**Brexit in the Europe. Relocation of financial professionals.**

**Where to go from London?**

1. Introduction. Brexit and exodus prerequisites.

"Brexit" is the withdrawal of the United Kingdom (UK) from the European Union (EU). Following a referendum held on 23 June 2016 in which 51.9 per cent of those voting supported leaving the EU, the invocation of Article 50 of the Treaty on European Union started a two-year process which was due to conclude with the UK's exit on 29 March 2019, a deadline which was later extended to 31 October 2019. Withdrawal has been advocated by Eurosceptics, both left-wing and right-wing, while pro-Europeanists, who also span the political spectrum, have advocated continued membership. There is no solid consensus on whether it's definitely good for economics to withdraw, or vice-versa. The broad consensus among economists is that Brexit will likely reduce the UK's real per capita income in the medium term and long term, and that the Brexit referendum itself had damaged the economy. Studies on effects since the referendum show a reduction in GDP, trade and investment, as well as household losses from increased inflation. Brexit is likely also to reduce immigration from European Economic Area (EEA) countries to the UK, and poses challenges for UK higher education and academic research.

Former Prime Minister David Cameron, who called the referendum and campaigned for Britain to remain in the EU, announced his resignation the following day. Home Secretary Theresa May replaced him as leader of the Conservative party and as Prime Minister. Following a snap election on June 8, 2017, she remains Prime Minister. The Conservatives lost their outright majority in Parliament, though, and with it – May's critics argue – a mandate for a "hard Brexit," in which Britain leaves the EU's single market and customs union. (The alternative is known as "soft Brexit.")

The new Brexit deadline for Britain to ratify the withdrawal agreement is October 31. The deal May negotiated with the EU has been rejected by the House of Commons three times. May has given up on winning the support of hardline Brexit supporters in her own party and is now hoping to reach a compromise with the main opposition party.

1. London City and the financial sector.

London's finance industry is based in the City of London and Canary Wharf, the two major business districts in London. London is one of the pre-eminent financial centers of the world as the most important location for international finance. London took over as a major financial center shortly after 1795 when the Dutch Republic collapsed before the Napoleonic armies. For many bankers established in Amsterdam (e.g. Hope, Baring), this was only time to move to London. The London financial elite was strengthened by a strong Jewish community from all over Europe capable of mastering the most sophisticated financial tools of the time. This unique concentration of talents accelerated the transition from the Commercial Revolution to the Industrial Revolution. By the end of the 19th century, Britain was the wealthiest of all nations, and London a leading financial centre. Still, as of 2016 London tops the world rankings on the Global Financial Centres Index (GFCI),[280] and it ranked second in A.T. Kearney's 2018 Global Cities Index.

Economists have warned that London’s future as an international financial center depends on whether the UK will obtain passporting rights for British banks from the European Union. If banks located in the UK cannot obtain passporting rights, they have strong incentives to relocate to financial centers within the EU. It's worth to say, that during the Brexit referendum in 2016, the UK as a whole decided to leave the European Union, but a majority of London constituencies voted to remain in the EU.

The consequences of Brexit are tremendous for London city and financial sector overall. New York has overtaken London as the world’s most attractive financial center, a survey said on Wednesday, as Britain’s decision to leave the EU prompts banks to shift jobs out of the city to keep access to Europe’s single market.

1. Relocation of financial companies and finance professionals.

On 4 October 2016, the Financial Times assessed the potential effect of Brexit on banking. The City of London is world leading in financial services, especially in foreign exchange currency transactions, including euros. This position is enabled by the EU-wide "passporting" agreement for financial products. Should the passporting agreement expire in the event of a Brexit, the British financial service industry might lose up to 35,000 of its 1 million jobs, and the Treasury might lose 5 billion pounds annually in tax revenue. Indirect effects could increase these numbers to 71,000 job losses and 10 billion pounds of tax annually. The latter would correspond to about 2% of annual British tax revenue. According to Anthony Browne of the British Banking Association, many major and minor banks may relocate outside the UK.

Financial services firms, which account for about 12 percent of Britain’s economic output and pay more tax than any other industry, potentially have a lot to lose from the end of unfettered access to the EU. Around 5,000 roles are expected to be shifted from London or created in the EU due to Brexit by March, a Reuters study published earlier this year found.

