An Investigation of Age-Dependent Agglomeration Effects in Financial Services

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Abstract

This paper fills the gap in the literature as to whether financial institutions experience disproportionate agglomeration benefits due to their length of establishment. The incentive to agglomerate is not justified if the established firms do not benefit, as some literature propose. There is evidence to suggest it is inaccurate to say that only young firms benefit from clustering, or established firms suffer negative impacts, As an exploratory investigation, the finding suggests that age can play a role in different benefits sought by different sectors within financial services. This study proposes cluster-based management policies that take account of the establishment profile of cluster members and their identifiable needs.

Keywords: Financial services; clusters; age-dependency; agglomeration economies

Marshall (1920), Porter (1990) and Krugman (1991a; 1991b) argue that industrial clusters provide incumbents with external agglomeration economies that raise productivity, returns, and innovativeness. Porter's work in this area is most pervasive, as many economies adopt cluster-based economic development plans (see European Commission, 2002), including the Singapore Economic Development Board. The popularity of clusters among policymakers may in part stem from Porter's (2000) assertion that clusters are of general benefit to all industries.

While clustering may appear beneficial for financial services, see Kuah (2008a; 2008b) and Pandit, Cook and Swann (2001), is clustering beneficial to firms at different stages of their development? Acs, Audretsch and Feldman (1994) argue that young firms are more capable than established firms in capturing the spill-over effects through cluster networks. Hence, clustering may offer parasitic opportunities to feed off the knowledge, skills, and infrastructure for the young firms. Established companies with an accumulated internal resource could be less reliant on the agglomeration econo-

mies and spill-overs provided by a network of closely-related companies. Shaver and Flyer (2000) contend that the incentive to agglomerate is not justified if established firms do not benefit. Do clustering really offer differing benefits and gains to member companies based on their length of establishment at a location?

This question is rather important to Singapore as a recent survey in the *Financial Times* (Tucker, 2008) places the Singapore Financial Centre fourth in the world, after London, New York, and Tokyo. The Singapore Financial Centre has completed a liberalisation phase (1999 to 2004) and is keen to attract new players, especially in the wealth management sector (Kuah, 2008b). We therefore provide an exploratory examination of the age-dependent benefits, in particular, whether member firms experience disproportionate agglomeration benefits during their stay in a cluster. The issue for this study is whether established financial institutions and new incumbents benefit similarly or do returns to agglomeration diminish with a firm's exposure to a cluster? Our hypothesis provides a different perspective to that generated by the likes of Arthur (1990) and Krugman (1991a; 1991b) where agglomeration economies merely improve with the number of firms concentrated in a geographic location.

This paper sets out to examine whether the effects of locating in a stronger or larger cluster are influenced, in part at least, by the establishment (using the period of incorporation, or age) of a firm at the location. With 13 geographical regions and associated sectorial clusters, the United Kingdom's financial services industry becomes a viable laboratory for this exploratory analysis of age-dependent effects. For example, building societies in the Yorkshire region, asset management in the Edinburgh-Glasgow interface, and banking in the City of London are all prominent regional financial clusters (Pandit et al, 2001; Clark, 2002). Financial clusters in the UK have grown largely independent of modern planning and are characteristics of historical events, see Collins (1988).

Do Clusters Offer Common and Persistent Benefits?

Marshall (1920) was the first to recognise the importance of what he termed "industrial districts". Geographic concentrations enable incumbents to grow more quickly than those outside of the location (Romer, 1986; 1990; Arrow, 1962) through Marshall-Arrow-Romer (MAR) externality. More recently, discussions by Porter (1990) and Krugman (1991a; 1991b) re-emphasise the importance of geography and externalities in determining a firm's growth prospects. However, others (Pouder and St John, 1996; Swann, Prevezer and Stout, 1998; Folta et al, 2006) highlight the potential effects of congestion, which argue that once a critical mass is reached,

