

Game Theory with Application in Economics and Finance

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Paris and Frankfurt compete to woo Britain's banks post-Brexit (16 pts).

At the end of 2017, continental competition is heating up to benefit from the Brexit as half a dozen European Union (EU) cities vie to attract London-based banks and financial services companies worried about losing their access to the European single market. Among them, Paris and Frankfurt vie to become the EU's principal financial centre post-Brexit.

The purpose of this exercise is to study the strategic interaction between France, Germany, the European Commission and City banks.

Part A. Competition between Paris and Frankfurt (9 pts).

Consider two players, Paris, denoted as P , and Frankfurt am Main, denoted as FM , who are engaged in a post-Brexit bid to lure London bankers to their city. Competition takes place through two channels: tax breaks and flexibility of employment laws.

With increasing populist and anti-EU parties in France and Germany, governments are understandably wary of being seen to bend the rules for bankers. Indulging international high-earners is an extremely sensitive subject for the electorate. This imposes a rational limit for governments on both tax reduction and flexible working legislation.

To simplify the analysis, we assume there are only two possible levels of tax cuts: high, denoted as H , and low, denoted as L . We also assume there are only two possible levels of hiring-and-firing regime: flexible, denoted as F , and rigid, denoted as R .

To simplify the payoffs, we normalize the mass of banks at unity, so attracting all the banks (resp. zero banks) gives a city a payoff of 1 (resp. 0). We also assume there is a social cost associated to high tax cuts, denoted as c_H , with $0 < c_H < \frac{1}{2}$. Such a cost can be seen as the government's loss of revenue due to lower taxes collected from domestic firms.

All City banks prefer higher tax cuts and a more flexible hiring-and-firing regime. The proportion of banks that prefer a flexible hiring-and-firing regime to high tax cuts is denoted as $\alpha \in (0, 1 - c_H)$ (i.e., P 's (resp. FM 's) payoff when France chooses (L, F) and Germany chooses (H, R) is α (resp. $(1 - \alpha - c_H)$). In case of similar policies, banks split equally between both cities (i.e., P 's and FM 's payoffs when France and Germany play the same pair (x, y) , with $x \in \{H, L\}$ and $y \in \{F, R\}$, is: $\frac{1}{2}$ if $x \neq H$; and $(\frac{1}{2} - c_H)$ if $x = H$).

- A1. (**3 pts**) Ignore the employment legislation channel and consider the simultaneous tax competition between P and FM . Give the 2×2 corresponding matrix payoff, characterize both the set of pure strategy Nash equilibria and the set of Pareto-efficient outcomes.

- A2. (3 pts) Ignore the tax breaks channel and consider the simultaneous employment legislation competition between P and FM . Give the 2×2 corresponding matrix payoff, characterize both the set of pure strategy Nash equilibria and the set of Pareto-efficient outcomes.
- A3. (3 pts) Consider the simultaneous tax and employment legislation competition between P and FM . Give the 4×4 corresponding matrix payoff and characterize the set of pure strategy Nash equilibria. Is the Nash equilibrium Pareto efficient?

Part B. European harmonization of tax policies (3 pts).

The European banking union would remain incomplete without a harmonization of tax policies. The European Commission suggests all specific taxes on banks to be centralized and merged into a single financial activity tax.

- B1. (3 pts) By considering how EU moving first would transform the matrix considered in question A3, which of any unique tax cut level H or L should be chosen by the European Union?

Part C. City banks (4 pts).

We are back to Part A where there is no intervention from the European Commission.

All banks do not have the same preferences. Some of them have a financial activity that requires them to maintain a staff composed of the most talented bankers. This requires a flexible hiring-and-firing regime. Most of these employees enjoy living in a cosmopolitan city such as London or Paris. Other banks prefer to be close to the European Central Bank, situated in Frankfurt, and are susceptible to be influenced by the cost of renting office space which is lower in Germany.

To simplify the analysis, we assume there are two groups of banks. The first group is composed of banks who will select Paris, unless the hiring-and-firing regime is less flexible than Frankfurt. The second group is composed of banks who will select Frankfurt unless the tax cut is lower than in Paris. The cities' payoff associated in attracting the first (resp. second) group is denoted as B_1 (resp. B_2). For instance, when Paris and Frankfurt both play (H, F) , their respective payoff is $B_1 - c_H$ and $B_2 - c_H$. We assume $\min\{B_1, B_2\} > c_H$

- C1. (2 pts) Depict the game tree where Paris plays first and Frankfurt moves second.
- C2. (2 pts) What are the payoffs associated with the set of the subgame perfect Nash equilibria?

Questions (4 pts)

Are the following statements correct? If not, give a counter-example.

- Q1. (2 pts) The manner in which people discount future payoffs is the same for everyone.
- Q2. (2 pts) The manner in which an individual discounts future payoffs is the same between all periods.