More than 2 million people work in financial services across Britain, with 396,000 in London. The head of the City of London predicted in July that 3,500 to 82,000 financial jobs would go because of Brexit in the short-term and more might disappear later.

1. Cities-competitors – enticing invitations for London financiers.

Many world countries and their capitals hope to catch the payrolls taxes and economic impact of financial institutions relocation from London. Other reasons to compete for the City men include almost guaranteed property prices surge and cultural level increase if financiers will relocate to the city, to mention also educational level soar in the winning city.

So, which other cities (do NOT mismatch "cities" with the "City of London"!) are trying to lure financial institutions and financiers?

From the global perspective, the list of leading finance capitals looks as follows: New York took the first place, London the second place followed by Hong Kong and Singapore in the Z/Yen global financial centers index, which ranks 100 centers on factors such as infrastructure and access to quality staff. European alternative financial centers are Frankfurt, Paris, Dublin, Amsterdam and others.

So, Asian competitors are most close, with Hong Kong only three points behind London in global rank. Many London executives have warned that the biggest threats to London are not from other European centers but from global competitors such as New York and Hong Kong. Moreover, the largest increase has come from Asians in London who are concerned about how Brexit could affect London as a finance center and a place to build their careers. They think job-market sentiment is better back home. Recruiters in Hong Kong and Singapore have spotted a surge in enquires from London-based banking professionals wanting to relocate to Asia.

But none of the competitors in Europe play for time: as an example, by July 2016 the Senate of Berlin had sent invitation letters encouraging UK-based start-ups to re-locate to Berlin. And more influential business capital of Germany, Frankfurt, takes situation seriously - advantages, including the presence of important financial institutions such as the European Central Bank and almost other 200 banks, as well as numerous law firms, make Frankfurt an attractive market for international investors in the light of the changes caused by Brexit. In France Paris is set to become Europe’s post-Brexit trading hub as the world’s biggest banks and asset managers prepare for life after the UK leaves the European Union. And Amsterdam is scrambling to present himself as the best place to relocate London’s largest financial services business - Amsterdam city leaders admit to having had conversations with more than 100 companies thus far [as on 11.27.2017], and are already arranging re-location for 18 of them. Other European alternatives may include Dublin, Luxembourg, Madrid and many others.

1. Relocation problem of the financier from the point of view of a data scientist.

Let us stop for a minute and try to imagine – where will I go if I leave London because of Brexit? Of course, financiers buy or rent a home in the city where he lives, he or she would eat, drink and go in for sports. They have families and their children go to schools (or kindergartens). They like movies, theater and and recreation facilities. So, where to go from the London, to minimize adventure aftermath?

To answer all of these questions, we need to compare the above-mentioned cities – how all and everyone is similar or dissimilar with London. This can be done very differently – we can compare GDP, price level of the "financier's consumption basket", or count friends and co-workers in every alternative city, or just construct an indicator how long and tidy is to go from the city of work to the sweet small village where financier's mother-in-law lives. One of approaches is to compare alternatives geographically – which option of relocation is MOST similar with London in the spatial arrangement of city venues, so that the venues in London and in the alternative relocation city are distributed identically throughout the city. And this is a kind of data science task – to represent each city as a dataset and compare the proximity of such a datasets. For example, a person buying or renting a home in Paris (alternative) might want to be able to compare the neighborhoods of Paris to other neighborhoods in London (reference point).

The core question of how to account for spatial effects. Most of modern cities are similar: as anything the financier can get in London, sure he can get in every other megapolis. The only difference is in the spatial distribution of their venues. In practice, spatial effects can be accounted for by partitioning the data into discrete spatial units of aggregation (neighborhood), and then ignoring any spatial dependencies in the data within these discrete units. By tallying the amount of parks, bars, or universities the city has relative to all other types of venues, one can get a sense for what a city is like.

There is a number of approaches how we can compare cities as a collection of venues. In every approach it is natural to characterize a city by the ensemble of amenities it offers. The main difference is how to partition (an if partition at all) the city – by equally sized grid regions, by municipal neighborhoods boundaries or do no spatial aggregation within the city at all. All of approaches have their pro and contra.

In our work we follow the approach, stated by Mr. Alex Aklson in his course "Applied Data Science Capstone", and compare neighborhoods of London and alternative centers of Hong-Kong, Singapore, Frankfurt, Paris and Amsterdam.

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