1 Question 1

Why is location an important factor in the geography of finance?

If money, in all it's forms, is indispensable to the modern economy since "...permits the separation of sales and production in space and time"(Harvey 1999, p.245), why study the geography of finance? While one could assume that modern telecommunications and information technology infrastructure would make finance aspatial and footloose when compared to other sectors of the economy such as natural resource extraction or manufacturing, the empirical evidence from many lines of evidence, including but not limited to (Code 1983; Code 1991; Green and Meyer 1992; Green 1993; Meyer 2007; Gong and Keenan 2012; Green, O'Hagan, and Lefebvre 2015) show that financial institutions are primarily an urban phenomenon.

As per (Dixon and Monk 2014), world financial assets amount to just under 100 trillion USD. This represents a very large claim against productive output as resumed in GDP, and tying such vast sums into geographic space could be used to help prepare regulators and other stakeholders to anticipate shocks to these sums of money, lest one becomes the next Iceland, Ireland, Cyprus... where the size of the financial shock was too large for the state to properly handle.

A less catastrophic use of this information for the state, would be to further knowledge of the finance sector, its location in physical space, as well as the associated jobs that it sustains. These jobs are an important source of quaternary sector employment, which offers higher than average wages compared the 'average' job in the economy. As such, it's important for the government to understand these jobs in order to protect a valuable tax resource. To quote from the Roman Emperor Tiberius (42 BC – 37 AD) via Suetonius: "It is the part of a good shepherd to shear, not flay, his sheep."(Thomson 2006)

Lastly, understanding the locational preferences of large financial firms can help these large firms better choose a headquarters/regional headquarters location, as can be seen in the saga of UBS's buyer's remorse over it's move of 55km from Manhattan financial district to the low land costs of Stamford Connecticut (Bagli 2011). Furthermore, when explaining the disadvantages of the new suburban location, the company admits to having difficulty recruiting top-tier talent, as well as wanting to be closer to po-

tential clients despite having a tailor made and cutting edge building and infrastructure.

2 Question 2

Are there circumstances in which agglomeration economies advantage might be overstated or perhaps even illusionary? In answering, provide at least one example.

Agglomeration economies consists of processes that take advantage of economies of scale and network effects. Furthermore, these processes operate on two important levels, that of the individual firm and that of the region. However, it would be fallacious to believe that the net effect of agglomeration are always tangible or beneficial.

Economies of scale are frequently at the forefront of economics literature (Panzar and Willig 1977) with regards to firm-level competitiveness. It should be noted that when drawn schematically in an idealized model, the cost curve is u shaped: costs decrease as production increases and once optimal conditions are surpassed, costs increase. Financial commentatiors such Yves Smith have stipulated that despite the perennial promesses of synergy driven by the elimination of duplication of effort during bank mergers, the empirical evidence shows that the costs of managing large banks have diminishing returns when banks pass 25 billion dollars in yearly revenue (Smith 2010).

As it currently stands, there is no formal model for the spreading of tacit knowledge in an economic cluster. While it might be a true that knowledge spreads via the "old boy's network" during time away from work and between employers, much of this literature pertains to the experience of information technology professionals located in California's Silicone Valley as well as the film industry in Hollywood. This popular phenomenon might not be true in different cultural backgrounds such as the Cambridge information technology cluster, where there is very little off-the-clock fraternization between employees that have moved on to other employers due to long work hours and the social climate is more restrained, and thus there is less 'shop-talk' and thus transmission of best practises between employers.

On a regional scale, it is possible for agglomeration clusters to adversely affect broader economic conditions even though the clustering activity is

profitable for the firms in the cluster. For example, Cecchetti and Kharroubi (2012) observes that the size of a country's financial sector is correlated with GDP growth only up to a point, and that over-sized financial sectors are a drag on economic growth. This finding is explored in further detail in Cecchetti and Kharroubi (2015), and this working paper finds that large finance industries crowed-out other sectors of the economy, and this crowding out offers a mechanism for explaining the lower overall economic growth seen in the 2013 paper.