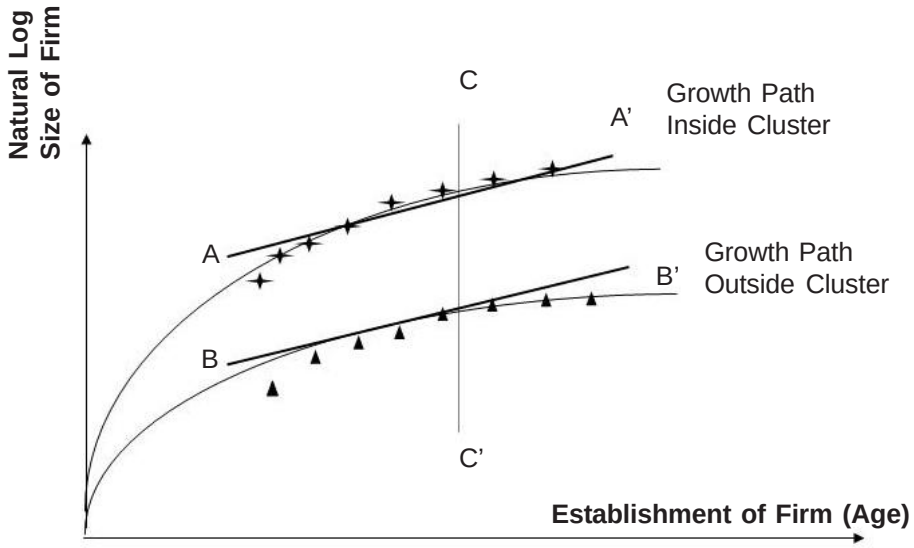
diseconomies may set in. In order to explore the dependency of the firm's establishment in a cluster, on the gains and losses from agglomeration externalities, this section discusses: (a) theoretical arguments on agglomeration economies; (b) empirical evidence of cluster strengths on firm performance; and (c) the performance implication of clustering due to firms' period of engagement in a cluster.

External agglomeration economy of scale, or localisation externality (Weber, 1929; Hoover, 1937; Rosenthal and Strange, 2006), arises if a specific industry is substantially large at a location. The specific sources are from labour market pooling, specialised suppliers, and technological knowledge spill-overs (Shaver and Flyer, 2000; Henderson, 2003; Feser, 2002). External agglomeration economy of scope, or urbanisation externality, can be brought about by diversity of industries in an urban concentration (Jacobs, 1969; 1984). Firms may benefit from being close to a supporting industry that supports a completely different industry, with the sharing common skills and benefits. In an industry cluster where the activities are very closely related, such as financial services, the lineage and linkages to several related sectors (Pandit et al, 2001) will benefit from the proximity of each other, creating the external economy of complexity (Parr, 2002). These externalities are thought to affect all firms alike, irrespective of their establishment in the cluster although it has been argued that incumbents will only benefit if they closely network or collaborate with each other (Kuah, 2002).

Swann and Prevezer's (1996) empirical work demonstrates that the ultimate size of a firm in a cluster can be determined, in part at least, by the size of the firm's own sector (own sector cluster strength) and that of related sectors (related sectors cluster strength) present at the location. Associated models also look at the entry of firms into clusters (Swann et al, 1998) or focus on innovation or patenting in clusters (Baptista and Swann, 1998; Beaudry and Breschi, 2000). Cluster effects can be illustrated with one hypothetical firm located in a strong cluster and another firm located outside the cluster (or in a weaker cluster, as indicated by a smaller agglomeration) is shown in *Figure 1*. The vertical axis depicts the firm size in logarithmic terms, while the horizontal axis depicts the age or length of establishment of the firm. The convex-shaped paths depict higher growth rates when a firm is young and consolidate to a certain size upon reaching its maturity.

