Does Political Participation Change a Financial Centre's Competitiveness?

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Abstract

What role does polyarchy (and thus increased democracy) play in aiding the development of an international financial centre? We find support for decades of theorising that some jurisdictions use autocracy (less polyarchy) to help grow out their financial centres. We look at the growth of these financial centres as the extent to which they attract more funds from abroad (cross-border bank liabilities). Polyarchy decreases as other international financial centres' centrality in the global financial centre network expands. Polyarchy increases in most jurisdictions over time because some financial centres rely on increasingly polyartic governance as a way to foster financial innovation through increased participation by non-previously powerful sectors. Namely, the growth of an international financial centre's centrality in global financial networks relies on tapping down on polyarchy. Yet, such polyarchy – when used by some very central jurisdictions to remain central – "spreads." We model such a relationship between polyarchy and centrality in the global financial network, describing even the most complex quantitative analysis in a way a non-specialist can understand. These results could impact decisions ranging from Brexit to Hong Kong's autonomy in its post-2047 period.

Keywords: international financial centres, endogenous global city network centrality, dynamic polyarchy, finance juntas, financial competitiveness, Bayesian network analysis.

JEL Codes: D72, F55, F33, P48

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Introduction

Politicians and policymakers in places like London, New York and even Moscow have sought - for decades - to turn their cities into international financial centres. Such a transformation has involved - to a greater or lesser extent - consultation with a range of groups and social interests. These groups - from the banker's association to the environmental groups and consumer protection groups - mould policy to a greater or lesser extent in each financial centre -- depending on each jurisdiction's democratic traditions and rules encouraging/discouraging such participation.

Such participation has an effect on the performance of an international financial centre (in terms of assets attracted from abroad, foreign listings on stock exchanges) and so forth. Yet, only recently have policymakers thought about influencing their financial sectors' competitiveness - through regulations and alliances (or not) with these social groups. As more social groups participate in financial regulation, such a polyarchy (or rule by many persons and groups) affects the rules these policymakers adopt. Yet, so too, do the rules -- and thus the polyarchies -- governing other international financial centres. As French policymakers deregulate Parisian-domiciled international banks and financial services firms, policymakers in the British Virgin Islands must adapt…or have their own banks' market shares affected.

Our paper looks at this long-term 'dance' between international financial centres' competitiveness and the stretch of democratic (or at least multi person and group) participation in the governance determining financial sector rulemaking. We find support for decades of theorising that some jurisdictions use autocracy (less polyarchy) to help grow out their financial centres. Yet, not every financial sector can set up finance czars - as increased participation in some financial centers may represent a competitive response to less participation in others. Interestingly, though, we tend to observe polyarchy spreading or waning across international financial centres - depending on important (or central) international financial centres' competitiveness (defined as foreign bank deposits attracted) and polyarchy.

Our paper has only major sections. The first section presents our model of international financial centres' politics/polyarchy and competitiveness. We argue that political and social groups in one international financial centre may react to changes in other international financial centres which their own polyarchies (or centralized lawmaker) adopts. **We forgo the usual literature review - as we have provided this elsewhere.**[1] The second part of the paper presents our methods, data, and results. The final section concludes.

We must levy several self-criticisms and limitations of our work at the onset. First, we use the word 'polyarchy' to reflect our data source - rather than as any real measure of the term. Second, we assume that such polyarchy reflects onto financial law/rule-making - a limit as many very democratic jurisdictions might have very closed financial lawmaking. Third, we assume that such

[1] Our paper would exceed 15,000 words with the literature review. We cite literature as absolutely necessary as we develop our argument and results. For the review, see **ANONYMIZED FOR PEER REVIEW**.

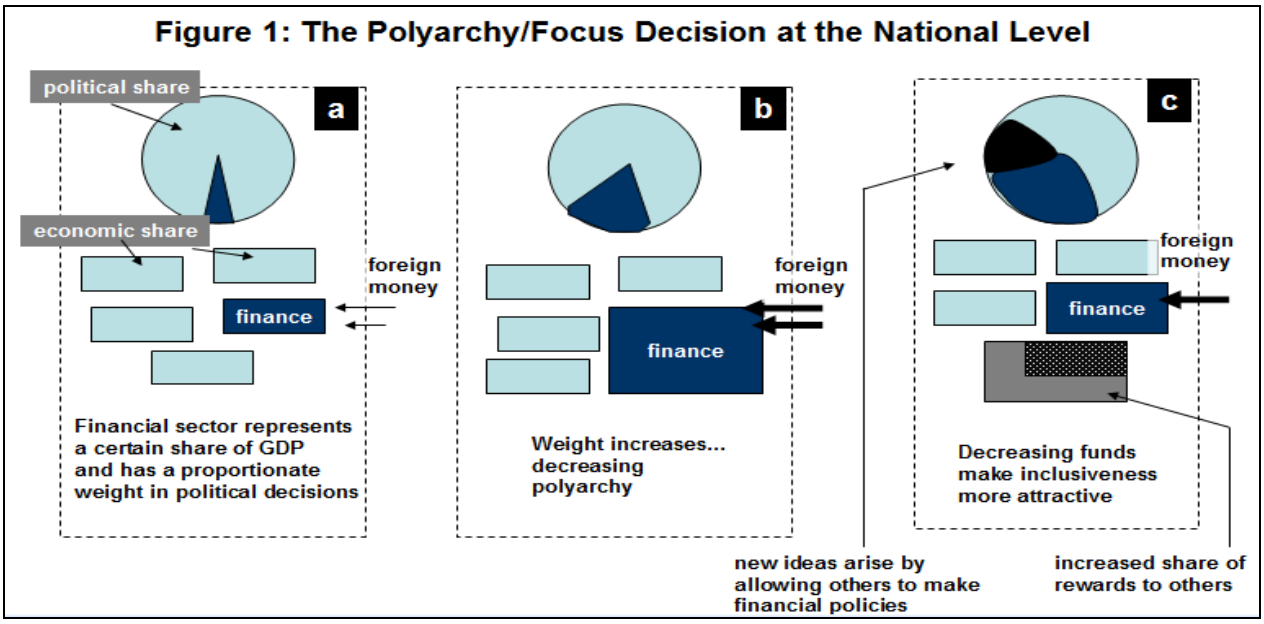
lawmaking reflects such polyarchy…and affects the deposits their banks can attract from abroad. Fourth, we measure the competitiveness of an entire financial centre using this single measure of bank liabilities.

Modelling and Operationalizing Endogenous Change in IFC Politics and Competitiveness

Changes Within and Between Countries

Our model focuses on the trade-off between political rights and economic power in international financial centres. Figure 1 shows a simplified, non-mathematical, graphical, static version of our model. In the left-most side of the figure (part a), we depict various sectors of the economy (as blocks) and their relative political power as the circular pie at the top. We highlight the financial sector as the dark blue box, whose size depends on cross-border banking liabilities (deposits and funds from abroad). The dark blue slice of the pie represents finance's weight in political decision-making. In part b of the figure, we observe the financial sector's increased importance (share) in/of political decision making, concomitant with its current, future, or even perceived ability to attract capital from abroad.[2] Such a trend might correspond with an increased focus on financial policy (and thus decreasing polyarchy in order to implement financial policies rather than other policies).[3] Similar decisions in other jurisdictions negatively impact on the size of the home jurisdiction's financial institutions (depicted in the figure's part c) as a shrinking in size compared with part b. In part c, the financial sector's political power (concentration of influence) shrinks, yielding way to other sectors with better/different ideas – as depicted by the black coloured slice of the political pie. Other sectors' inclusion in policy making increases as does their inclusion in the economy (as shown by the larger size of non-finance sectors).

Figure 1: The Polyarchy/Focus Decision at the National Level

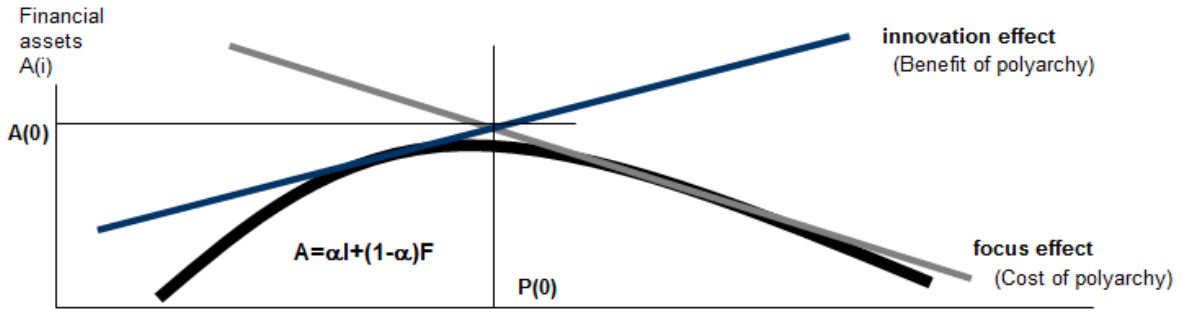


[2] We discussed in the literature review how even the perceived importance of a future, possible financial centre could influence political decisions taken in the present.

[3] Part of this trade-off involves simple opportunity costs. Politicians have finite attention spans, meaning that topics which take up more of policymakers' time and attention necessarily crowd out consideration and work on other topics, as Cotton (2016) describes.

In slightly more mathematical form, the amount of cross-border financial assets and polyarchy in a jurisdiction depends on the focus/concentration of policy on finance and the creation of new ideas and innovations in finance, ideas which will help attract funds from foreign financial centres. Figure 2 shows the simplest possible representation of these factors. In theory, more polyarchy brings more innovation, from access to more ideas and high-powered interest in finance's success – as represented by an upward sloping innovation effect curve.[4] At the same time though, more polyarchy diverts time, attention and political capital away from finance – as shown by a decreasing focus curve. The mix between these forces decides the level of cross-border financial system liabilities and the level of political polyarchy – and both forces work at the same time.

Figure 2: The Basic Political Driver of Financial Centre Competitiveness



The figure shows the relationship between a jurisdiction's financial assets and its polyarchy as the balancing of political and "practical" forces. Financial assets and polyarchy rise as a jurisdiction's financial elites must find more innovative ways of competing in global financial networks. A 'focus effect' counters such an 'innovation effect', representing the practicalities of taking decisions and implementing them, as well as the squandering of financial assets concomitant with the more complex negotiations involved in more polyartic systems. This effect results in the jurisdiction's ability to attract more financial assets as political participation falls. The actual observed relationship reflects a weighted average of these two effects (which we illustrate with a simple Bezier formula/curve to provide an illustration of how such a relationship might be mathematically modelled). As usual, an equilibrium level of financial assets and polyarchy exists when the costs of focus balance the gains from new ideas – at A(0) for the initial level of financial assets and P(0) for the initial level of polyarchy.

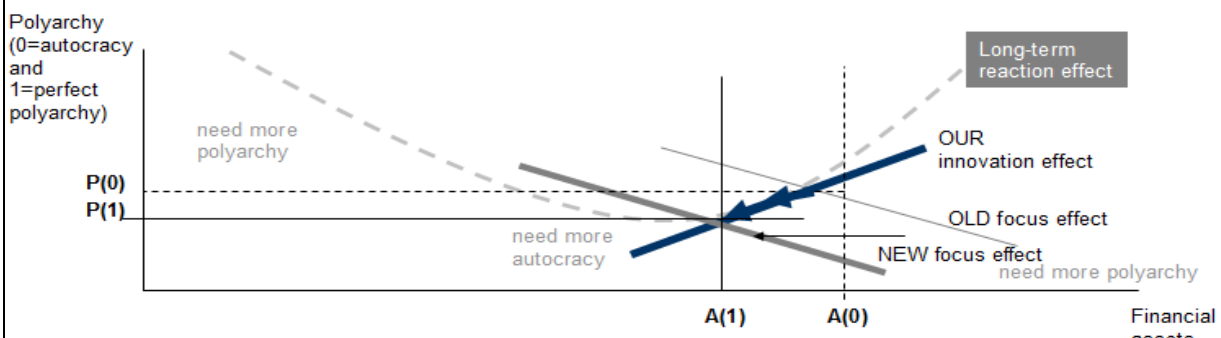
These curves allow us to examine the impact of other jurisdictions' changes in policy. Figure 3 shows the effect of an increase in the focus of financial policies and politics in one of the jurisdiction's main counterpart jurisdictions (for example the effect in France of the UK focusing on financial policy and Westminster's deafening to health and other policies).[5] Such a policy – according to our model – would shift out the focus effect curve. The move (and we flipped the axes to make the figure focus on changes in financial assets) results in a decrease in polyarchy and a fall in financial assets – as the home jurisdiction matches this focus and loses business to the more focused rival. Figure 4 shows the effect at home of these changes – as local political and economic forces encourage more participation. A shifting out of the innovation curve represents

[4] Of course, the economy has several sectors – and innovation spreads/differs across sectors. The spread of such innovation would affect the supply and demand for financial services. Because we do not model the way such an "innovation effect" curve from microeconomic foundations, we do not discuss further details here. See Calvet *et al.* (2003) for a taste of some of the complexity involved.

[5] Westminster refers to the place in London where government operates from.