Similarly, agglomerations can loose their competitive edge with their competition when scarcity of skilled labour raises wages above the level of competitiveness. Furthermore, Huber (2012) finds that this phenomenon is especially hurtful to smaller companies in a cluster, for they have less resources to offer higher compensation when compared to larger firms.

How to we tally the cost of environmental degradation? A classic example is the UK's industrial midlands and the City of London. This area industrialization via classical Marshallian districts saw wealth and prosperity being generated on a scale unseen until then in human history, however, the benifits were allocated in a haphazard fashion and many of the lower strata of the population did suffer the effects of pollution, such as poor air quality due to coal combustion products, unsafe working environments leading to deaths and maiming on the job, such that 40% of the volunteers for the Boer War (1899-1902) were deemed medically unfit for service[1] (Hall 2002).

3 Question 3

This question has the following parts: (1) Describe, explain and discuss "Spatialization" based on Fabrikant, Skupin et al.; (2) Next, provide a hypothetical for now, but as good-as-you-can-make-it, example of Spatialization using some of the data for your study. Which of your data variables (pp. 14-15 in your Proposal) can be used? Pay attention to the X and Y axis, ensuring they make sense and have a clear label. State what these labels are; (3) What Distance Modeling could be applied to your

[1]Incidentally, this was a major impetus for the turn of the century public health movement, and also was a foundational plank in David Lloyd George's push for post-WWI public health policy(Hall 2002)

example? (Cf. Chapter 6 on Distance Relationships by Chrisman); (4) Given 'Investment DistanceSheds' generated in (3) in non-spatial 'financial spaces', what Surface Modeling can be applied? (Cf. Chapter 8 on Spatial Analysis using Continuous Fields by Burrough et al); (5) What results can be expected from using this type of approach? Comment on this three-part 'Surface Analysis of Distance Models derived from Spatialization of Investment Data' approach.

3.1

Spatialization is the use of geographic principles and techniques to examine non-geographic data(Skupin and Fabrikant 2003). The use of geographic metaphors is intended to help the researcher find insights in otherwise inaccessible high-dimensional data by transforming the data into "map-like" cartographic space (Skupin and Fabrikant 2008). This approach draws from Tobler's First Law of Geography (Tobler 1970), and readers of the cartographic data can intuitively grasp that nearby objects are inherently more related that those that are further apart.

3.2

Assuming, *arguendo*, that it's currently possible to create a spatialization model to examine the investment proclivities,as measured as a function of industrial category, of institutional investors, this model take the 25 industrial sub-classes and analyze the data via dendrogram hierarchical clustering algorithm. This algorithm takes the jaccord index dissimilarity matrix and iteratively clusters the least dissimilar values. The degree of dissimilarity indicates the hight of the node (horizontal branch of the cluster) in the diagram. Next the highest value of the newly clustered pair is entered into the new matrix and the algorithm continues until it runs out of pairs to join (Pathak 2014). The resulting dendrogram can be entered into a multidimensional scaling model.

As for labelling the axes on the plot created by the multidimensional scaling algorithm, the orientation of the plot is purely arbitrary, what matters is the relative proximity between the points as well as the relative axes within the plot since these can lead to categories or underlying groups. Furthermore,

while it is intended to observe this data two dimensional space (as per the follow-on questions), it would be imprudent to no look at the scree plot for 1,2,3,4,5, and 6 dimensions in order to ensure that the kink in the plot is at or about the 2-dimension and that stress levels in the plot are no higher than 0.15 and ideally under 0.1.(Oksanen, Blanchet, Kindt, Legendre, Minchin, O'Hara, Simpson, Solymos, Stevens, and Wagner 2016)

3.3

Assuming that the set of coordinates created in the previous section did not fail the assumption of 2 dimensions and was not overstressed, the points can be used to create surfaces, such as Thiessen polygon/Voronoi diagram. These polygons are created in such a way that all of the surface area within the polygon is nearer to it's point than any other point in the diagram, and each vertice (intersection of 3 lines) is the equidistant to the three closest points.

