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Allocating the tax base of « digital » companies using game theory tools

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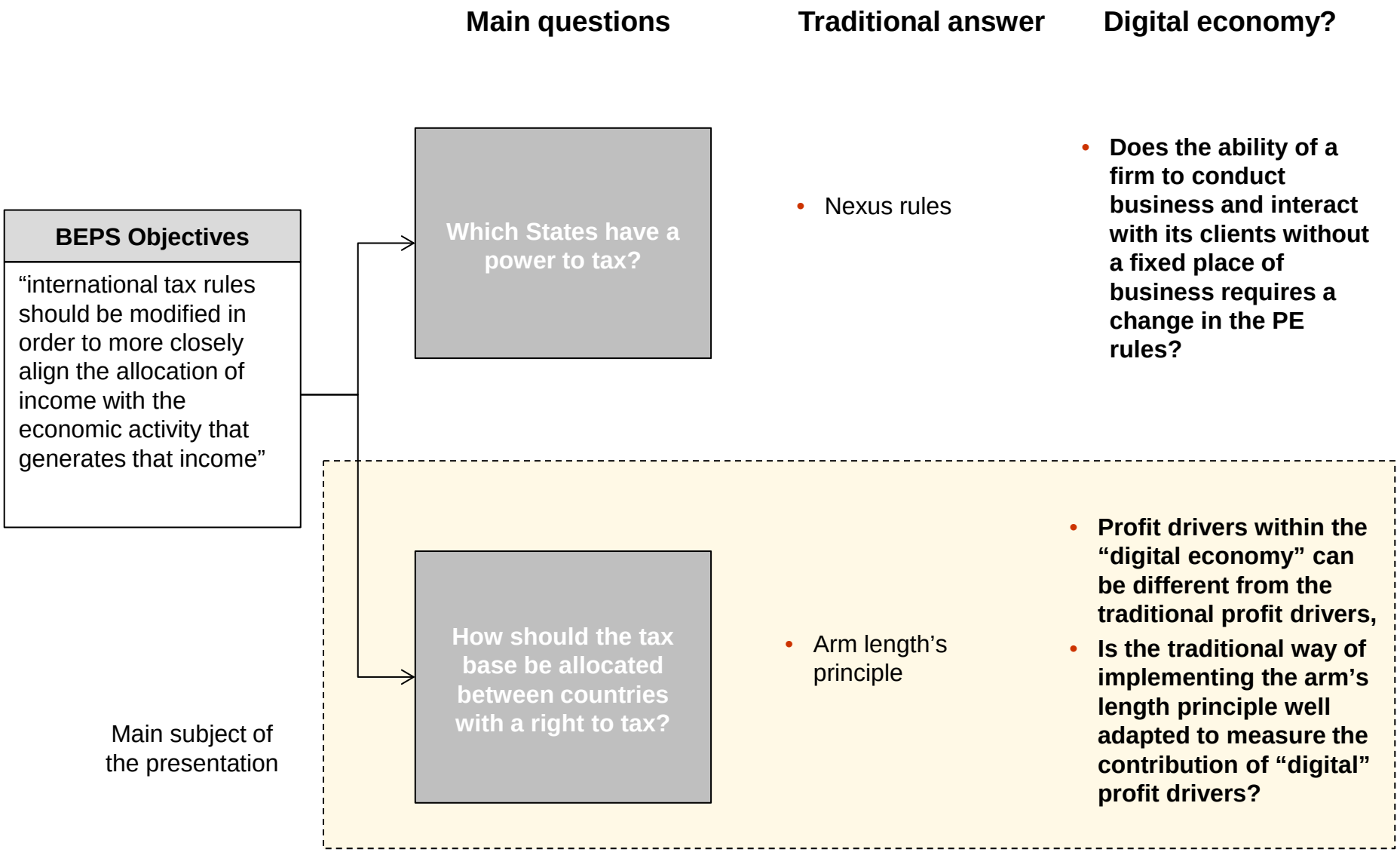
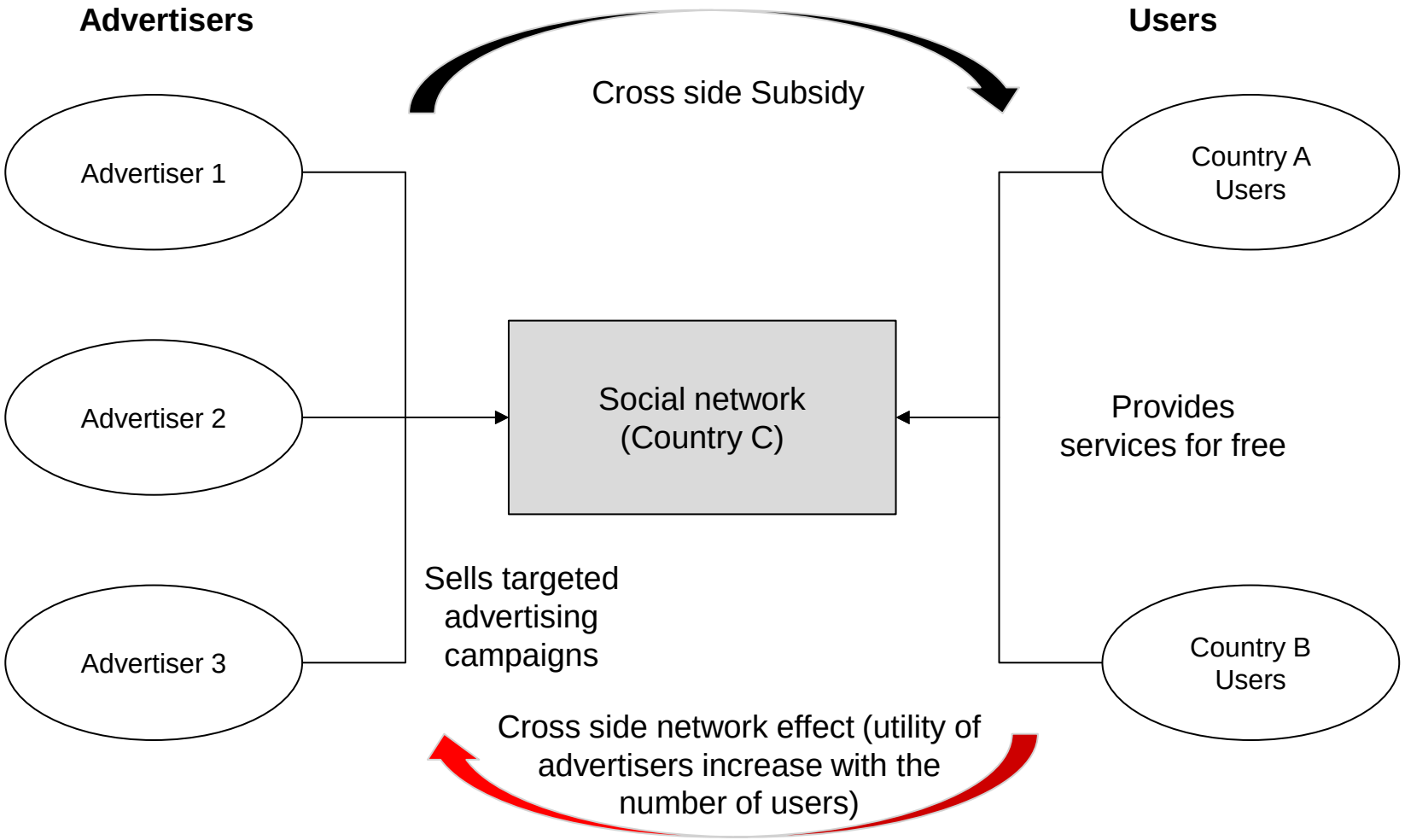
BEPS raise two type of questions, which answers are likely to be different for the “digital economy”