Smaller firms can achieve a higher rate of growth due to a smaller base (Ward and McKillop, 2005; Beaudry and Swann, 2001). The same rate of growth, however, cannot be sustained as firms saturate in size upon reaching maturity of their product or technology lifecycle. If a linear Ordi-

Figure 1: Size of Firms Inside and Outside Clusters



Source: Adapted from Beaudry and Swann, 2001

nary Least Square (OLS) regression is used, two almost parallel lines (AA' and BB') may occur. AA' and BB' indicate the trend growth rate of a firm inside a cluster and outside a cluster respectively. CC' represents a cross-sectional point in time during a census. Swann and Prevezer (1996); Baptista and Swann (1998); Pandit et al (2001); Beaudry and Swann (2001) find that the agglomeration of similar firms in a geographical cluster significantly and positively influences the growth of incumbent firms. Their work assumes no age-dependency effects, and incumbents should enjoy a faster rate of growth.

The cluster based approach stresses the demand and supply benefits (Kuah, 2002; Pandit et al, 2001; Swann et al, 1998). Following Marshall's (1920) argument, the supply-side benefits include the accumulation of skilled labour, a pool of input supplies and technological spill-overs. While on the demand side, clustering enables a firm to be nearer to the market, and innovating with sophisticated customers (Porter, 1990). Clustering reduces customer search costs, raises the prospect of the firm being found, and enables the Hotelling effect of taking market share from rivals (Pandit et al, 2001).

The effects of congestion are inherent both on the demand and supply sides. As more new firms enter an established location, there may be performance implications to the firm. Pouder and St John (1996) contend that a cluster goes through certain phases—origination (rapid growth in number

of firms), convergence (slower growth), and reorientation (decline). Cluster phases need not be aligned with the industry life cycle, as both the firm and cluster may grow at different rates to the industry. Folta et al (2006) demonstrate the extent to which diseconomies of agglomeration may depend on the size of a cluster. Therefore, the question remains today whether younger entrants or established financial services firms benefit more from clustering?

Acs et al (1994) further contend young firms are more capable than older firms of plugging the spill-over effects through cluster networks. Chung and Kalnins (2001) show the presence of large and established firms in a cluster enables new young firms to grow more rapidly through the exploitation of under-serviced niches. The literature suggests the prospects of clusters favour the young, but is still inconclusive. Depending on the above debate, we can formulate the hypothesis that member firms experience disproportionate agglomeration benefits during their stay in a cluster.

Model, Method, and Data

Cluster Model

Beaudry and Swann (2001), Cook et al (2001), Pandit et al (2001), Baptista and Swann (1998; 1999), Swann et al (1998), Swann and Prevezer (1996) provide an established literature for the cluster model. The model can provide a firm's trend growth rate of employment, when equation 1 is differentiated by firm age. The trend growth rate of a firm is augmented with two measures of cluster strength, namely, own-sector employment (S_{Ic}) and related-sectors employment (S_{Jc}) in a geographical cluster. Equation 1 details the basic model.

Equation 1. $$\ln E_{n\in\{I:c\}} = \alpha + \beta\,(\text{Age}_n) + \gamma_1 \ln S_{Ic} + \gamma_2 \ln S_{Jc} + \upsilon$$

To test if the member firms experience disproportionate agglomeration benefits during their stay in a cluster, equation 1 is modified with an age-dependent coefficient to the cluster strengths for interaction effects.

Equation 2. $$\ln E_{n\in\{I:c\}} = \alpha + \beta\,(\text{Age}_n) + \lambda_0 \ln S_{Ic} + \lambda_1\,(\text{Age}_n * \ln S_{Ic}) + \zeta_0 \ln S_{Jc} + \zeta_1\,(\text{Age}_n * \ln S_{Jc}) + \upsilon$$

Equation 2, with the variables described in Table 1, posits the firm's performance (or trend growth rate) is associated to age, the cluster strengths, and combined effects between age and cluster strengths. Other exogenous cluster variables and endogenous firm level characteristics, such as population density, employment diversity, and the nature of firms activities (sub-

sidiary, holding and HQ) were employed. However, early statistical analysis provided no conclusive support for these measures. For simplicity, we explore the basic cluster model detailed in equation 2.