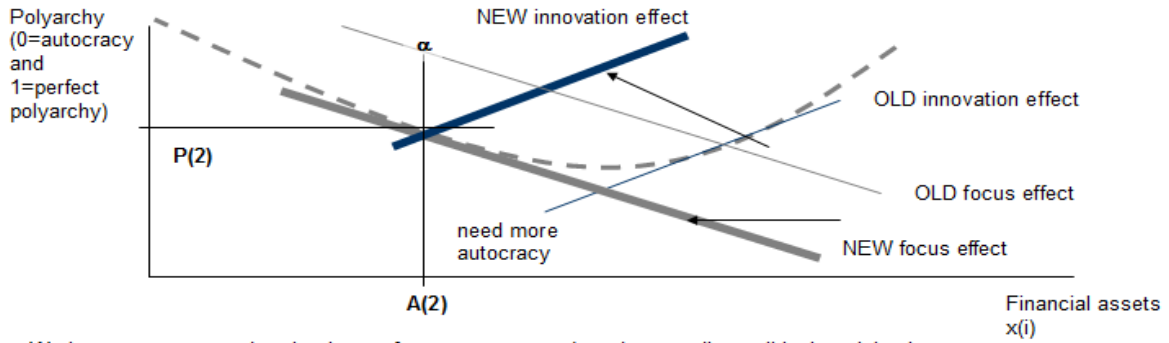
the effect of local financiers looking for new, innovative ideas from sectors formerly muted out, and other sectors looking for recompense for their previous patience. Such an internal shift further undermines foreigners' confidence in placing their money with our financial institutions.[6] Such a decline would have – in the past – represented the simple redistribution of political power and economic fortunes (as shown by point α in the figure lying along the previous focus curve). Because our counterpart jurisdictions have increased their focus on becoming world class financial centres, we can extend our own polyarchy far less than before in order to remain competitive... at least in this middle term.

Figure 3: Our Reaction To Other Jurisdictions' Political Tightening



If other jurisdictions increase their focus, our jurisdiction's assets fall, requiring a similar response at home up to a point. We represent this as an increasing shift in our focus (a downward move along the innovation curve). The overall effect consists in reducing our polyarchy and financial assets as shown by the shifts from A(0) to A(1) and P(0) to P(1).

Figure 4: The Need to Innovate Our Way Out of Declining Competitiveness



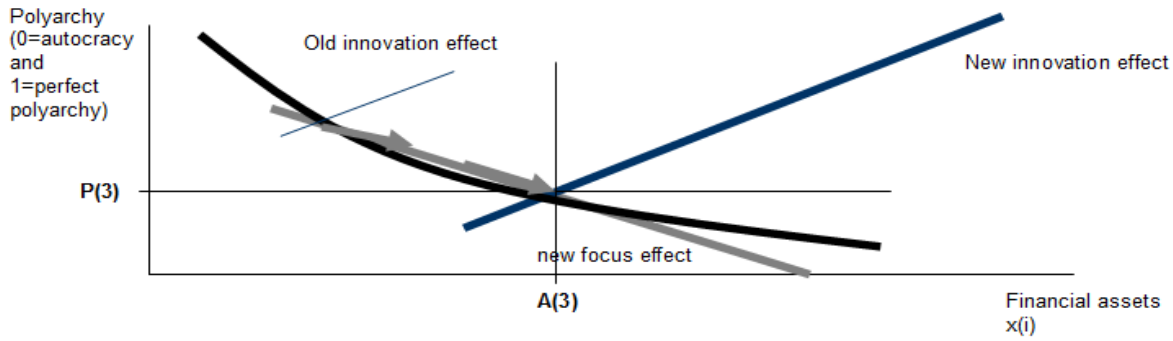
We innovate to respond to the threat of more autocracy abroad, expanding political participation to generate new ideas and generating support for reform by distributing resources to new groups. Such polyarchy continues hurting our financial status in the short-term, until the effects of new ideas kick in. Our jurisdiction is not less polyartic for the same level of financial assets as last year. In other words, we would be much more polyartic at this lower level of financial assets, if not for the autocratic response abroad (as shown by the value α).

In the longer-term though, polyarchy and financial assets held by our financial institutions settle at an equilibrium point dictated by finance-related tastes and technologies. Figure 5 shows the increase in financial assets and the accompanying decrease in polyarchy from its temporary very

[6] See Pond (2018) for a model of this effect, with the financial sector replacing these authors' view of exploitation from government.

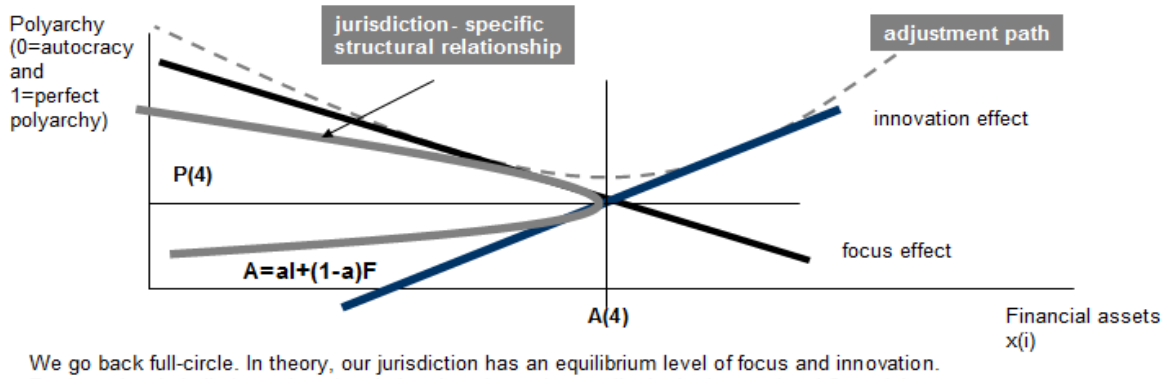
high levels, as financial services firms implement innovative ideas. Figure 6 shows the same relationship between these variables as in Figure 2, though with the figure turned on its side. The figure shows an adjustment path as other jurisdictions change their polyarchy and/or financial assets (and thus their centrality in the international network of financial centres). The levels A(4) and P(4) represent those post-adjustment, equilibrium values.

Figure 5: Reactions of Other Jurisdictions' Political and Financial States



Decreased political participation and polyarchy helps our jurisdiction quickly and efficiently implement the results of the innovation we "feed" into our financial system. Such a political concentration moves us along the focus effect curve. Our financial assets grow, as polyarchy falls.

Figure 6: Reactions of Other Jurisdictions' Political and Financial States



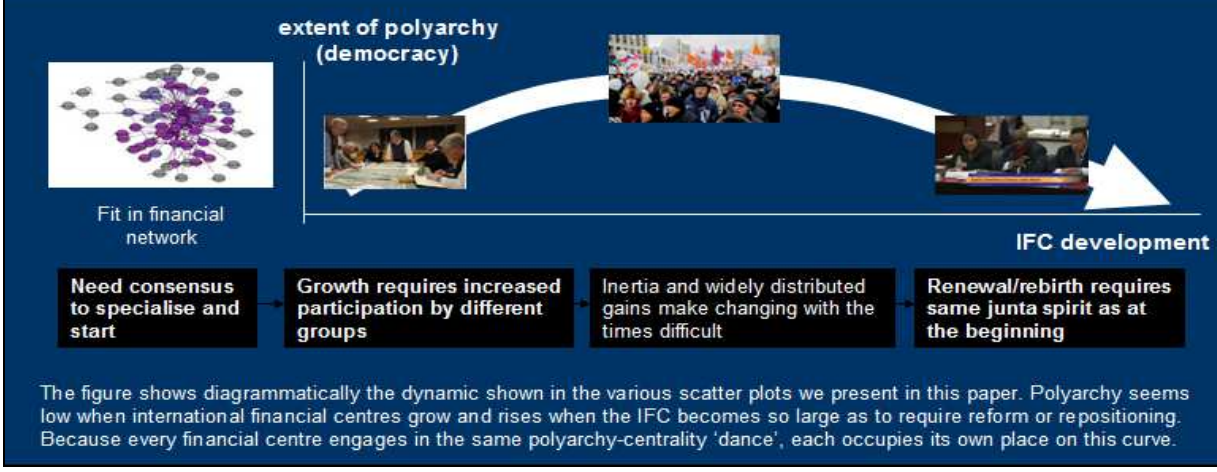
We go back full-circle. In theory, our jurisdiction has an equilibrium level of focus and innovation. Barring other jurisdictions changing their polyarchy and centrality in the international financial centre network, our polyarchy and centrality should settle at some steady state. We show the structural relation we described in the first of this series of figures (except with the axes flipped).

Because each wave of innovation leads to larger, more developed financial services firms, we can hypothesize about the way polyarchy changes as a financial centre develops. Figure 7 shows that conjectured change. As a financial centre seeks to grow, a pushing/guiding political force discourages dissent and encourages foreign investment. Experiences from the UAE, Singapore, and Qatar represent the most mediatised examples.[7] In other cases, the lack any traditional means of economic development -- combined with a geography that gave finance a natural competitive

[7] Such a theory completely contradicts work by authors like Genschel and colleagues (2016), who argue that autocratic regimes have little incentive to be reform. History dispels this myth.

advantage - encouraged an autocratic political focus on finance.[8] While many international financial centres still make finance a core area of policy, many have started opening to other areas. To what extent does such an opening represent a way of invigorating finance – rather than an attempt to diversify the local/national economy? Only time will tell.

Figure 7: The Transition Path of an International Financial Centre?



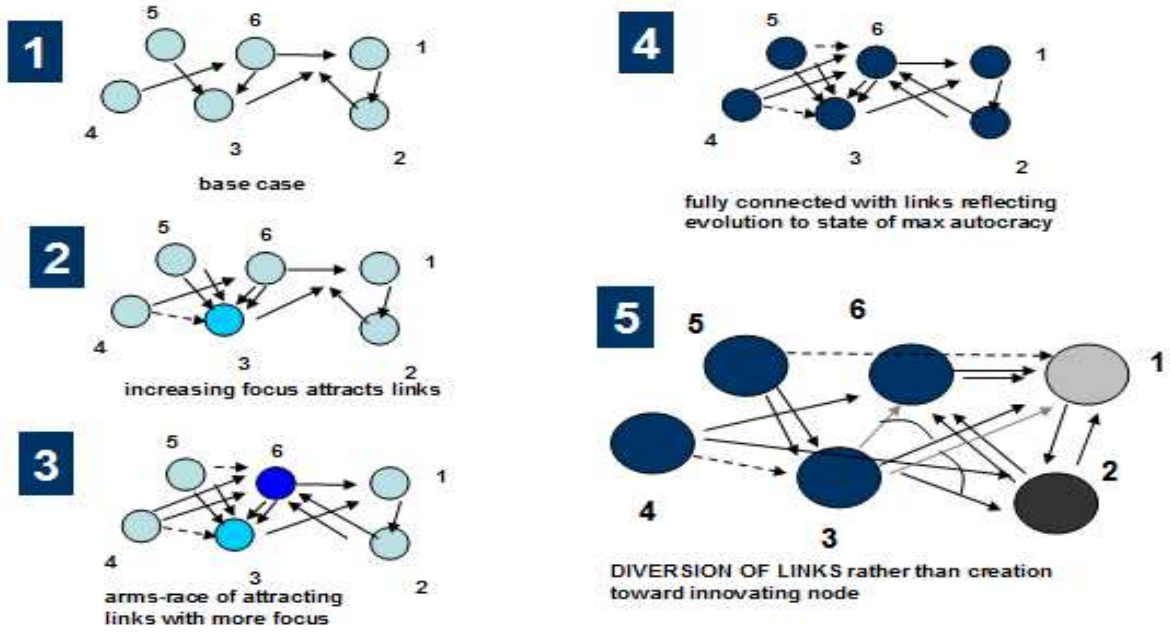
The figure shows diagrammatically the dynamic shown in the various scatter plots we present in this paper. Polyarchy seems low when international financial centres grow and rises when the IFC becomes so large as to require reform or repositioning. Because every financial centre engages in the same polyarchy-centrality 'dance', each occupies its own place on this curve.

Changes over Time

In our model, international financial centres grow over time, as they focus on finance. Figure 8 shows the mental model we used to develop our model. In plate 1, we see 6 financial centres represented as a simple set of nodes. In plate 2, we show the situation where financial centre number 3 focuses on developing its financial centre. As we described in the literature review, and showed in the previous empirical overview section, such a policy-focus leads to more links and more financial assets travelling along those links.[9] As plate 3 shows, as other financial centres focus even more intensively on finance, they build out both the quantity and depth of these network links.[10] As we described in the literature review, historically one financial centre developed and grow because of growth in counterpart centres. The self-reinforcing network of financial centres grows as more and more centres decide to develop their financial centres and linkages.

[8] Bassens and his colleagues (2010) provide a discussion of autocrats' 'world city' approach to development.
[9] Li and Resnick (2003), using a model very similar to ours, finds for two effects influencing democracy's impact on foreign investment.
[10] A theoretical justification for such an effect might go as follows. More polyartic institutions reduce certainty over the protection of property rights (as more interests vying for control means more unstable policy). Such uncertainty thus reduces all kinds of capital flows, deposits and portfolio investments (Cao and Ward, 2014). Naturally the argument could go the opposite way, with more autocracy giving politicians discretionary power over already-made investments. Such power would decrease confidence in the sanctity of property rights – and thus reduce foreign deposits and portfolio investments (as Stasavage, 2002 describes).

Figure 8: Dynamics of International Financial Networks (Link/Fund Attraction Versus Diversion)



The figure shows the dynamic effects of an increase in focus (a decrease in polyarchy) for theoretical financial centres in a theoretical network. The light blue node (number 3) indicates an exogenous change toward more focus. The darker blue node (number 6) indicates more focused policies than those pursued by node 3 (simulated possibly as a random reaction to node 3's policy). As more nodes focus their financial policies, the number of links increases. Plate number 4 shows the results of this race to the bottom, where all nodes have the maximum number of links. Similarly, in plate 5, the light gray node (number 1) represents the introduction of innovation-producing polyartic policies. The dark gray node (number 2) represents a jurisdiction introducing more polyarchy than in node 1. The cycle reverses itself, except such increases in polyartic policies cause links to divert from other financial centres (preserving the total number of links in the system). One could imagine/model an intermediary situation, where some nodes decrease their polyarchy, while others increase such polyarchy (thus avoiding the all-of-nothing wave-like patterns we have shown in this simple example).