Three “digital” factors put a greater emphasis on the “users base” as a profit driver

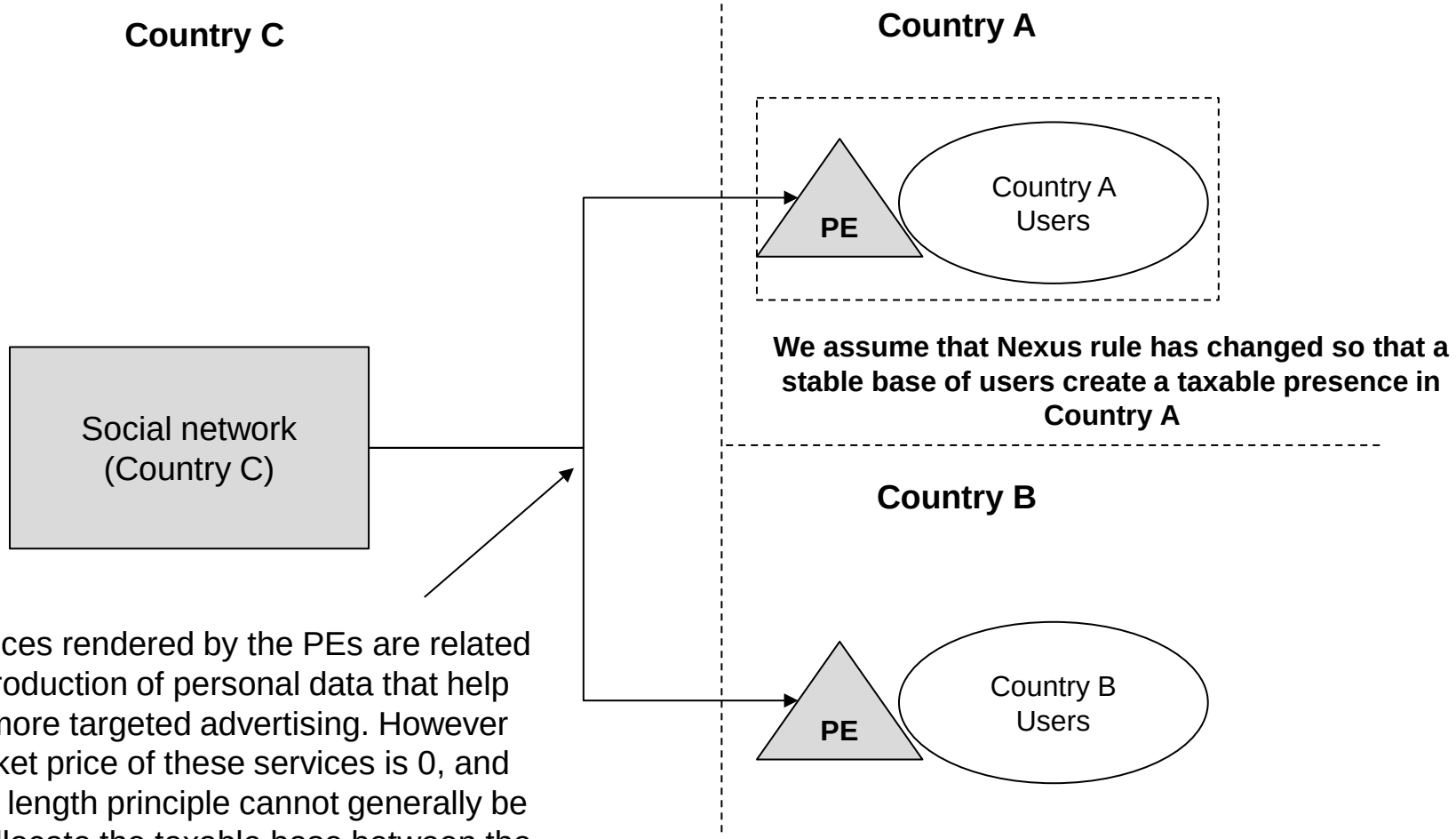
Reason	Example of application	Main subject of the presentation
Double sided markets and platforms	• A social network addresses two kind of agents: users and advertisers. The more users (and the more information they exchange), the more valuable the social network is for advertisers, which explains that the services to users are provided free to increase their number. • Both sides of the market can be located in different countries. In this setting, having a strong user base in Country A (even if there is no taxable presence in this Country) increases the value of the offer of the social network. • Cf. e.g. J.C. Rochet & J. Tirole, *Two sided markets, a progress report*, 37 RAND Journal of economics (2006)	
Network externalities and “winner takes all”	• Network externalities exist when the value of a product or service for one consumer is dependent on the number of other consumer of that product. In markets where network externalities are important, having the largest customer base is a strong competitive advantage. • Consider a device manufacturer, which sales subsidiary in Spain successfully developed a large customer base. This, in turn, gave incentives to independent firms to develop highly successful applications in Spanish language running on that device. The existence of these applications is now a key competitive advantage for the device manufacturer when he wants to make inroads in South American markets. • Cf. e.g. H. Varian, C. Shapiro & J. Farrell, *The economics of Information Technology* (Cambridge University Press 2005).	
“Customer Energy”	• Certain “brick and mortar” firms have successfully integrated their clients in their value chain, making them perform certain activities in exchange for a lower price or a better product. • In video networks, a limited proportion of users are uploading most of the videos. The contribution of these “active” users, and the quality of the video they upload, is a key driver for the large worldwide audience of these websites (along with the quality of the technical infrastructure for instance). • Cf. e.g. H. Varian et *al, op cit*.	