3.4

While Thiessen polygons have bben used in geography and meteorology as a crude form on interpolation, assuming that the entire surface area of the polygon has the same weight may not be appropriate for all uses. As such, these polygons can be smoothed using Tobler's pycnophylactic interpolation (Brunsdon 2014)

3.5

References

Bagli, C. V. (2011). Regretting Move, Bank May Return to Manhattan. New York Times http://www.nytimes.com/2011/06/09/nyregion/ubs-may-move-back-to-manhattan-from-stamford.html.

Brunsdon, C. (2014). *pycno: Pycnophylactic Interpolation*. R package version 1.2.

Cecchetti, S. G. and E. Kharroubi (2012). Reassessing the impact of finance on growth. http://www.bis.org/publ/work381.pdf.

Cecchetti, S. G. and E. Kharroubi (2015). Why does financial sector growth crowd out real economic growth? http://www.bis.org/publ/work490.pdf.

Code, W. (1983). The Strength of the Centre: Downtown Offices and Metropolitan Decentralization Policy in Toronto. *Environment and Planning A 15*(10), 1361–13.

Code, W. (1991). *Information Flows and the processes of attachment and projection, the case for financial intermediaries*. Routledge. Found in: Collapsing Space and Time: Geographic Aspects of Communications and Information.

Dixon, A. and A. Monk (2014). Frontier finance. *Annals of the Association of American Geographers*.

Gong, H. and K. Keenan (2012). The Impact of 9/11 on the Geography of Financial Services in New York: A Few Years Later. *The Professional Geographer 64*(3), 370–388.

Green, M. B. (1993). A Geography of Institutional Stock Ownership in the United States. *Annals of the Association of American Geographers 83*(1), 66–89.

Green, M. B. and S. Meyer (1992). A Temporal, Spatial and Functional View of Investment Companies in the United States. *The East Lakes Geographer 27*, 48–64.

Green, M. B., S. O'Hagan, and M. Lefebvre (2015). The economic geography of institutional investment in the united states, 2010. *Urban Geography 36*(6), 798–822.

Hall, P. (2002). *Cities of Tomorrow: An Intellectual History of Urban Planning and Design in the Twentieth Century*. Wiley. 576 pages.

Harvey, D. (1999). *The limits to capital*. Verso London.

Huber, F. (2012). Do clusters really matter for innovation practices in information technology? questioning the significance of technological knowledge spillovers. *Journal of Economic Geography*.

Meyer, S. (2007). Finance, insurance and real estate firms and the nature of agglomeration advantage across canada and within metropolitan toronto. *Canadian Journal of Urban Research*.

Oksanen, J., F. G. Blanchet, R. Kindt, P. Legendre, P. R. Minchin, R. B. O'Hara, G. L. Simpson, P. Solymos, M. H. H. Stevens, and H. Wagner (2016). *vegan: Community Ecology Package*. R package version 2.3-5.

Panzar, J. C. and R. D. Willig (1977). Economies of scale in multi-output production. *The Quarterly Journal of Economics 91*(3), 481–493.

Pathak, M. A. (2014). *Beginning Data Science with R*. Springer.

Skupin, A. and S. Fabrikant (2003). Spatialization methods: A cartographic research agenda for non-geographic information visualization. *Cartogr Geogr Information Sci 30*(2), 99–119.

Skupin, A. and S. I. Fabrikant (2008). *Spatialization. in: Wilson, J., and Fotheringham, S. (Eds.) The Handbook of Geographical Information Science*. John Wiley & Sons.

Smith, Y. (2010). *ECONned :How Unenlightened Self-Interest Undermined Democracy and Corrupted Capitalism* (1 ed.). New York: Palgrave Macmillan. 362 pages.

Thomson, A. (2006). THE LIVES OF THE TWELVE CAESARS by C. Suetonius Tranquillus. Revised and corrected by T.Forester, Esq., A.M., Project Gutenberg, `http://www.gutenberg.org/files/6400/6400-h/6400-h.htm`.

Tobler, W. R. (1970). A Computer Movie Simulating Urban Growth in the Detroit Region. *Economic Geography 46*, pp. 234–240.