As some financial centres fall behind, they engage in the innovation needed to develop new markets, new ideas, new financial products and new markets. New innovations do not always require democracy (increased polyarchy). An increase in polyarchy does not guarantee financial innovation. Places like Singapore and Shanghai have developed for a long time without such polyarchy. In our model, such polyartic-led innovation results in a shift in financial links – a diversion of funds from other centres.[11] Polyarchy changes the relative distribution of resources – allowing for future concentration.[12] Yet, in the short-term, innovation only serves to give other financial centres time to further focus their policy priorities toward finance.

[11] Most of the literature would probably agree with such a diversion – though most of the literature does not couch financial flows in network terms. Armstrong and Drysdale (2011), for example, describe how 'political closeness' encourages investment between politically close jurisdictions (necessarily at the expense of less politically close jurisdictions in a world with finite/scarce resources. Because they do not model investment in network terms, their investment diversion effects less clearly show the way funds swing from one place to the next with changes in politics.

[12] Indeed, not enough academics note the diversionary effect that political regime has on cross-border financial flows. Every time a study like Jakobsen and De Soysa (2006) finds that democracy (or whatever political institution)

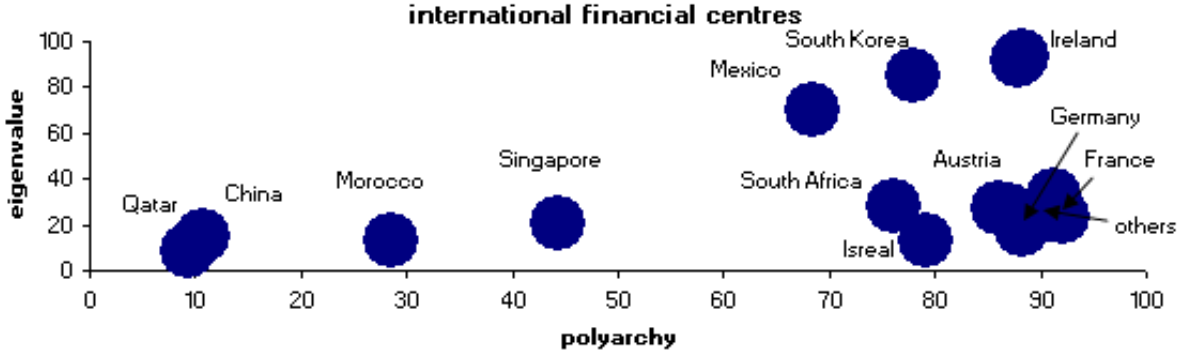
The Data and Empirical Methods We Used

Jurisdictions, raw polyarchy and network centralities

In order to test our theories, we first had to compile the relevant data for the relevant jurisdictions. Figure 9 shows the jurisdictions in our study, while Figure 10 shows the average values of polyarchy and eigencentrality from 2005 to 2015 – before being adjusted for the way that macroeconomic and other factors affect them. Figure 11 shows the extent to which aggregate polyarchy has changed (fallen) over the years when compares with jurisdictions' eigencentrality. . Figure 12 shows the networks of financial relations between international financial centres in 2005 and 2015. Grouping these networks in modules, we see increasing concentration over time (matching other data).

Figure 9: The Financial Centres In Our Study

Figure 10: The average values of polyarchy and eigencentralities for selected international financial centres



The figure shows the average values of polyarchy indices and eigencentralities for the international financial centres in our study from 2005 to 2015. Sources: V-Dem (2017) for polyarchy indices and Bank for International Settlements for the underlying data on cross-border bank liabilities for eigencentralities.

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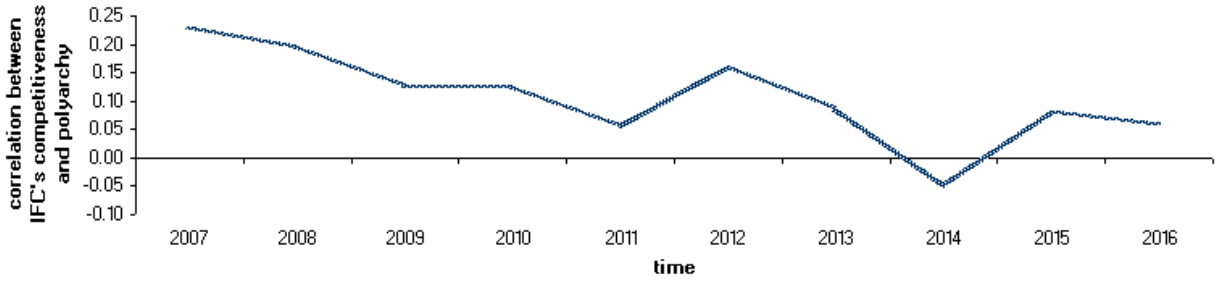
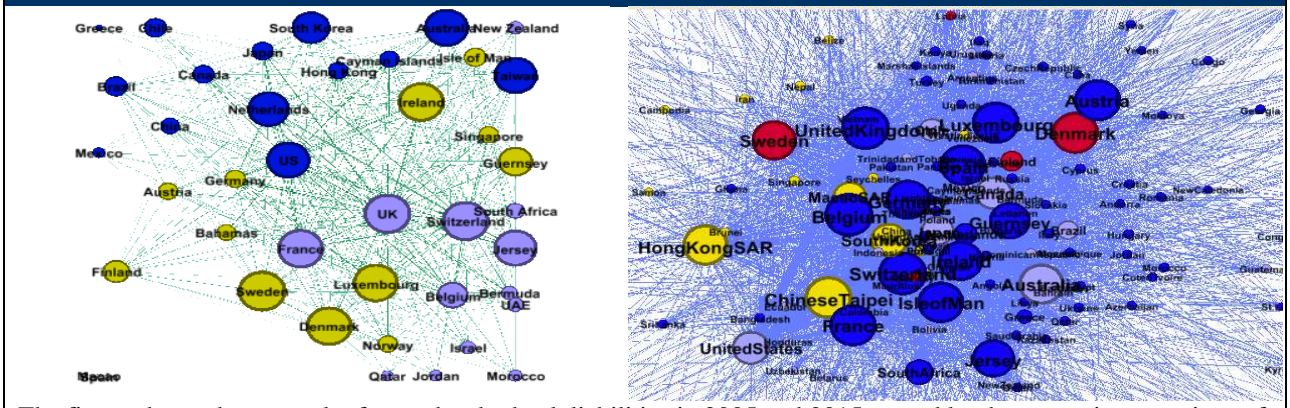
increases foreign financial flows, every country-specific negative sign in their regression analysis represents a case of diversion (where a country lost funds at the expense of another).

Figure 11: Recent Years Have Seen Anti-Democratic Reforms for IFCs



The figure shows the correlation between each international financial centre's competitiveness (its YtZen rating) and the level of polyarchy measured by the Varieties of Democracy Project for the period 2007 to 2016. The downward trend in this correlation does not account for uncertainties (variance) in these data and we do not show confidence intervals.... providing the reader with a roughly "feeling" for the data. See paper for list of jurisdictions we used and other details.
Sources: YtZen for IFC competitiveness ratings and the Varieties of Democracy Database (various years).

Figure 12: Financial Networks in 2005 and 2015

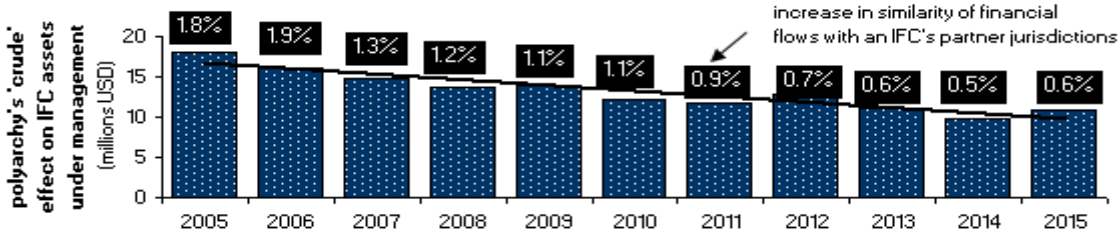


The figure shows the network of cross-border bank liabilities in 2005 and 2015, sorted by the top major groupings of financial centres. Such "modularity" (as the statistical name for such grouping) results from closer links between module members than the rest of the network. Such modularity changed radically over the 10 years. In 2015, top groupings accounted for 56%, 39% and 3% respectively for the top three modules. In 2015, the top grouping accounted for 63%, 20% and 10% of all financial centres (with 3 more groups scoring the remainder). These networks became thus more concentrated over time.

The way that polyarchy affects the amount of cross-border liabilities that banks can attract has decreased over time. Figure 13 shows the slope of a line of best fit between polyarchy and cross-border bank liabilities placed by each jurisdiction's largest counterpart jurisdiction. For example, in 2005, on average, a one point increase in polyarchy in any particular jurisdiction (like France) resulted in that jurisdiction's main counterpart (like the UK) placing roughly $18 million in extra cross-border liabilities in that particular jurisdiction (France). The values in the black boxes show the way 'drop off' in each jurisdiction's counterpart's cross-border liabilities changes for a one point increase in that jurisdiction's polyarchy. We define such a 'drop-off' as the proportional difference in the value of cross-border liabilities from lower ranked jurisdiction counterparts. For example, France's second largest counterpart jurisdiction (the US) may provide 12% fewer cross-border bank liabilities than the first ranked jurisdiction (the UK). Similarly, on average, France's

third largest counterpart jurisdiction provided 12% fewer liabilities than the US. The value in the black boxes in Figure 13 do not represent the value of such a drop-off. Instead, they measure the way that drop-off value changes as polyarchy in a jurisdiction rises.[13]

Figure 13: Democratic Institutions' Ability to Make for Larger and More Diverse International Financial Centres Diminshed in the Mid-2000s

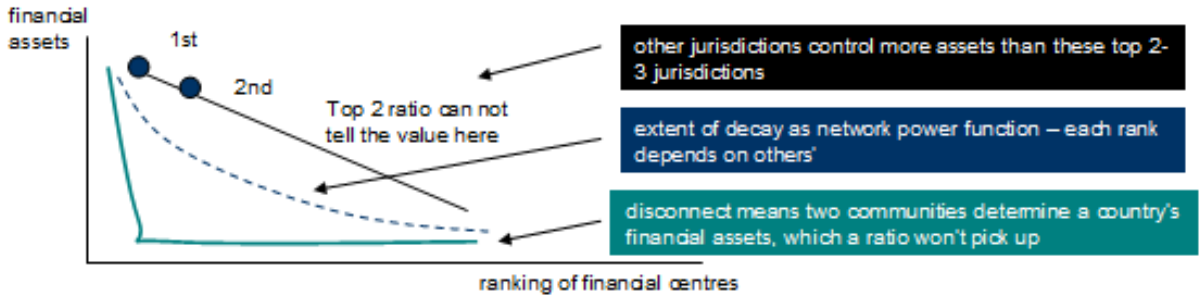


The bars in the figure show the way that international financial centres' (IFCs) largest partner investor/banking partner changes with a one point change in polyarchy (or the extent to which more numerous groups participate in that IFC's financial policy and political decisions). For example, in 2005, a one point increase in such polyarchy increased bank liabilities to the roughly 30 IFCs we analysed by about $18 million -- before controlling for other factors like exchange rates, economic growth, local stockmarket performance and so forth. In 2015, polyarchy's effect on the average IFC's largest partner decreased to a statistically significantly amount, to around $12 million. The black boxes show the percent decrease in inequality because these IFC's partners. For example, in 2005, a one point change in polyarchy lead to a 1.8% decrease in the difference in the dispersion of bank liabilities coming IFCs' partner IFC jurisdictions. We calculated such disperson by fitting a power curve to the value of the flow of bank liabilities to each IFC by its partner jurisdictions, ranked by size from highest to lowest. All 2005 numbers shown here differ from the 2015 with a 95% level of confidence.
Sources: Data from the Bank for Internatiional Settlements (2017), with calculations by authors.

One approach to analysing our bank liabilities data might consist of looking at the ranks of cross-border bank liabilities between these financial centres. We might devise some method – like a ratio of largest to smallest counterpart jurisdiction – or some measure the deviations from the average. Figures 14-16 explain why we used network characteristics instead. In brief, we used network characteristics because of the dependencies between the financing partners themselves. As Figure 14 shows, the construction of any ratio of even deviation from average assumes that one observation (country's data) do not depend on other countries. We can construct a reliable ratio (for example) if the denominator partly changes every time the denominator does. As Figure 15 shows, if we compare financial centres' network centralities with entropies (a measure of the similarity of each partner's bank liabilities), we see little relationship at all (as shown in the scatter plot in the lower left hand side of the figure). Figure 16 describes the term eigencentrality we use throughout this study.