Table 1: Description of Variables

Variable	Description
$E_{n\in\{I:c\}}$	Employment of firm n from industry I at location or cluster c
Age_n	Age of firm measured from date of incorporation to present date
α	Regression constant
β	Coefficient indicating the trend growth rate of the firm where $\beta = 1 + \sum_{c=1}^{C-1} d_c D_c + \sum_{i=1}^{I-1} d_i D_i$ D_c represent cluster dummy variables (1 or 0), one for each of regions (C= 12) D_i represent sectors dummy variables (1 or 0), one for each sector (I = 8) $d_{c \text{ and}} d_i$ is their contribution to the trend growth rate
S_{Ic}	Total employment of the particular sector I at particular cluster c
S_{Jc}	Total employment in all sectors other than I at a particular cluster c
υ	Residual or disturbance term on regression
λ_0	Coefficient indicating the effect of cluster strength in the firm's own sector on firm size
λ_1	Age-dependent coefficient indicating the effect of cluster strength in the firm's own sector on firm trend growth rate
ζ_0	Coefficient indicating the effect of cluster strength in other related sectors on firm size
ζ_1	Age-dependent coefficient indicating the effect of cluster strength in other related sectors on firm trend growth rate.

Dependent Variable

The measure of firm performance in the cluster model is the firm employment size, $\ln E_{n\in\{I:c\}}$. This approach follows the previous studies (Beaudry and Swann, 2001; Cook et al, 2001; Pandit et al, 2001; Baptista and Swann, 1998; 1999; Swann et al, 1998; Swann and Prevezer, 1996), as the natural logarithmic term models the lifetime growth of the firm *(See Figure 1).*

Independent Variables

Two independent variables represent the cluster effects from firms in the same sector and firms in related sectors in a geographical cluster. The total employment of a firm's own sector, i, in an industry cluster, c, is represented by S_{Ic} . The total employment of the firm's related sectors, j, in the industry cluster is represented by S_{Jc}. As our data is rich, summing the sector employment in each region renders the total employment of a firm's own sector. Similarly, the employment of other financial services sectors in each region provides the total employment of a firm's related sectors. Such aggregates were also compared to other government reports (Department of Trade and Industry, 2001; Office of National Statistics, 2001) and they were found to be of a similar magnitude.

The model employs the firm age since its date of incorporation at the location, Age, as an independent variable. The specific purpose is to measure the trend growth rate of the sector when equation 1 is differentiated that is, $d(\ln E_{n\hat{i}\{I:c\}})/ d(Age_n)$). If this variable does proxy for more than the growth path of the firm, it will dominate the estimated results in the regression by highly significant coefficients and a high R^2. The basic model will not explain all the determinants of firm growth in a cluster, but focus on the age-dependent benefits to incumbents gained from agglomeration economies. *Table 2* presents the descriptive statistics for each variable by sector.

Sources and Operationalisation of Data

The sample used in this study is drawn from the population of UK financial services companies extracted from FAME (Financial Analysis Made Easy). FAME captures all UK-registered companies including those yet to file their first set of accounts. The data are extracted by UK geographic regions (such as Wales or North East) and UK Standard Industry Classification 1992 (SIC) codes complying with the firm's primary activity, that is, SIC 65, SIC 66, and SIC 67. For 2001, there were 17,534 valid financial services companies recorded in FAME. However, only 7,473 companies (42.3 per cent) provided employment figures. The main reasons for the lack of employment data are that holding and/or consolidated companies do not consolidate employment data of their subsidiaries, and small firms with few employees (one to five people) are not required to file a full financial report. However, the sample obtained contains both large and small firms.

