estimates can be displayed in the space of Sensitivity and 1-Specificity by the **ROC curve**

- The line of the ROC curve represents the probabilities assigned by the model to each observation in the space of the trade-off between the probability of detecting true or false positives across all possible cut-off points along the values of the classifier

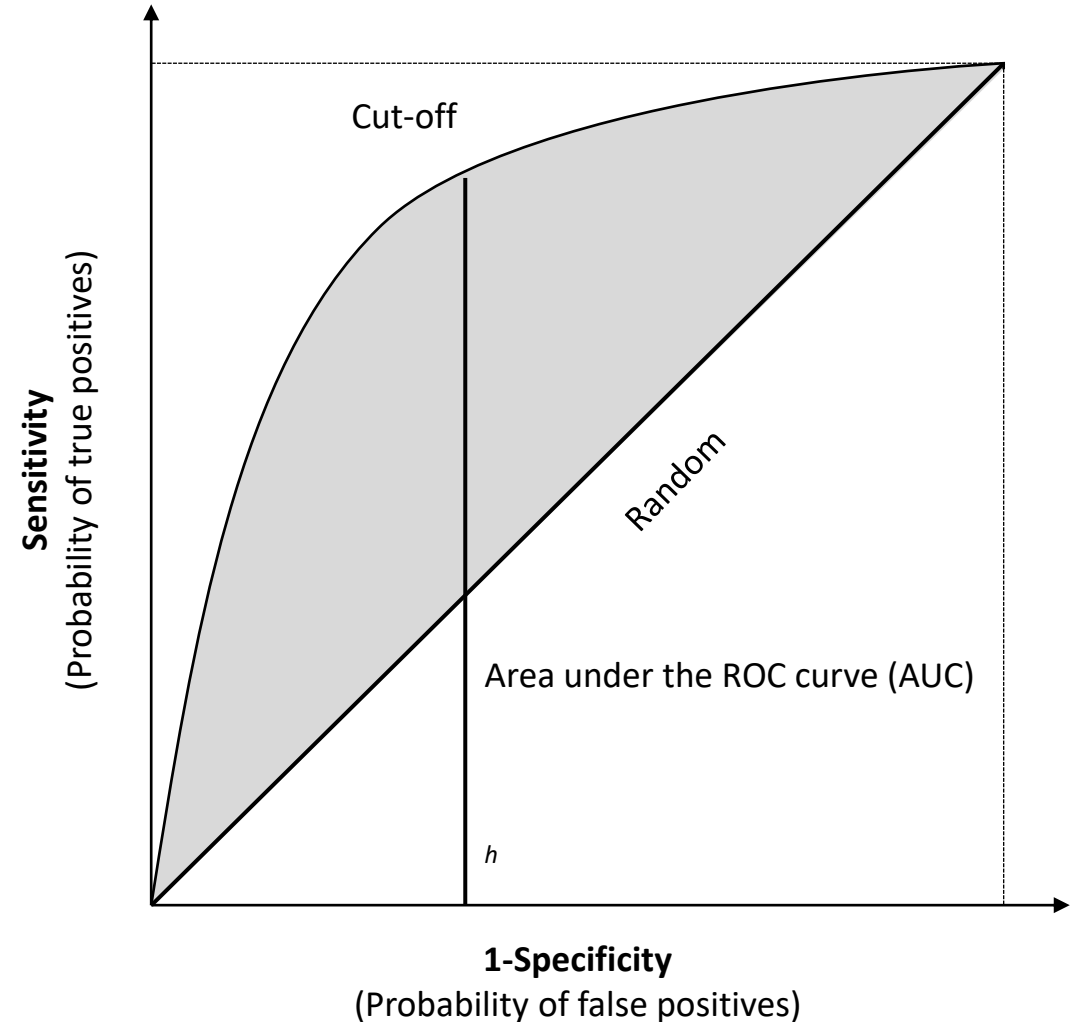


MNE vs. comparable non-MNE method – Selection

- In order to single out, along the ROC curve, the observation that most efficiently discriminates between positives and negatives (Cut), the following equation should be maximized:

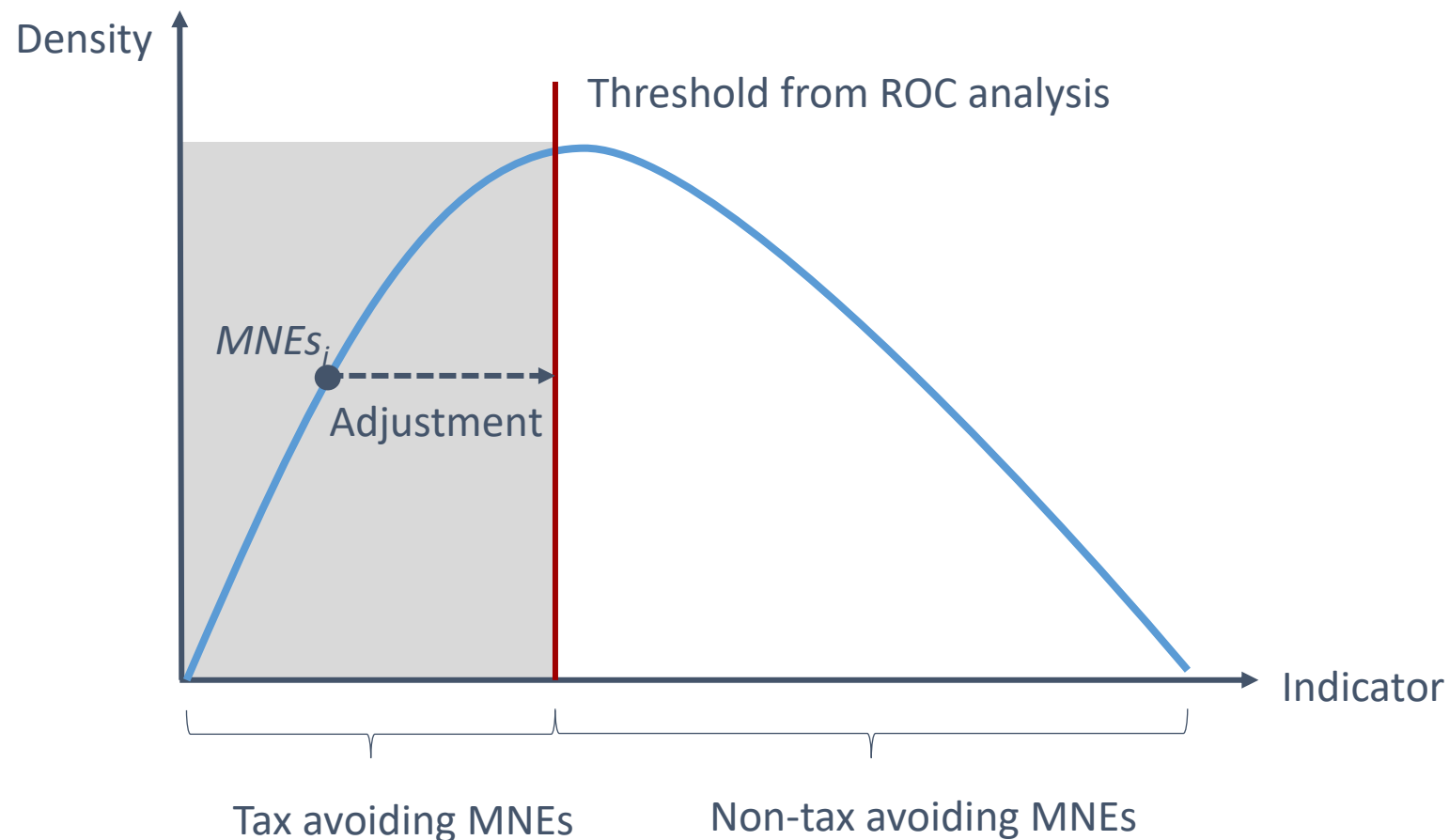
$$Cut = h * sensitivity - (1 - h) * (1 - specificity)$$

where h and $(1-h)$ represent the relative weights to manage the trade-off between true and false positives.



MNE vs. comparable non-MNE method – Correction

- The correction for BEPS exploits the information provided by the ROC analysis in the selection phase



MNE vs. comparable non-MNE method – Correction

- The correction of profit shifting exploits the information provided by the ROC analysis in the selection phase
- For each TA unit, the following condition applies:

$$\bar{S} > \alpha F_{1,i} + \beta F_{2,i}$$

where factors are:

$$F_{1,i} = \sum_j \gamma_{j,1} x_{j,i} \quad \text{and} \quad F_{2,i} = \sum_j \gamma_{j,2} x_{j,i}$$

- The procedure assigns to the indicator x_1 , which is the ebit-to-turnover ratio, the value such that, for each TA MNEs, the following condition is obtained:

$$\bar{S} = \alpha F_{1,i} + \beta F_{2,i}$$

MNE vs. comparable non-MNE method – Correction

- This allows to define the adjustment condition as:

$$\tilde{x}_{j,i} = \frac{\bar{s} - (\alpha \sum_{-j} \gamma_{-j,1} x_{-j,1} + \beta \sum_{-j} \gamma_{-j,2} x_{-j,2})}{\alpha \gamma_{j,1} + \beta \gamma_{j,2}}$$

where:

- \bar{s} is the threshold value defined by the ROC analysis on the composite indicator
- $(\alpha \sum_{-j} \gamma_{-j,1} x_{-j,1} + \beta \sum_{-j} \gamma_{-j,2} x_{-j,2})$ represents the effect of the other variables on the value of the composite indicator
- $\alpha \gamma_{j,1} + \beta \gamma_{j,2}$ represents the weight of the ebit-to-turnover ratio on the value of the composite indicator
- $\tilde{x}_{j,i}$ is the adjusted value of the ebit-to-turnover ratio in order to bring the TA MNE on the threshold
- The amount of the adjustment is obtained as: $(\tilde{x}_{j,i} - x_{j,i}) * Turnover_i$

Preliminary results for Italy

Sector	Number of MNEs	Number of Tax avoiding	% of Tax avoiding MNEs	Declared EBIT	Adjustment	Incidence of adjustment (%)	Adjustment per MNE
Mining and quarrying	78	59	75.6	112.6	49.8	30.7	0.8
Food and beverage	804	440	54.7	3729.9	1261.5	25.3	2.9
Textile	306	196	64.1	446.9	164.7	26.9	0.8
Wearing apparel	349	193	55.3	627.3	103.4	14.2	0.5
Leather	281	198	70.5	698.8	304.9	30.4	1.5
Wood, Paper and print	414	278	67.1	1048.7	445.9	29.8	1.6
Chemical and pharmaceuticals	736	449	61.0	3879.7	1437.0	27.0	3.2
Rubber and plastic	691	406	58.8	1520.6	596.4	28.2	1.5
Non-metallic minerals	355	199	56.1	920.0	279.2	23.3	1.4
Metals	1607	930	57.9	3779.8	1823.5	32.5	2.0
Electronics	1124	683	60.8	2417.6	1013.9	29.5	1.5
Machinery	2091	1341	64.1	4704.7	1684.5	26.4	1.3
Automotive	526	387	73.6	2137.6	1042.0	32.8	2.7
Other manufacturing and repair	1042	583	56.0	1698.8	670.9	28.3	1.2
Energy, water and waste	2653	1473	55.5	15612.1	9812.5	38.6	6.7
Construction	2951	1466	49.7	1963.5	1342.6	40.6	0.9
Wholesale and retail trade	8102	4414	54.5	19865.8	5570.8	21.9	1.3
Transportation and logistics	1714	1271	74.2	12387.2	1973.1	13.7	1.6
Hotel and restaurants	1239	690	55.7	967.0	81.2	7.7	0.1
Telecommunications	689	473	68.7	13526.8	790.9	5.5	1.7
Informatics	2340	1652	70.6	2896.5	1744.8	37.6	1.1
Real estate	5503	2903	52.8	3716.4	531.1	12.5	0.2
Business services	6992	5769	82.5	11726.0	4584.4	28.1	0.8
Personal services	1780	1232	69.2	2972.5	866.7	22.6	0.7
Total	44367	27685	62.4	113356.6	38175.7	25.2	1.4

Measuring (outward and inward) IFFs

- The amount of the correction is obtained by comparing the EBIT-to-turnover ratio of the two groups of MNEs defined by the model
- The amount of correction actually represents the measure of IFFs
- In particular:

BEPS generating country

$$OutwardIFFs_i = (\tilde{x}_{h,i} - x_{j,i}) * Turnover_i$$

where $\tilde{x}_{h,i} > x_{j,i}$

BEPS collecting country

$$InwardIFFs_i = -(\tilde{x}_{h,i} - x_{j,i}) * Turnover_i$$

where $\tilde{x}_{h,i} < x_{j,i}$

Conclusions and open issues

- The MNE vs comparable non-MNE profit shifting method is able to measure profit shifting by MNEs
- The method exploits only the information about domestic firms, which is generally available for NSOs
- The method can be performed for either BEPS generating and BEPS collecting country with small changes in the procedure
- The main shortcomings are related to:
 - The lack of information about foreign enterprises (which is unavailable or very costly, e.g. bureau Van Dijk)
 - The difference between MNEs and non-MNEs can be connected with other factors that cannot be captured
 - Some relevant variables related to the financial statement (debt, immaterial assets) are missing for branches or un-incorporated enterprises
 - Confounding effect, where other reasons may contribute or lead altogether to the identified BEPS activity, may not be captured by the data that inform the model

Thank you.