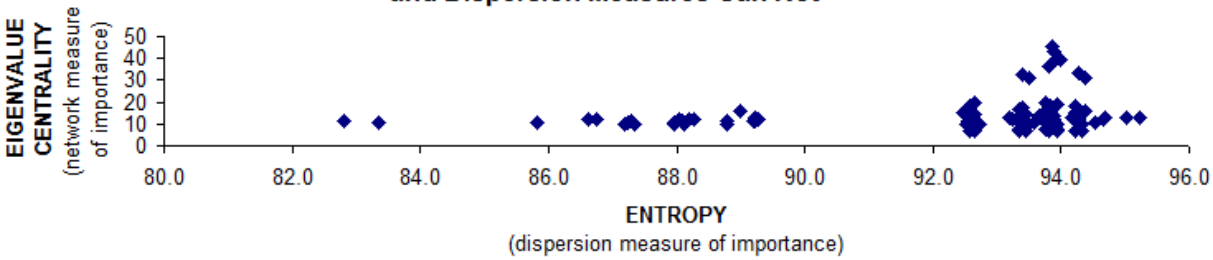
[13] As explained in the figure, we estimate such a change by regressing the value of these drop-offs by polyarchy ratings for the jurisdictions we studied for each year. The value in the black box shows the value of the slope of that regression line. Such a regression covers up differences in jurisdictions (namely the line of best fit may not completely describe two countries' data lying relatively far away from the line). The regression also does not control for extraneous factors like macroeconomic conditions and the quality of national institutions. We control for these variables later in our study.

Figure 14: Why Do We Use Networks Rather than Ranks?



Simple ratios of financial centres or even dispersion measures line Gini Indices can not pick up the relative importance of a node like network measures can. In the IFC world, larger IFC necessarily have more and larger links. Networks pick up relationships "down the distribution" that simple ratios can not (they assume jurisdictions are independent).

Figure 15: Network Measures Capture IFC Importance In a Way Standard Ranks, Ratings, and Dispersion Measures Can Not



The figure shows the eigenvalue centrality and the entropy of financial centres in each years used in our study. We see no clear relationship, with such a relationship varying across countries and times (as we described earlier). Eigenvalue centrality refers to the importance of an international financial centre's cross-border bank liabilities, given the links to other important centres. Entropy just measures the difference in these liabilities, relative to all other countries for that year. Source: authors (based on data from the BIS).

Figure 16: What is Eigencentrality?

As we describe in the appendix, eigencentrality refers to the importance of an international financial centre in the network of such financial centres. Such centrality takes into account the value of cross-border bank liabilities a jurisdiction attracts from counterpart jurisdictions. Such centrality also takes into account the importance of that jurisdiction's partner countries for their own counterparts. The eigencentrality algorithm basically traces the value of all these liabilities across the whole network of financial centres for all jurisdictions. The most central jurisdictions attract large amounts of cross-border liabilities from jurisdictions which attract a large amount of these liabilities and so on all the way through the network. The German word *eigen* means characteristic (as in a physical or identifying characteristic). Such a procedure thus finds the true or characteristic values of these jurisdictions by already including the potential investments/liabilities other financial centres indirectly make to that jurisdiction through its networks of partners. Eigencentrality thus truly provides a financial-system-wide view.

Figure 17 shows the variables we used in our study. The dependent variables consist of polyarchy in each jurisdiction as well as two measures allowing us to quantify the nature of each jurisdiction's financial networks. In order to compare polyarchy and a jurisdiction's centrality in international financial centre networks, we had to control for non-political factors. For example, a

jurisdiction could attract large amounts of cross-border bank liabilities because of favourable exchange rates or because its government requires more funding to operate public services (and they want to use foreign funds/deposits to finance such funding).

Figure 17: List of Variables Used to Remove the Effect of Macroeconomic and Other Variables When Estimating the Amount of Cross-Border Bank Liabilities

Factor	N	Mean	Std. Dev	Min	Max	Diff?
Dependent Variables						
Polyarchy	192	85.06	12.45	9.21	94.71	*
Largest 'investment' partner	181	231776	355,563	1406	2,002,814	*
Power Law	181	-0.3	0.1	-0.63	-0	*
Macro push/ pull factors						
Real effective exchange rate index†	180	99.03	7.95	70.9	125.7	*
Real interest rate (%)	140	5.28	8.56	-10.8	44.6	
Attraction Factors						
Market cap. (% of GDP)	150	93.94	61.16	17.57	282.51	*
GDP per capita, PPP (current thousands international $)	192	37.4	14.56	4.77	129.34	*
S&P Global Equity Indices (annual % change)	192	7.13	29.27	-69.94	125.11	
Current account balance (% of GDP)	192	1.35	5.44	-7.51	31.06	
Commercial service exports (current billion US$)	192	116.45	134.74	5.58	730.59	*
Connectivity factors						
Air transport, millions of passengers carried	172	89.23	172.36	0.55	798.22	*
Demanders of funds						
Central government debt, total (% of GDP)	160	60.65	26.52	18.37	132.36	*
Gross capital formation (% of GDP)	192	23.07	4.14	14.73	43.26	
Suppliers of funds						
Gross domestic savings (% of GDP)	192	26.03	8.08	12.47	75.54	*
FDI, net inflows (% of GDP)	192	6.22	11.35	-5.63	87.44	*
Broad money growth (annual %)	116	8.50	6.66	-25.5	22.05	
Institutional factors						
Rule of Law‡	190	1.35	0.78	-0.66	2.10	*

† 100 =2010

‡ rule of law comes from the World Bank's Governance Indicators for the variable by that same name. All the other variables should be self-explanatory.

Diff? refers to whether we calculated and used annual differences in this variable.

Without controlling for macroeconomic and other factors, our analysis would have been badly biased. The previous figure (Figure 17) shows the five (5) factors that we grouped these variables into.[14] Macroeconomic push-pull factors include variables that could push or pull funds across borders to a jurisdiction's banks. Exchange rates and interest rates represent self-explanatory variables.[15] Attraction factors represent variables that might attract foreign funds (the size and

[14] We do not provide a complete literature review – which would easily double the size of this paper. Instead, we appeal to readers' common sense, and refer to the literature when necessary (especially in determining if any work exists about polyarchy as a dependent variable in analysis related to the variables we describe in this section).

[15] While these variables obviously affect cross border deposits and portfolio investment, their effect on polyarchy/democracy remains murkier. Few academics have (rightly) tried to assess the effect of exchange rate changes on political regimes (and/or the extent of democracy/polyarchy). Of the studies we could find, like Steinberg

performance of local stock markets, the need to finance trade, and the overall jurisdiction's wealth/size.[16] Air transport represents our only factor measuring the jurisdiction's connectivity.[17] Demanders of funds – like government and business investment – draw out demand for foreign funds.[18] Suppliers of local funds might help crowd out (or crowd in) foreign funds.[19] These suppliers include households and their savings, foreign direct investment and credit growth by/from the central bank.[20] Finally, no analysis is complete these days without a consideration of local institutions and the quality of regulations (as proxied by the World Bank's *Governance Indicators* variable measuring the rule of law).[21]

Getting polyarchy and network centralities ready for analysis

Macroeconomic and other factors correlate heavily with the polyarchy and centrality of international financial centres. Figure 18 shows the number of variables, combinations of these variables, and non-linearities in these variables which correlate with their jurisdiction's polyarchy indices.[22] About 80% of all these combinations statistically significantly correlate with polyarchy at a 95% level of confidence or better. These data show that we must remove their effects before trying to find patterns related to these international financial centres' centrality in their financial networks. Figure 19 shows the general process we used to strip away the effects of these macroeconomic variables – on both polyarchy and eigencentrality values. We regressed these variables (the covariates) on polyarchy and eigencentrality values using panel methods – in order to arrive at "pure" polyarchy and eigencentrality values.[23] As Figure 20 shows though, we had to correct the data for the interdependencies between them. The left side of the figure shows two

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and Malhotra (2014) most looked at the effect of political regime on exchange/interest rates – rather than the other way around. Likely endogeneity makes these variables, though, but dependent and independent in any econometric analysis. One can easily see how exchange rate changes affect the distribution of gains from globalisation – which affects the relative bargaining power of these sectors (Frieden, 1994).

[16] The most popular area of research for stock market performance revolves around political cycles (Santa-Clara and Valkanov, 2003; Asteriou and Sarantidis 2016) . While not exactly our question (about the cycling of democratic versus autocratic decision making in financial policy), the reader can probably easily infer the extension from the effects on partisan politicians describes by authors writing in this area.

[17] Econometric analyses have already tied connectivity to banking and investment, though not very specifically to political regime. See Levitz and Pop-Eleches (2010) for an example from the EU on how travel (connectivity) influences political regime and Barsbai, and his co-authors (2017) for a broader, more robust study.

[18] The effect of cross-border capital flows on political openness represents another under-researched question (like any question where polyarchy/democracy represents the dependent variable). Bak and Moon (2016) find statistically significant effects, while Escriba-Folch (2017) does not.

[19] While no one seems to have looked at how savings affects democracy, at least authors like Scheve and Stasavage (2017) have looked at wealth.

[20] Credit policy's effects on democratisation alone has taken up a vast literature, with expansion money and credit supporting the incumbent or not (depending on credit's effects on inflation, public spending, and other variables. We prefer to avoid this discussion all together, rather than give a few, inadequate, references.

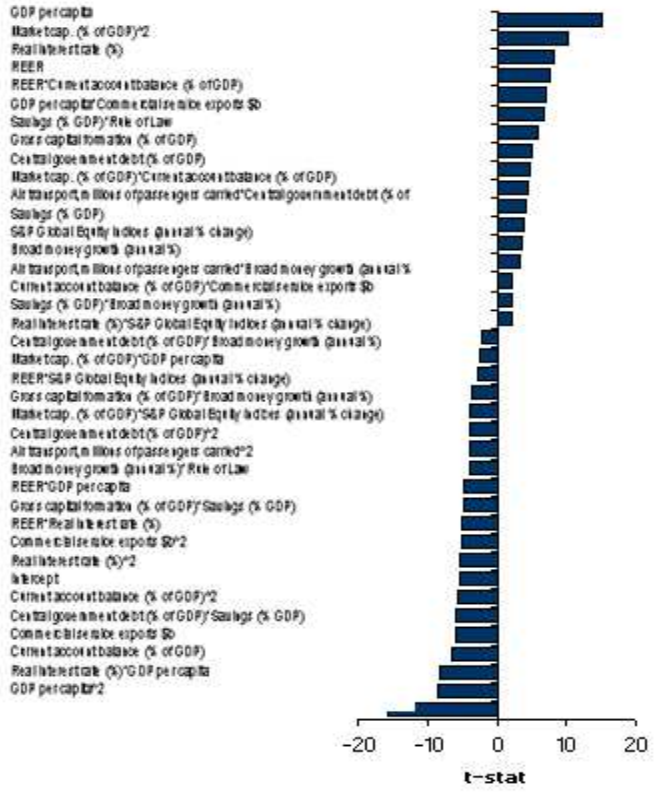
[21] The World Bank's Governance Indicators have opened up an entire academic industry looking at the effects of "institutions" on just about everything. Wagner and his colleagues (2009) represents one study looking at the 'quality of institutions' and its effects on democracy.

[22] We refer to a technique in the figure known as response surface regression. Such a regression basically has squared terms (which hunt for non-linearities) and interactions between variables already built into the algorithm. The recursive method we discuss helped our analysis because regressing so many values "bins" our data into so many containers that parameter estimates become very imprecise.

[23] Panel regression represents such a well-known technique that we do not describe these methods. The reader completely unfamiliar with such regression can easily find a video about the technique.

completely independent factors (regression requires such independence to "work correctly").[24] We see many variables clumping nearer to each other than these independent axes (known as eigenvectors). The correlation matrix on the right side of the figure further shows such interdependences between these variables. A bit fewer than half of all these variables statistically significantly correlate with each other. Without correcting for such inter-correlation, we would accidently assign part of the effect of exchange rate movements on trade balances, to cite one of the many 'multicollinearities' (as economists refer to such a problem) in these data.

Figure 18: So Many Variables Affect Polyarchy That We Must Control for Them



The figure shows the variables which statistically significantly correlate with polyarchy across years and countries. We found these correlations using a technique known as response surface regression. Such a technique looks for non-linearities and interactions between variables. A computer normally could not solve such a large system of equations. We used a particular robust technique known as a recursive power method to find very microscopic values of our matrix when inverting the matrix to find a solution. The techniques we used are less important than the general message. Most of the variables in our study statistically significantly correlate with polyarchy – interfering with any analysis trying to spot the effects of a jurisdiction's network centrality on such polyarchy. We could show similar results for network centrality – that these variables affect the extent to which financial firms attract cross-border bank liabilities. Such multiple correlation would interfere with any attempt to look directly at the relationship between jurisdictions' polyarchy and network centrality. We describe below how we removed the influence of these factors from our analysis.

[24] 'Work correctly' means to find the unbaised, least variance estimates of parameters like the effect of eigencentrality on polyarchy (and visa-versa).