The data are classified into 13 geographic regions, see *Table 3,* to measure agglomeration effects in UK regions. The use of geographical regions in understanding clusters in USA or UK is similar to approaches of Canina, Enz and Harrison (2005), Pandit et al (2001) and Baptista and

Table 2: Descriptive Statistics

Sectors	Banks and Building Societies		Credit and Leasing Firms		Trust and Pension Fund Firms		Life Insurance Firms		Non-Life Insurance Firms		Fiancial Auxiliary Firms		Insurance Auxiliary Firms		Market and Securities Firms	
Variables	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**	**Min**	**Max**
Age	1	92	1	87	1	101	1	101	1	99	1	90	1	89	1	90
Ln (Size of own sector employment	3.4	13.0	3.0	9.4	2.9	12.8	5.2	10.9	2.3	11.9	0.7	10.6	2.4	10.2	3.9	9.9
Ln (Size of related sector employment)	8.0	13.4	8.9	13.9	8.8	13.5	5.5	13.9	7.5	13.8	8.9	13.9	9.0	13.9	9.3	13.9
Ln (Firm Size)	0	11.4	0	8.7	0	10.8	0	9.7	0	10.1	0	10.4	0	9.4	0	8.9
	Mean	**sd**	**Mean**	**sd**	**Mean**	**sd**	**Mean**	**sd**	**Mean**	**sd**	**Mean**	**sd**	**Mean**	**sd**	**Mean**	**sd**
Age	22.9	19.6	16.4	17.4	16.8	16.2	20.6	15.3	21.7	18.5	10.3	13.0	15.3	14.5	8.8	10.2
Ln (Size of own sector employment)	11.7	2.2	8.2	1.5	11.6	1.6	9.8	1.3	10.2	1.7	7.3	2.1	9.2	1.7	9.1	1.7
Ln (Size of related sector employment)	12.6	1.3	12.0	1.6	12.3	1.6	11.9	1.6	12.2	1.6	12.4	1.7	12.8	1.6	13.4	1.1
Ln (Firm Size)	4.0	2.5	3.1	1.9	2.7	1.8	2.6	1.6	3.0	1.5	2.8	1.8	3.8	1.7	2.7	1.6

Swann (1999). The definition of various UK regions is adopted from Office of National Statistics (2001).

The main difference between our classification and that of Pandit's is that (a) North Wales and South Wales are combined to be one region; (b) Northern Ireland is now included; and (c) regional boundaries of North West London is assimilated into regions of East and South East regions by the Office of National Statistics. The classification of geography makes use of each company's registered address; and coded as "1" in one of the 13 geographical regions, and '0' in other regional dummies.

Table 3: Definition of United Kingdom Regions

NSCOT	Highlands, Islands, Aberdeenshire, Angus, Dundee, Argyll & Bute, Perth, Kinross & Stirling	***WALES***	Clwyd, Dyfed, Gwynedd, Powys, Gwent, Mid, South & West Glamorgan
SSCOT	Borders, Fife & Clackmannanshire, Lothian, Renfrewshire, Ayrshire, Falkirk, Dunbartonshire, Lanarkshire, Dumfries/ Galloway, Glasgow, Edinburgh, Helensburgh & Lomond	***EMID***	Derbyshire, Nottinghamshire, Lincolnshire, Leicestershire, Northamptonshire, Rutland
		WMID	Stoke-on-Trent, Telford, Wrekin, Shropsire, Staffordshire, Warwickshire, West Midlands, Worcestershire.
NIRE	Coleraine, Derry, Ballymena, Strabane, Omagh, Ulster, Belfast, Newry, Craigavon, Dungannon, Eniskillen	***EAST***	Luton, Peterborough, Southend-on-Sea, Thurrock, Bedfordshire, Cambridgeshire, Essex, Hertfordshire, Norfolk & Suffolk
NWEST	Blackburn, Darwen, Blackpool, Warrington, Cheshire, Greater Manchester, Cumbria, Lancashire & Merseyside	***SWEST***	Bath, Bristol, Bournemouth, Poole, Swindon, Torbay, Cornwall & Isles of Scilly, Devon, Dorset, Gloucestershire, Somerset & Wiltshire
NEAST	Cleveland, Darlington, Hartlepool, Redcar, Middlesbrough, Stockton-on-Tees, Tees Valley, Durham, Northumberland & Tyne/Wear	***SEAST***	Southampton, Windsor, Milton Keynes Portsmouth, Reading, Isle of Wight, Wokingham, Buckinghamshire, Berkshire, E/W Sussex, Hampshire, Kent, Oxfordshire, Surrey
YORKH	Humberside, N,S & W Yorkshire, Kingston, N & NE Lincolnshire, Leeds, Bradford, Sheffield, Hull, Halifax	***LON***	Inner and Outer London