Platforms operating on two sided markets illustrate the difficulty of applying the arm's length principle to perform profit allocation (1/2)



In certain situations, it is optimal for the platform to give the service freely to the users of one side to maximize the revenues generated on the other side

Platforms operating on two sided markets illustrate the difficulty of applying the arm's length principle to perform profit allocation (2/2)



The Services rendered by the PEs are related to the production of personal data that help selling more targeted advertising. However the market price of these services is 0, and the arm's length principle cannot generally be used to allocate the taxable base between the headquarter and the PEs

Another standard should be used to perform the profit allocation

Games theory provides a sound theoretical framework to perfom the tax base allocation

Mathematical model of a social network

- The Social network can be divided into three economic entities
  - The set of users of country A
  - Thet set of users of country B
  - The technical platform and sales entity in Country C
- Each economic entity, if it were independent could generate some « profit » on a standalone basis (although the standalone profit of entities A and B is likely to be 0).
- A surplus is obtained if all entities work together. Reaching a certain critical mass of users would indeed increase the average ad price. Due to the existence of surplus (« S ») generating transactions, the following equations would hold:
  - π (social network) = $\pi_A + \pi_B + \pi_C + S$

Formalization of the profit split

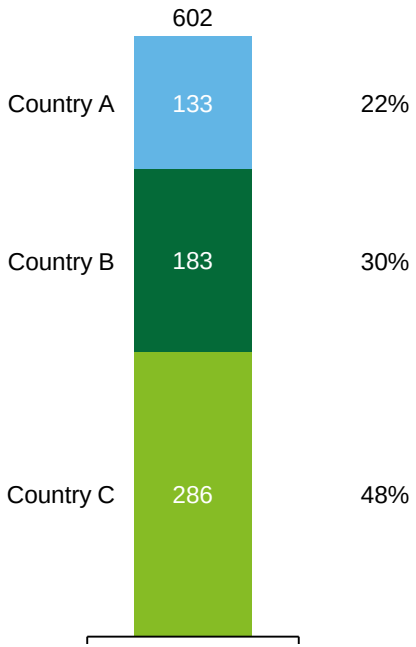
- We want to find a splitting function α, which gives to each subsidiary its share of the overall profit. This function should verify the following criteria:
  - $\alpha(A) = \pi_A + \alpha_1 S$
  - $\alpha(B) = \pi_B + \alpha_2 S$
  - $\alpha(C) = \pi_C + \alpha_3 S$
  - $\alpha_1 + \alpha_2 + \alpha_3 = 1$
- Each entity should be granted its reservation profit (what it could earn on a standalone basis) plus a share of the overall surplus, proportional to its contribution to the generation of this surplus.
- The problem described here can be analyzed using game theoretic tools, it is an example of a broader class of games (“fair division games”), for which only one solution verifying simple criteria exists based on the “Shapley Value” (Shapley (1953), Shubik (1982), Young (1988)).
- In principle, the idea is: if suddenly each subsidiary of the MNE would become independent, what would be the outcome of a bargain over the overall profit?

Numerical example of the use of the Shapley Value to allocate tax base

Assessment of the profit of each coalition

	Profit that could be generated by the coalition
A (PE)	0
B (PE)	0
C	10 M€
(A,B)	0
(A,C)	200 M€
(B,C)	300 M€
(A,B,C)	600 M€

Allocation of the tax base



$$\phi_i(v) = \sum_{S \subset N \setminus \{i\}} \frac{(n-s-1)!\,s!}{n!} \left(v(S \cup \{i\}) - v(S)\right)$$

Game theoretic solutions can theoretically achieve BEPS objectives, they are however difficult to apply

- **Game theoretic based profit allocation methods allow for a good alignment of the taxable basis with the real contribution of an entity:**
  - Applying such a method requires to understand the way a firm is generating profit, and the real role of a particular subsidiary within that process.

- **However, Game Theoretic solutions are based on counterfactual analysis, which are more complex to apply and involve a certain element of subjectivity**
  - Assessing the importance of a subsidiary requires to understand how much profitable the whole MNE would be without this subsidiary.
  - Counterfactual analysis are complex and require to perform assumptions, even though such analysis a routinely performed, sometimes with a very high level of complexity in the antitrust area (e.g. merger simulations or calculation of damages related to an antitrust offence).

- **The solution might reside in a different process for large and smaller firms**
  - Setting up guideline with general references to sound economic principles might be very helpful to increase taxpayer's security.
  - The largest firms, for which the stakes of coming up with a "fair" profit allocation are the highest, it might be worth performing more sophisticated analysis which should ultimately yield a more robust result.
  - For smaller firms, easier to apply methodologies might prove more efficient.