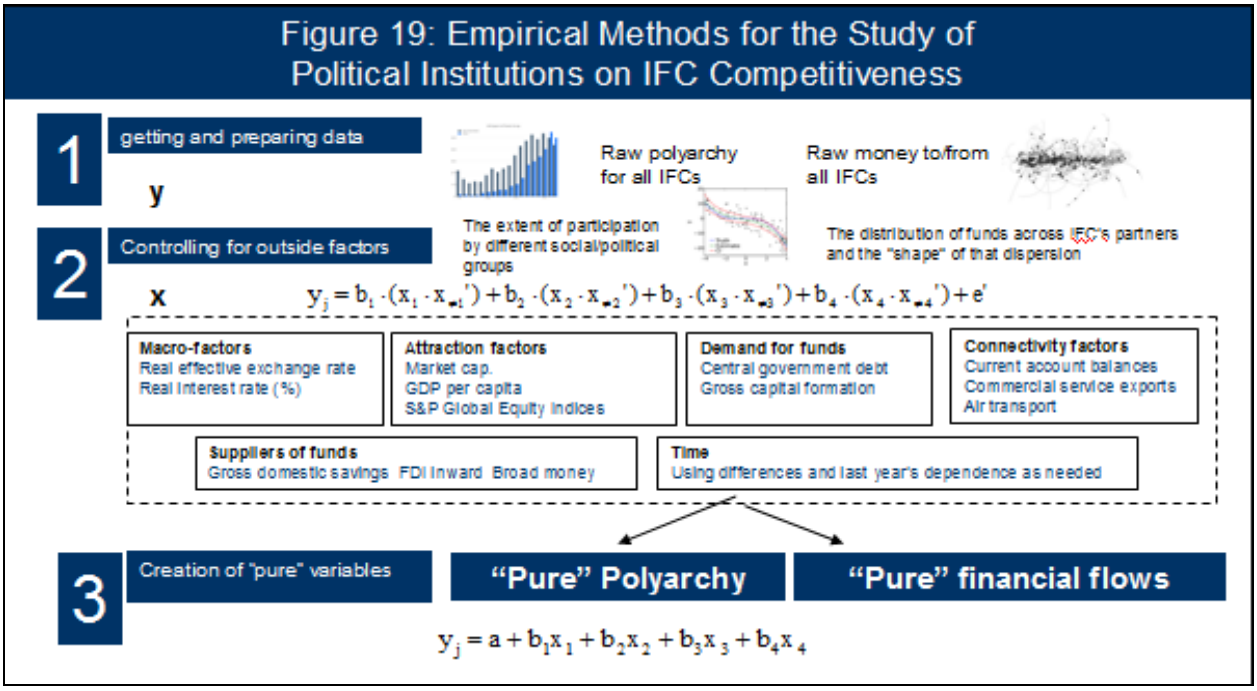
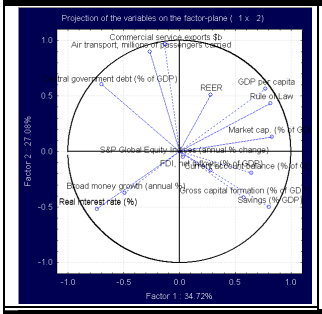


Figure 20: Fixing Problems That Arise When Variables Correlate With Each Other (Multi-collinearity)



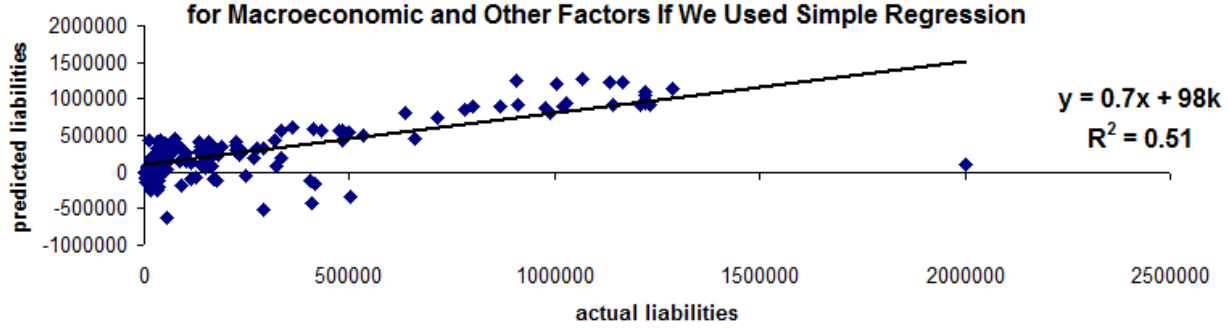
	Means	Std.Dev.	Polyarchy*100	REER	Real interest rate (%)	Market cap. (% of GDP)	GDP per capita	S&P Global Equity Indices (annual % change)	Current account balance (% of GDP)	Commercial service exports $b	Air transport, millions of passengers carried	Central government debt (% of GDP)	Gross capital formation (% of GDP)	Savings (% GDP)	FDI, net inflows (% of GDP)	Broad money growth (annual %)	Rule of L
Polyarchy*100	89.46	2.47	1.00	0.40	-0.37	0.52	0.58	0.01	0.41	0.33	0.18	-0.15	-0.09	0.19	-0.05	-0.19	0.
REER	98.52	10.75	0.40	1.00	-0.46	0.20	0.45	-0.09	0.04	0.40	0.24	0.01	-0.14	-0.11	0.23	-0.10	0.
Real interest rate (%)	8.34	11.72	-0.37	-0.46	1.00	-0.55	-0.82	0.09	-0.16	-0.37	-0.23	0.26	-0.34	-0.27	-0.12	0.47	-0.
Market cap. (% of GDP)	122.89	61.73	0.52	0.20	-0.55	1.00	0.69	0.30	0.76	0.08	-0.05	-0.45	0.21	0.62	0.23	-0.43	0.
GDP per capita	39.09	14.93	0.58	0.45	-0.82	0.69	1.00	-0.05	0.41	0.46	0.34	-0.19	0.24	0.40	0.01	-0.54	0.
S&P Global Equity Indices (annual % chang	6.28	32.49	0.01	-0.09	0.09	0.30	-0.06	1.00	0.11	-0.03	-0.02	0.01	-0.06	0.04	-0.07	-0.07	-0.
Current account balance (% of GDP)	-0.25	6.12	0.41	0.04	-0.16	0.76	0.41	0.11	1.00	-0.20	-0.34	-0.43	0.05	0.70	0.26	-0.26	0.
Commercial service exports $b	182.64	216.90	0.33	0.40	-0.37	0.08	0.46	-0.03	-0.20	1.00	0.93	0.71	-0.51	-0.56	-0.19	-0.24	0.
Air transport, millions of passengers carried	200.76	283.51	0.18	0.24	-0.23	-0.05	0.34	-0.02	-0.34	0.93	1.00	0.74	-0.42	-0.61	-0.33	-0.21	0.
Central government debt (% of GDP)	48.44	23.14	-0.15	0.01	0.26	-0.45	-0.19	0.01	-0.43	0.71	0.74	1.00	-0.69	-0.80	-0.25	0.02	-0.
Gross capital formation (% of GDP)	22.91	3.53	-0.09	-0.14	-0.34	0.21	0.24	-0.06	0.05	-0.51	-0.42	-0.69	1.00	0.69	0.01	-0.12	0.
Savings (% GDP)	23.79	7.07	0.19	-0.11	-0.27	0.62	0.40	0.04	0.70	-0.56	-0.61	-0.80	0.69	1.00	0.17	-0.23	0.
FDI, net inflows (% of GDP)	3.92	3.42	-0.05	0.23	-0.12	0.23	0.01	-0.07	0.26	-0.19	-0.33	-0.25	0.01	0.17	1.00	-0.05	0.
Broad money growth (annual %)	9.19	7.45	-0.19	-0.10	0.47	-0.43	-0.54	-0.07	-0.26	-0.24	-0.21	0.02	-0.12	-0.23	-0.05	1.00	-0.
Rule of Law	1.35	0.77	0.45	0.46	-0.96	0.61	0.86	-0.07	0.24	0.28	0.14	-0.38	0.41		0.12	-0.47	1.

The figure shows the extent to which the covariates we try to control for correlate with each other. Such correlation (called multi-collinearity) causes any analysis of one variable (like government debt) to pick up the effects of other variables like market capitalisation, trade balances, popularity as an air travel destination and so forth. The left part of the figure shows the relationship of our variables with two completely independent variables (called orthogonal factors). Ideally, we need our variables to sit on one of these axes. The right hand side shows the correlation coefficients between the variables we used to adjust our polyarchy and network centrality data. The coloured cells show the correlations with a 95% probability or greater of statistically significantly varying with each other. Source: authors calculations (with data from the Bank for International Settlements, 2017).

The resulting analysis yields the 'predicted values' of our key variables of interest. Regressing a jurisdiction's bank liabilities on exchange rates, government debt, air travel and other factors yields a predicted value for these liabilities. The model's error thus reflects the part of these financial flows unexplained by these macroeconomic and other factors. We use these errors as our estimates/variables of 'pure' cross-border bank liabilities (after controlling for these other factors). Figure 21 provides one example of how we estimated the largest liability flow from each jurisdiction's largest counterpart for one year (in 2005). The figure shows the actual values of these liabilities, their predicted values from our model, and the differences between the predicted values and actual values. Figure 22 shows the extent to which the values of bank liabilities for the

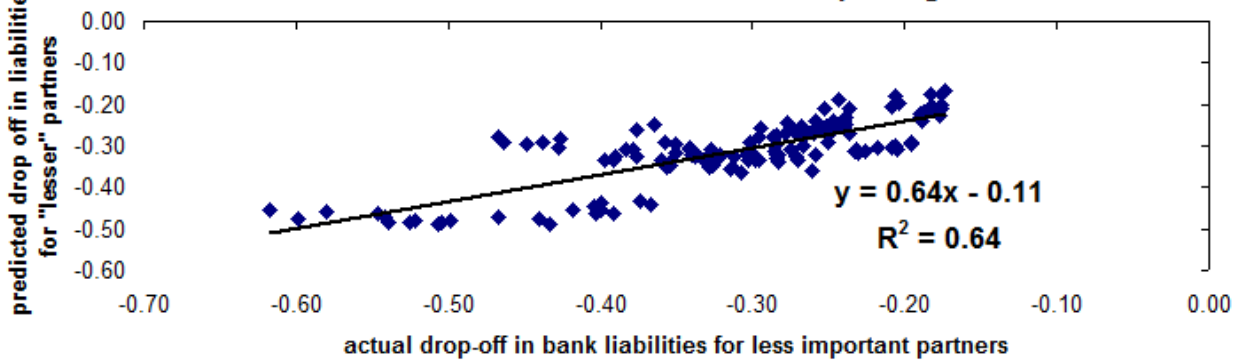
second, third, fourth and other partner jurisdictions "drop off" (decrease in value) by rank. Such a drop off – combined with the largest finance partner – provides the new structure of financial networks.[25]

Figure 21: Adjusting Network Banking Partners' Bank Liabilities for Macroeconomic and Other Factors If We Used Simple Regression



The figure shows the relationship between actual cross-border bank liabilities from each country's largest cross-border counterpart and those predicted by the best fitting model. For example, in 2005, the largest value of Australia's cross-border bank liabilities came from the US. We estimate this predicted value for each country, for each year, in order to estimate how funds would have flowed between international financial centres if we could remove the effects of variables like real exchange rate changes, GDP growth, the level of government debt, and so forth. We show a simple linear regression here to illustrate the general idea. In practice, we used a machine learning model (which actually did not deviate too much from this simplistic model).

Figure 22: Adjusting for the Fall-Off in Network Partners' Bank Liabilities for Macroeconomic and Other Factors With Simple Regression

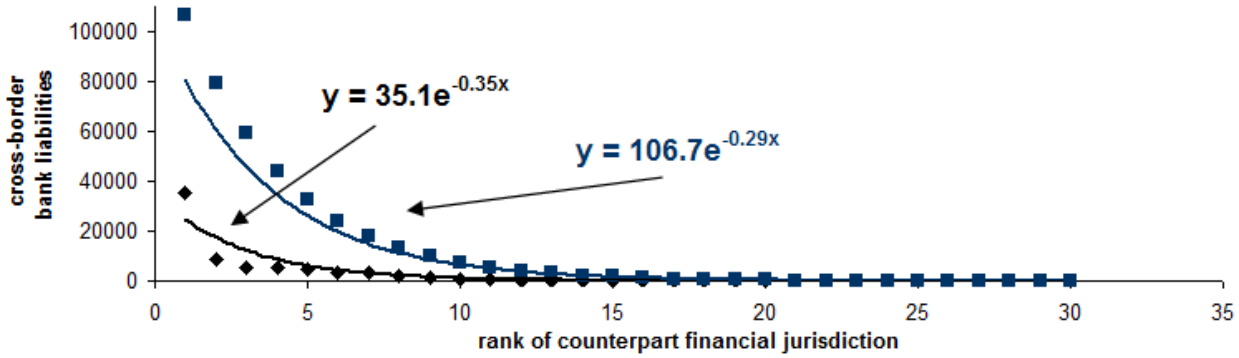


The figure shows the predicted "drop off" in the value of bank liabilities for each of the countries in our sample. We calculate such a drop off by sorting the value of bank liabilities coming from each jurisdiction's partner jurisdictions, and then fitting an exponential function to these values. For example, the value of each of Australia's counterpart jurisdictions decreased by 35% when sorted from largest counterpart jurisdiction to smallest. We show the linear predicted value of these 'drop-off' values in the figure to illustrate our broader methodology. We used a machine learning algorithm to fit the actual values (though these values came pretty close to our more complex method).

[25] Because all jurisdictions in the BIS database link to each other, we do not need to worry about the existence/ absence of links. Thus, we only need to know which jurisdiction provides the most bank liabilities (as a lead counterpart) and the other finance partners' (ranked by the value of their cross-border bank liabilities in a jurisdiction) liability flows diminish in relation to that ranking. These two numbers (the lead counterpart and the 'drop-off' value) provide all the data necessary to construct a fully-linked network.

We constructed 'pure' financial networks for these cross-border bank liabilities by combining these new largest partner estimates with these new drop-off estimates. Figure 23 shows how we constructed these new networks – using Australia's cross-border bank liabilities from 2005 as an example. If Australia's largest provider of funds in 2005 held $35 million in assets (recorded on the Australian side as a liability), then our cross-country econometric estimation predicted a value of $106 million – assuming exchange rate movements, different government debt levels, and other factors had not affected these funding patterns. By rank, each counterpart jurisdiction placed 35% fewer funds with Australian banks than the one ranked ahead it. After controlling for these macroeconomic and other effects, they should have placed 29% less – in effect investing more per partner jurisdiction.