The four-digit SIC level is used to re-classify firms on the basis of Buckle and Thompson's (1998) division of activities within financial services, similar to Pandit et al's (2001) work. As a result, the industry is divided into eight specific sectors, as seen in *Table 4*, to control for activity differences in different sectors. Each observation (firm) is coded "1" or "0" based on their primary sector.

Data Analyses

The data analysis is divided into two stages. The first stage analyses the data based on the eight sectors to enable the estimation of sector level effects. Cook's statistics are used to indicate any influential observation that might generally affect the model (To confirm robustness of the sector-specific models, 1, 5, and 10 per cent observations are randomly removed to examine the significance of the estimators. The results are robust and not reported for conciseness). The first stage also serves to confirm the dataset and cluster model, the latter which has been used in other studies.

The second stage of analysis involves investigating the age-related cluster effects. Relating to equation 2, suppose $\lambda_1 < 0$, this means the cluster effects from the firm's own sector are stronger when a firm is young, but conversely $\lambda_1 > 0$ means that the cluster effect is stronger when the firm is old.

Likewise, when $\xi_1 < 0$, the cluster effect from related sectors is stronger when a firm is young, while $\xi_1 > 0$ means the effect is stronger when the firm is old.

Limitations of the Cluster Model

Time-series data on firm employment would limit the size of sample under investigation. By use of cross-sectional data of 2001, before the impact of the global financial crisis, the ebb and flow of economic cycle is held to be the same across all firms nationally. Significant events such as shocks and mergers in the history of financial institutions are not captured and only data of surviving firms are analysed in this simple model.

Beaudry and Swann (2001) highlight two issues of endogeneity. The first is the overestimate of own-sector employment (S_{Ic}) by including the employment of the firm ($E_{n\in\{I:c\}}$) in the aggregate. As demonstrated by Beaudry and Swann (2001), this introduces a small bias to the order of 1/n. The second issue arises if the dependent variable ($E_{n\in\{I:c\}}$) is included in the independent variable (S_{Ic}) which means that the disturbance term, u, is not completely independent of the own-sector employment aggregate. Beaudry and Swann (2001) conclude the negligibility of any potential simultaneity bias if the sample is large. The sample contains 15 small sectorial clusters

Table 4: Definition of Sectors within the Financial Services Industry

Banks and Building Societies	6510 - Monetary Intermediation 6511 - Central Banking 6512 - Other Monetary Intermediation including Banks and Building Societies
Credit and Leasing Firms	6520 - Other financial Intermediation 6521 - Financial Leasing 6522 - Other Credit Granting including Finance Houses, Factoring and Mortgage Finance Companies.
Trust and Pension Fund Firms	6523 - Activities of investment trust, unit trust, property trust, bank holding companies, venture and development capital companies. 6602 - Pension Funding
Life Insurance Firms	6601 - Life Insurance
Non-Life Insurance Firms	6603 - Non Life Insurance
Financial Auxiliary Firms	6700 - Activities Auxiliary to Financial Intermediation 6710 - Activities Auxiliary to Financial Intermediation except Insurance and Pension Funding 6713 - Activities Auxiliary to Financial Intermediation not classified elsewhere
Insurance Auxiliary Firms	6720 - Activities Auxiliary to Insurance and Pension Funding
Market and Securities Firms	6711 - Administration of Financial Markets 6712 - Security Broking and Fund Management

that have an aggregated employment of less than 100 people. Therefore only 52 firms in our sample are affected, indicating the minute scale of the problem. Another potential problem is heteroscedasticity, which is addressed using White's (1980) correction.