Figure 23: Readjusting Each Financial Centre's Cross-Border Bank Liabilities for Macroeconomic and Other Factors



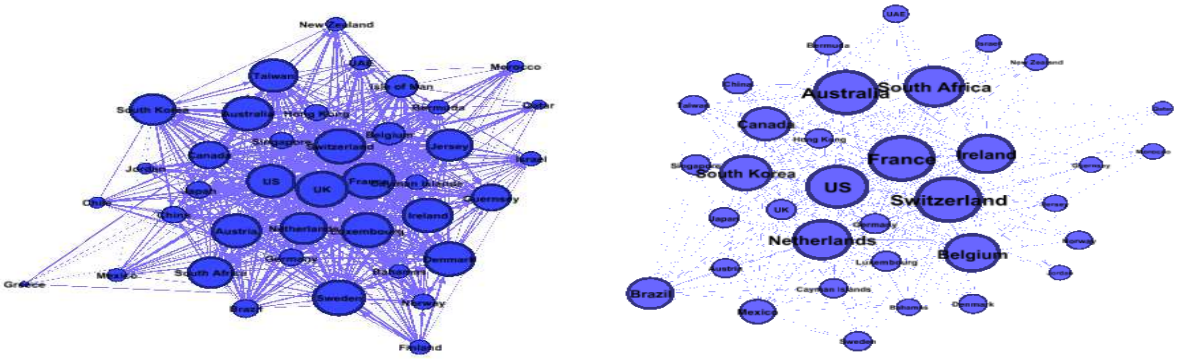
The figure shows how we adjusted one country's (Australia's) cross-border bank liabilities for exchange rate movements, GDP sizes, government debt stocks and the other factors we have previously described. The black line shows the value of Australia's cross-border bank liabilities coming from its largest partner jurisdiction (the US) as roughly US$35,000 in 2005. The next largest value of these bank liabilities came from the UK and represented about 35% less than cross-border bank liabilities from the US – and so forth down the line of partner jurisdictions. The predicted value of Australia's bank liabilities ('removing' the effect of all these outside variables) came to about US$106,700 for the largest partner (again the US), with the US and other jurisdictions' cross-border bank liabilities' values decreasing by about 29% when sorted by size. Note that we used the residual of the regression to find these values – not the predicted values themselves.

Such differences in these financial centres' leading financial partner and the extent to which such financing drops off by rank leads to different network configurations, after going through this exercise for all the financial centres in a particular year.[26] Figure 24 shows the network of these bank liabilities in 2010, before adjusting for the effects of these macroeconomic and other variables – and after. Australia's and South Africa's centrality would have increased remarkably. Places like Jersey would have lost out a bit.[27] Figure 25 summarises these changes – showing the way mean values would have changed.

[26] Researchers like Georg (2011) and Derudder *et al.* (2003) have taken increasing interest in mapping out the networks of cross-border financial flows. The configurations of these networks take many forms – depending on the goal of the analysis.

[27] Unfortunately, too few scholars bother adjusting these networks. Without adjustment, as Aldasoro *et al.* (2017) and Bargigli *et al.* (2016) show, network changes could result from any factor – not just the one the author studies.

Figure 24: The Network of Cross-Border Bank Deposits and Other Liabilities for International Financial Centres Before and After Adjusting for Macroeconomic and Other Variables



BEFORE ADJUSTMENT **AFTER ADJUSTMENT**

The figure shows the network structure (geography) of cross-border bank liabilities for the most important international financial centres for 2010 (as one example from 2005 to 2015). For negative values of these flows, we switched the direction of these flows, from destination to source (rather than the other way around). We calculated each country's eigencentrality from networks like these for each year from 2005 to 2015. These eigencentralities measure the importance of an international financial centre, taking into account the size of cross-border bank liabilities its counterpart jurisdictions attract from their own partner jurisdictions. The final eigencentralities thus exclude the effects of macroeconomic and other factors we used in our preliminary regressions.

Figure 25: Summary Statistics for Polyarchies and Eigencentralities Used in Study

Variable	Valid N	Mean	Minimum	Maximum	Std.Dev.
Pure Polyarchy	160	18.81	0.0	119.38	11.15
Difference in Pure Polyarchy	141	0.74	-7.5	45.51	5.27
Voice	192	114.83	-170.0	173.96	55.87
Difference in Voice	163	-2.05	-162.3	91.89	19.48
Old eigencentrality	128	90.79	0.0	100.00	11.97
New eigencentrality	156	37.80	8.7	100.00	33.28
Change in new eigencentrality*	130	63.68	-10000.0	10000.00	3646.91
Invest Entropic Measure * 100	184	15.91	6.7	54.26	8.56

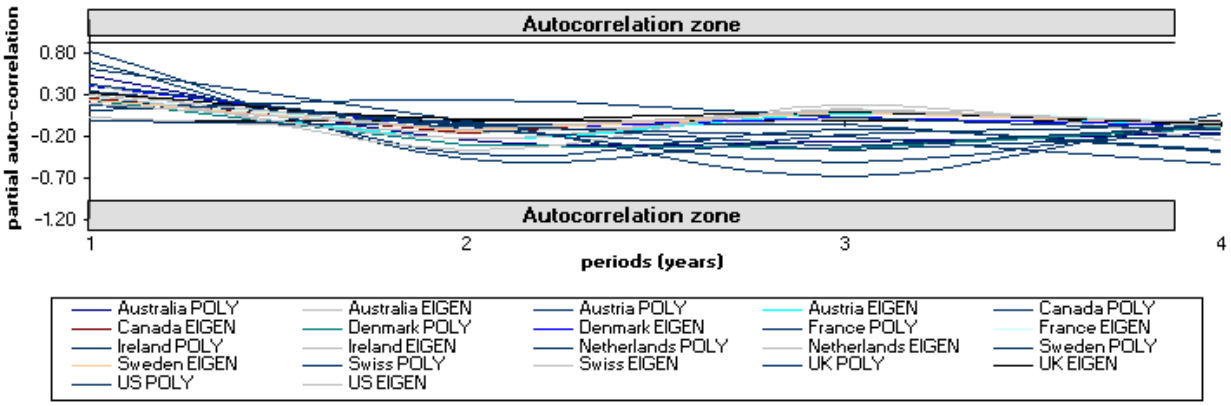
The figure shows the differences in the values of our variables, before and after controlling for outside factors. "Pure" variables refer to variables calculated as the 'error' or residual of the regression analysis we described earlier, adjusting for the effects of macroeconomic and other factors. We provide data for voice and entropy, two variables which we will discuss in more detail as we test the robustness of our analysis.
* We rescaled these changes to maintain the same scale as the other data.

Changes over time

Even after finding the "pure" values of polyarchy and eigencentralities, we still need to make sure that any correlation between these variables does not arise from inertia. If a country's polyarchy in any year depends mostly on such polyarchy in the previous year (or years) before, then such a dependence on the past can block out any attempt to correlate such polyarchy with the network importance of the jurisdiction and its partner/competitor jurisdictions. Figure 26 shows the extent of such inertia – which economists call auto-correlation – for select

jurisdictions' eigencentrality and polyarchy. We observe no value approaches one (1) – the value at which last year's polyarchy equals this year's polyarchy.[28]

Figure 26: No Evidence of Auto-Correlation in Polyarchy or Eigenvalue Measures



The figure shows the results of the four period partial autocorrelation on each international financial centre's "real" polyarchy scores and "real" eigecentralities for 2005 to 2015. The gray zones indicate values where we would need to difference our data or take other measures to eliminate the problems of data which entirely feed back on themselves (economists call such a process a unit root). We use these tests to account for correlation between periods, thus ferreting out the difference between the way polyarchy affects an international financial centre's centrality versus the way such centrality feeds back into itself. Partial correlation removes the influence of other periods' influence on (for example, the way that period 4 impacts on period 1 after removing periods' 2's and 3's effect on period 4).

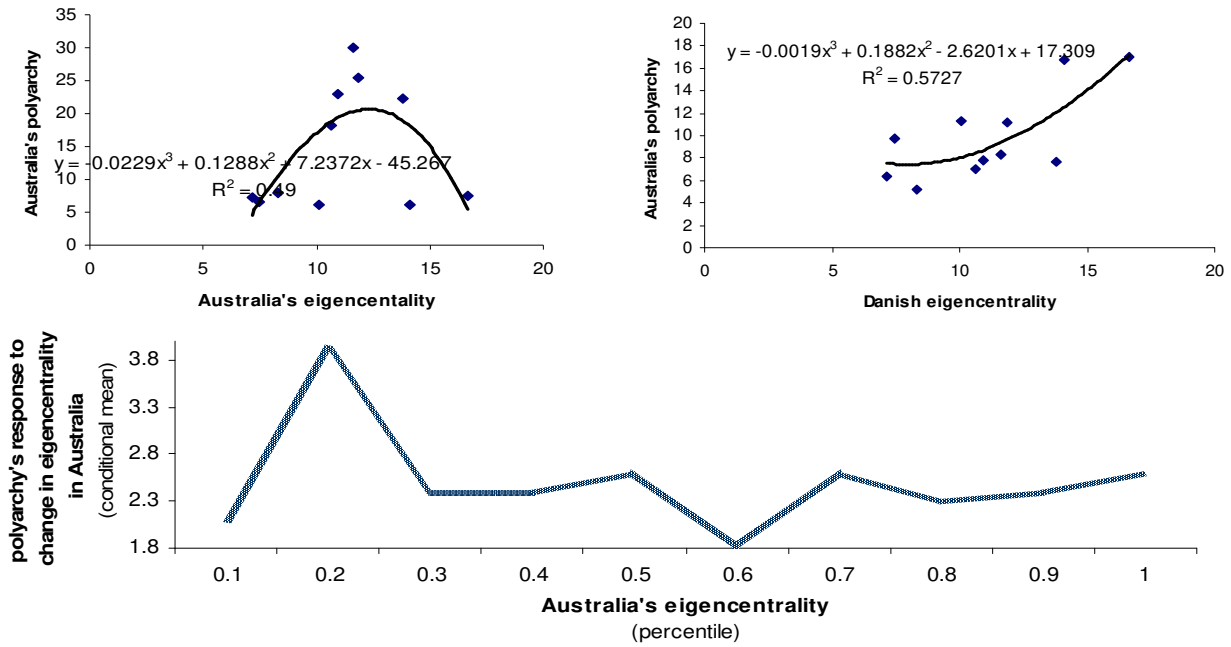
We can then look at how each country's polyarchy-eigencentrality adjusted over the decade. Figure 27 shows some examples of our data. The left hand side of the figure shows Australia's polyarchy compared with its own eigencentrality. We observe a hill-like pattern in this one example of Australia's polyarchy compared with the jurisdiction's own eigencentrality.[29] Australia's eigencentrality and polyarchy have risen together for lower levels of the country's eigencentrality. As Australia gains prominence in global international networks, polyarchy fell. We similarly show one example of the way Australia's polyarchy changed as Denmark's eigencentrality changed in the right part of the figure. In this particular outcome, Australia's polyarchy increased as Denmark eigencentrality rose. The trend on the bottom of the figure shows the way that Australia's polyarchy responded to a change in its eigencentrality – for various levels of its eigencentrality. Such a figure – called a 'spider plot' – shows the way that polyarchy reacts to a jurisdiction's eigencentrality over all possible states of these variables.

[28] The "1" we refer to comes from the formula $y_t = \vartheta y_{t-1} + \varepsilon$ where y_t refers polyarchy (for example) at time period t. The θ in this equation thus refers to the extent that last year's y depends on this year's y. A value of 1 means that last year's polyarchy completely explains this year's polyarchy (and values less than 1 describe 'inertia' as we've referred to it).

[29] We use the phrase "in this one example" because Bayesians acknowledge that these data represent one possible realisation of a broader relationship that we can not directly observe. Imagine Australia existing in multiple universes – and a correlation between polyarchy and eigencentrality in each alternate universe/dimension. Some correlations will resemble the one we observe in the figure – others less. By summing up over all these possibilities, we can uncover the deeper structural relationship between these variables. Medova (2007) provides a more technical, though easy to understand, explanation.

The "spider" graph in the last part of the figure shows a similar trend – adjusting for the randomness of these variables. Namely, this spider graph shows the results over 1,000 simulations – ensuring that the final relationship roughly depicts the relationship without very wide confidence intervals leading away from this line. Yet, this method of analysis treats different observations from different years as random draws from a deeper relationship between these two variables. Such a procedure gives a snapshot picture, by using data collected over time.

Figure 27: The Relationships Between Polyarchy and Eigencentrality
(Actual and Bayesian)



The figure shows the relationship between Australia's polyarchy and eigencentrality from 2005 to 2015 as an example of the methods we used in this study. The top left panel shows a simple correlation of these variables for Australia. The top right panel shows the simple actual correlation between Australia's polyarchy and Denmark's eigencentrality. The bottom curve – called a spider plot – shows the conditional mean of the way Australia's polyarchy changed for changes in its eigencentrality, over various levels of such eigencentrality. In this figure, changes in Australian polyarchy, compared with changes in eigencentrality rose when Australia did not occupy too central a position in global financial networks (ie possessed low eigencentrality). Such polyarchy increases the slowest at medium levels of eigencentrality – supporting the model we presented in the previous section of our paper. The figure shows the relationship over 1,000 simulations – and does not change when we rerun the simulations (namely we have a consistent parameter). Think of the figure as fitting regression lines on polyarchy and eigencentrality when dividing eigencentrality into sub-samples by size.

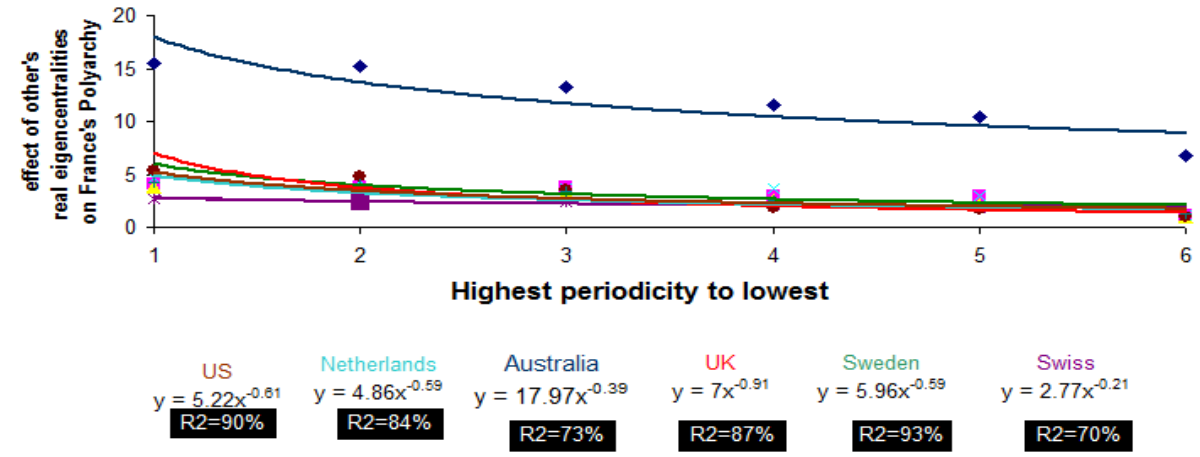
We should explain further the importance of the spider plot. If the top part of Figure 27 shows one realisation of the way Australia's polyarchy changed as the jurisdiction's eigencentrality changed from 2005 to 2015, we could imagine "alternate universes." We could imagine these data come from distributions which we can not see. We saw these data – but we could have easily seen other data too. The spider plot presents a Bayesian analysis of these variables. We resampled randomly 1,000 times from the historical data and the likely distribution generating these data.[30]

[30] Resampling refers to bootstrapping and Monte Carlo simulation. Bootstrapping refers to sampling the historical data again and again at random. Monte Carlo simulation refers to fitting a distribution around the historical data, and

Over all these samples, we obtained the stable relationship between the way polyarchy changes compared with eigencentrality – for various levels of eigencentrality. Such analysis allows us to see how polyarchy might change its response, as eigencentrality changes. We could (and do!) conduct similar analyses for all pairs of polyarchy and eigencentrality between international financial centres – providing a detailed map of political change in response to financial competitiveness.

What about adjustment over time? Polyarchy must respond to different eigencentralities – both the jurisdiction's own eigencentrality, as well as the centrality of its partner/competitor jurisdictions. Figure 28 shows the way we can differentiate between these effects, using a type of analysis known as Fourier Spectral Analysis. Such an analysis looks for wave patterns in each dataset. Longer waves mean an effect takes longer to appear. Looking at France's reaction to the increasing eigencentrality for the jurisdictions shown in the figure, we see that polyarchy responds most in the short-term (in 1 to 2 years). After that, polyarchy responds very minutely. France's polyarchy responds more to Australia's increased competitiveness (as measured by increased eigencentrality) than to the other jurisdictions – making Australia somehow a more important rival for France – even if French politicians and financiers do not recognise Australia as such a rival. By tracking the extent of these changes over time, we can observe how our detailed map of political change in response to financial competitiveness changes over time.

Figure 28: The Way France's Polyarchy Adjusted to the Increasing Centrality of Other Financial Centres



How does the polyarchy of a country (in this case France) react to the increasing centrality of partners'/competitors' financial centres over the years (from 2005 to 2015)? The figure shows the way that way that French polyarchy 'correlated' with changes in the eigencentrality of the jurisdictions shown in the figure for the same period. Such a correlation changes with time. We show the short-term, middle term and long-term reactions as a 2 year, 2.5 year, 3.33 year, 5 year and 10 year reaction to changes in these eigencentralities. Unlike an impulse response curve (which looks at the effects over time of a single, sudden shock like a one-time change in such eigencentrality), these curves show the periodic reaction (for example the longer term 5 year effect separating out the 2 year effects on their own). The equations in the figure show the decline in response from these 2 year to 10 year reactions as a function of time.

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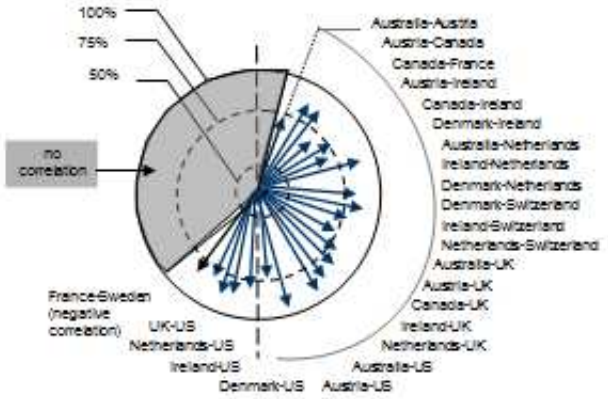
choosing data at random from the distribution. We treat them as the same only because Monte Carlo sampling produces many of the same data bootstrapping does (they use the same base data). Clearly, we can resample from these data as often as we wish.

The R2 shows how well our estimated decline in response over time matches the data (with 100% representing perfect matching and 0% representing no match at all). **This analysis can detect changes in causality (namely whether polyarchy responds to – or actually causes – changes in eigencentrality of other financial centres.** Specifically, we look at the 'gain' in a bivariate Fourier time series analysis for the periods shown, with 'coherency' of each period provided the R2s we report in the figure.

Does Polyarchy React to a Financial Centre's Centrality?

Before analysing our main research question, we should ask what effect did changes in polyarchy in one financial centre have in/on other financial centres? Figure 29 shows the correlations between the polyarchies of several of the countries we studied. In all cases, except one, polyarchy in one jurisdiction met with more inclusiveness in other jurisdictions – after adjusting for numerous factors and trends that could have affected these countries simultaneously. By removing these outside effects, we could be increasingly sure that financial centres reacted to each other – rather than international macroeconomic changes which would have caused all these jurisdictions' politicians and financial elites to restrict (or not) polyarchy. About half of these jurisdictions exhibited statistically significant correlations – for a level of statistical significance when we should only expect to observe about 5% of these polyarchies to have statistically significant correlations with each other.

Figure 29: Polyarchy in Some International Financial Centres Changes to Respond to Oligarchy in Other Jurisdictions Aimed at Increasing Their Own IFC Competitiveness

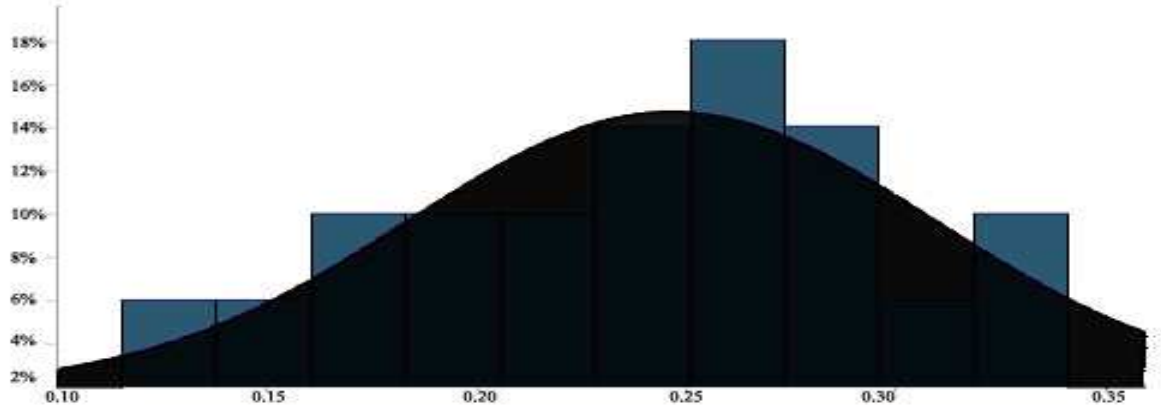


The figure shows the correlation coefficients between "real" polyarchy (adjusted for the effects of macroeconomic and other variables) between financial centres. Such a polyarchy refers to the extent to which more and various groups have a say in domestic policies and governance. Such a real polyarchy adjusts raw polyarchy score for factors unrelated directly to its competition as an international financial centre, such as exchange rate movements, stock market index changes, government demand for debt finance, the level of domestic savings, and other factors (which we describe in our paper). Correlation coefficients usually vary between -1 and 1, which we express here in percentage terms. We have shown how such polyarchy affects an international financial centre's cross-border bank liabilities (namely the extent to which financial services firms attract funds). We hypothesized that polyarchy in one jurisdiction would react to others', as international financial centres scuffle over relative position. These correlations trace polyarchy from 2005 to 2015, and we adjust them for a type of self-sustaining momentum in these data which economists know as auto-correlation. Roughly half of all country pairs exhibit statistically significant correlations at the 95% level of confidence. These data help prove that political inclusiveness in some international financial centres responds to centralising political power in rival centres aimed at "whipping" authority, power and effectiveness in growing assets under management.

Source: data from the Bank for International Settlements (2017) with calculations done by authors

How do we know these correlations actually represent something more than just random chance? Maybe we could collect data from these countries 10 years from now, and see a different pattern? Figure 30 shows the correlation between countries' polyarchy if we could draw data from 1,000 "alternate universes." Namely, we fit a pattern to all these countries' polyarchies and simulated the same variability and correlation structure in polyarchy that these data actually exhibited from 2005 to 2015. We see that, for all countries in our study, the correlation between one country's polyarchy and another's comes to about 0.25 on a scale ranging from -1 to 1. In other words, changes in a country's polyarchy 'explains' or 'accounts for' about 25% of its peer countries' polyarchy. Even a sceptic must accept that the polyarchy of one financial centre affects others.

Figure 30: Changes in the Polyarchy of Other Financial Centres Explains about 25% of a Jurisdiction's Own Change
(Bayesian Approach)



The figure shows the distribution of correlation coefficients across all pairs of financial centres' polyarchy scores in our study. We calculated this Bayesian statistic as follows. First, we fit an auto-regressive model to polyarchy in both jurisdictions of each of 54 pairs of countries, simulating what other possible evolutions of these polyarchy scores could have happened over a 10 year period. We then calculated, for each pair, a correlation coefficient – which changed randomly according to the random variation measured in the auto-regression of each pair of polyarchies. We then averaged all of these correlation coefficients to arrive at a single average correlation. Finally, we simulated 1,000 alternative 10 year periods – arriving at one average correlation coefficient across all pairs of countries for each of the 1,000 alternative periods. We show the distribution of these 1,000 averages (a Normal distribution centred at 0.25 and with a standard deviation of 0.06) as the black bell curve. We show a random sample of 44 of these averages as the blue bars just to see how one particular draw might look like. The Normal Distribution actually scored highest on the Akaike Information Criterion which helps statisticians decide which distribution best fits the data. The main message from the figure is that these data must be correlated (the alternative of 'no correlation' has less than a 0.01% likelihood of being true).

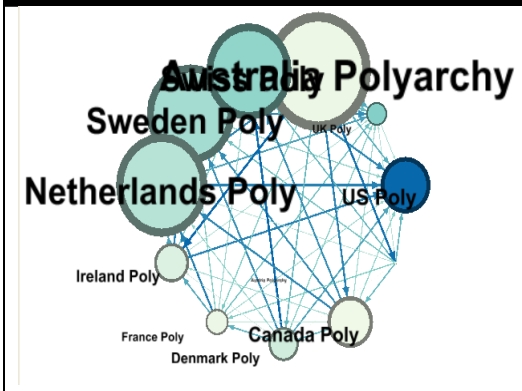
How exactly does such polyarchy flow through the international financial centre networks? We do not show the results of all the simulations we ran – simulations which attempt to track which jurisdictions account for more or less influence overall. Yet, we show the outlines of such influence in Figure 31. The figure shows the correlation between polyarchies for the jurisdictions we studied, with larger nodes representing those jurisdictions with larger overall correlations of their polyarchy with those of other financial centres. The left part of the figure shows one of these correlations before using eigencentralities to see how the correlations between the correlations of various financial centres' polyarchy work themselves out.[31] Looking only at correlations as links with a 'weighted degree', we observe the US having a relatively low correlation with other financial centres (remember the correlation we show appears at random from a fixed distribution and other correlations may vary a bit from this one).[32] Even though the US's correlation came out relatively low in this first simulation, we see that – after accounting for all these correlations and having correlations in polyarchy "work their way out" through the network; the US's polyarchy

[31] Recall the eigencentrality algorithm traces through the entire effect of polyarchy across the entire network, for all jurisdictions. Some might object to using a network to show these correlations. However, we use the figure to illustrate our methodology – rather than to draw any specific conclusions.

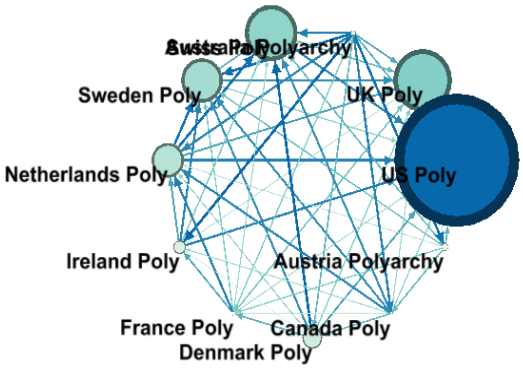
[32] The correlation coefficients provide the weights for each of these links. As we described previously, the actual data we observed historically represent only one "draw" from an unobserved population. By continuous resampling, we hope to trace out this unobserved distribution of financial centres' polyarchy and the way it changes over time.

again correlates highly with other jurisdictions (as shown on the right side of the figure). The difference between the left-hand side and the right-hand side of the upper part of the figure thus give us an idea about how changes in polyarchy ripple through to the US (and changes in the US to ripple outward). In the lower part of the figure, we show a second simulation; showing a higher correlation for the US with other jurisdictions – a correlation which remained high after accounting for the way such influence flows across the network. Some countries will change their correlations from simulation to simulation (depending on the strength of the original correlations with their peers). Yet, some jurisdictions will predominantly account for the overall 25% correlation coefficient between jurisdictions which we described in the previous figure.

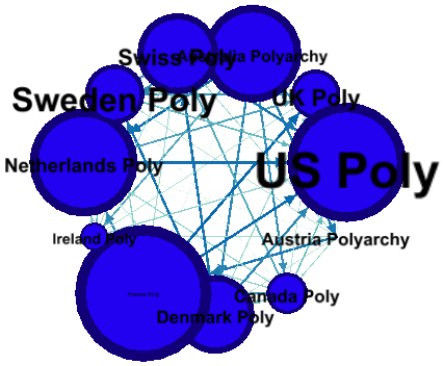
Figure 31: The US Becomes More Polycratic as a Polyarchy "Wave" Moves its Way Through the International Financial Network



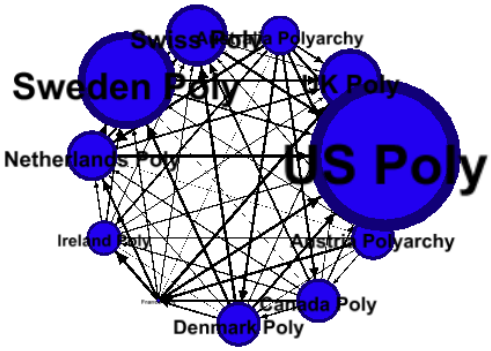
Weighted degree for simulation 1



Eigencentralities for simulation 1



Weighted degree for simulation 2

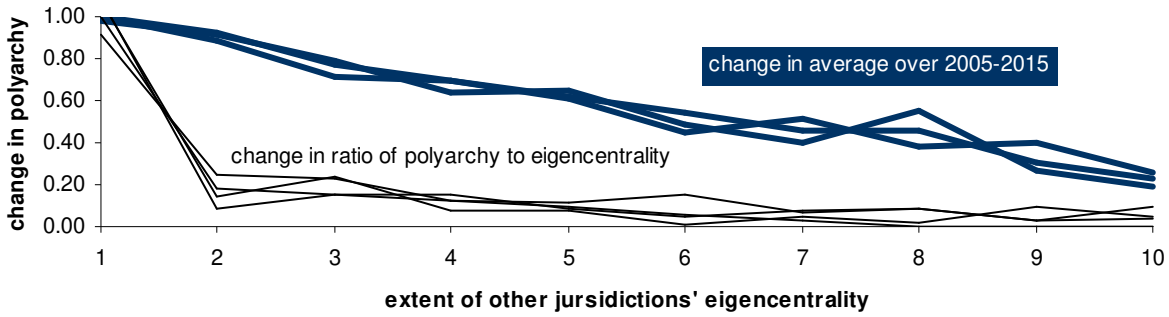


Eigencentralities for simulation 2

The figure shows correlation coefficients for each international financial centre in our study represented as a network. Higher correlations with other jurisdictions make a jurisdiction's node size bigger (and link colour darker). As such, these links to not represent actual flows *per se*...but correlations. The graphs of the left side of the figure shows two of the correlation coefficients resulting from our simulation (which itself comes from correlation data between these jurisdictions). The graphs on the right show the correlations after "running through" the network – taking the correlation of partners' correlations into account (eigenvalues). These correlations change from simulation to simulation. Yet, some patterns – like the US's high correlation – remain a relative constant across simulations.

How does polyarchy adjust to changes in other financial centres' eigencentrality? Figure 32 shows the conditional distribution between these two variables. In other words, how do changes at low levels of eigencentrality – versus high levels -- affect changes in polyarchy? For all countries, higher eigencentrality levels corresponds to lower levels of polyarchy. Looking that the way polyarchy changes to eigencentrality, as a percent of eigencentrality itself, we see a different relationship. Polyarchy drops most quickly at small levels of eigencentrality. Presumably, rivals need to adjust their polyarchy quickly, before growing international financial centres become a too much a threat.

Figure 32: Polyarchy Decreases as Rivals Become More Central to/in Financial Networks



The figure shows the way that polyarchy in international financial centres changed as their partners' eigencentralities changed. Such a graph depicts a *conditional distribution* – the distribution of polyarchy for every level of partners' eigencentrality. Polyarchy falls across international financial centres as their peers'/rivals' eigencentralities rise. The blue lines show the results of several resampling rounds. The black lines show the distribution of the quotient of polyarchy and eigencentrality as the dependent variable (thus removing the effect of eigencentrality 'size effects').

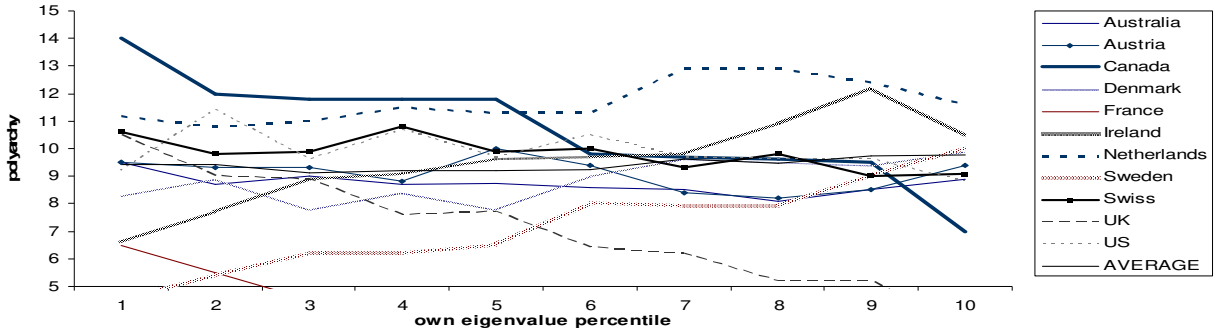
Where do we see the "innovation effect" in our data? According to our model, we would expect financial centres to start innovating when rivals become very large. Yet, in the data above, we see only a negative reaction to rivals' growth. Namely, polyarchy always seems to shrink – no matter how big rivals grow. To find such an effect, we must look at the way international financial centres' polyarchy responds to their own centrality – logical, as all "politics is local" (to coin the phrase).[33]

Polyarchy (and thus possibly innovation) increases as a jurisdiction's own eigencentrality rises – though not for every financial centre. Figure 33 shows the same conditional probabilities of a high or low polyarchy score for low or high eigencentrality values in/of a jurisdiction. We see that, for countries like Ireland and Sweden, polyarchy rose quickly as these jurisdictions' own eigencentrality rose over time. In cases like the US and Switzerland, polyarchy fell slightly. Figure 34 shows these relationships more clearly. In that figure, we plot the first three years' polyarchy and the final three years' average as a percent of the 10 year average. We show which countries' polyarchy scores rose as their own eigencentrality rose – versus those jurisdictions that fell. Because these trends come from 1,000 simulations based on our data, we can reliably

[33] As an international financial centre grows and becomes a more central part of the world economy, such size affects the centre's local politics and the extent of competition with other centres. Beyond a certain size, some financial centres' financial institutions may be able/asked to handle transactions too large for other jurisdictions. In other words, larger financial centres may experience higher levels of competition – thus resulting in new political interests and polyarchies previously absent, as described by authors like Hines (2009).

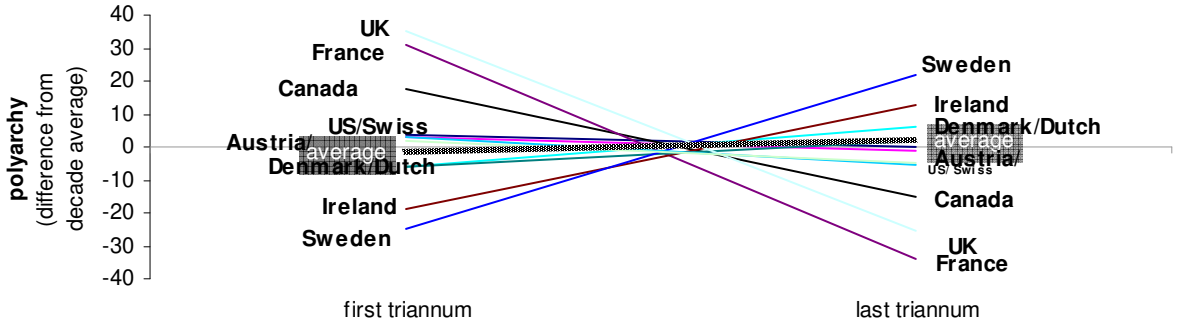
conclude that these patterns do not simply represent an accident of history (or one outcome among many). Bayesian estimation allows us to present data "robust" to any particular case or situation.

Figure 33. Own Responses to Own Eigencentrality



The figure shows the polyarchy of jurisdictions as their eigencentrality varies across time. When more central to international financial networks, many jurisdiction's polyarchy rose – exhibiting the "innovation" effect we hypothesized in our model. Yet, not every jurisdiction displayed this pattern. Some reasons for the lack of such a response may include our short time period (only 10 years), bad data on polyarchy, our model is wrong or at least wrong for some jurisdictions.

Figure 34: Some Countries Became More Polyartic as their own Eigencentrality Rose



The figure shows the change in polyarchy for increasingly higher levels of eigencentrality. We first looked at the correlation between each jurisdiction's own polyarchy and eigencentrality. Next we simulated 1,000 times changes along the distributions defining these scores to arrive at a conditional distribution for polyarchy (conditional on eigencentrality) – as shown in the figure above. To calculate these changes, we took the average scores for the first 3 years and last 3 years of the decade long series. We divided these scores by the decade average and multiplied by 100. The resulting Bayesian values show the way these financial centres' polyarchy changes with their own eigencentrality.

To sum up our analysis, we have found support for our model of democratic (polyartic) change in international financial centres. While we "cheated" – by relying on decades of experience and various studies pointing to the roles of polyarchy and financial network centrality, no one has tested such a relationship using quantitative methods before. We found that jurisdictions use polyarchy (and politics more generally) as a method of developing their own international financial centres – and to react to the development of other financial centres in the international financial centre network. We found that a jurisdiction's own development causes polyartic

change in large financial centres more often than foreign centres – likely a response to remain competitive.

Conclusion

In this paper, we have looked at the role of polyarchy in aiding the development of an international financial centre. We find support for decades of theorising that financial centres' reliance on increased autocracy (less polyarchy) to help grow out their financial centres. Yet, these results do not support more autocratic (or even authoritarian!) government. The successful international financial centres of today limited polyarchy in the past (if even ever so slightly) in order to help grow out their financial centres.[34] Yet, they also enfranchised other groups in their polyarchy to generate political support for the financial centre, bring in new ideas and financial innovations, and balance out national economic growth. These financial centres' policymakers restricted and expanded polyarchy (either intentionally or unintentionally) to grow their financial centres.[35]

At the heart of our methodology lies the comparison of polyarchy and a financial centre's centrality in the international network of financial centres. We looked at the growth of these financial centres as the extent to which they attracted more funds from abroad (specifically cross-border bank liabilities). We looked at their centrality by computing network graphs and calculating a robust form of such centrality known as 'eigencentrality.' We found that polyarchy decreases as other international financial centres' centrality in the global financial centre network expands. Such polyarchy – when used by some very central jurisdictions to remain central – "spreads." And despite the evidence from the last 10 years, our model predicts that polyarchy should increase in many jurisdictions over time because financial centres rely on increasingly polyartic governance as a way to foster financial innovation through increased participation by non-previously powerful sectors. Yet, growth in an international financial centre's centrality in global financial networks relies – in the shorter term -- on tapering polyarchy. Decreases in polyarchy have probably helped financial centres get ahead, depending on the centre and the time.

Our results inform several debates of the day. Activists for or against Britian's exit from the European Union (Brexit) or Hong Kong's total reunification with China in 2047 and others praise or condemn the effects of polyartic government on their financial centres' performance. Yet, before our study, they had little empirical evidence for doing so. Our study suggests that they should try to choose a level of democracy or polyarchy (rightly or wrongly) which maximises the performance of their financial centre overall. Instead, they should worry about <u>when</u> polyarchy changes vis-a-vis other financial centres. The mixed equilibrium our model predicts – namely that successful financial centres should adjust their polyarchy counter-cyclically with other centres – means that no level of polyarchy will always be best for a financial centre. Hong Kong's success as an international financial centre – like Britain's – will depend on whether they restrict or expand polyarchy at the right time in response to other financial centres.

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[34] Changes in our polyarchy dataset occurred in such small intervals that we had to multiply the original variable by 100 to derive large enough changes needed to compare with the other variables in our study. We do not want to give the impression that these financial centres went through large-scale political change during the time of our study.

[35] Our study did not look at optimal policy responses (or even equilibrium ones). Thus, we can not say what policymakers *should* do, only what they *did* do.

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