Results

Sector Specific

The sector-specific results are presented in *Table 5*. The coefficients are mostly significant at the 1 per cent level, indicating that the predictors have non-zero coefficients 99 per cent of the time. The models are significant and account for 5 to 14 per cent of the variations. Cook's statistics confirm that only 11 observations, out of 7,473 observations, have a statistic equal or greater than 0.004, with only one influential case at 0.03, which is subsequently removed.

For all the estimated sector models, the adjusted R^2 may be low. As with previous studies, this is not surprising as equation 1 proxies the complex growth-inducing effect of the cluster strengths across many firms in a particular year. The low adjusted R^2 also suggests that the potential for age to proxy for many unobservable firm level characteristics is not present. All the models are highly significant with good F test results. This indicates that the data has a degree of measurement error but the model may still be reasonable.

The regression constants indicate that firms in the bank and building societies sector, and the market and securities sector start at a much larger size compared to firms in other financial services sectors. The coefficients on age indicate that Bank and Building Societies (2.7 per cent), Credit and Leasing (3.6 per cent), Life Insurance (2.2 per cent), and Market and Securities (3 per cent) sectors grow on average much faster than other sectors such as Trust and Pension Funds (0.6 per cent), Non-Life Insurance (1.5 per cent), Insurance Auxiliary (1.8 per cent) and Financial Auxiliary (2.0 per cent) in UK.

The coefficient for own-sector employment is positive and significant for many of the sectors. This finding supports the position that the lifetime growth of firms intensifies in the presence of similar competing firms, as a result of localisation externalities. However, the negative effect from employment in related sectors suggests that too many related firms in a cluster can reduce firm employment growth, possibly a reflection of congestion costs as a diseconomy. Results from the cluster model are consistent with earlier published studies (Baptista and Swann, 1998; 1999; Swann and Prevezer, 1996; Pandit et al, 2001; Cook et al, 2001). Therefore, these initial findings provide broad confidence for the choice of sample, year, and

Table 5: Sector Specific Lifetime Growth

Lifetime Growth by Sector	Banks and Building Societies		Credit and Leasing Firms		Trust and Pension Fund Firms		Life Insurance Firms		Non-Life Insurance Firms		Financial Auxiliary Firms		Insurance Auxiliary Firms		Market and Securities Firms	
Variables	Coeff	Std Err	Coeff	Std Err	Coeff	Std Err	Coeff	Std Err	Coeff	Std Err	Coeff	Std Err	Coeff	Std Err	Coeff	Std Err
Constant	**9.53******	1.99	**1.50***	1.05	**2.02******	0.24	**1.28******	0.33	**1.34******	0.30	**2.24****	1.16	**2.06****	1.16	**7.84******	1.627
Firm Age	**0.03******	0.01	**0.04******	0.01	**0.01******	0.01	**0.02******	0.01	**0.02******	0.01	**0.02*****	0.01	**0.02*****	0.01	**0.03******	0.009
Effects from own sector employment	**0.40*****	0.16	**0.36*****	0.13	-0.03	0.04	**0.20******	0.05	**0.13*****	0.05	**0.29******	0.14	0.00	0.14	**0.42******	0.127
Effects from related sector employment	**-0.86*****	0.28	**-0.16***	0.12	**0.07***	0.05	**-0.09*****	0.04	-0.01	0.06	-0.14	0.16	0.11	0.14	**-0.69******	0.194
Adjusted R^2	8.5 per cent		14.3 per cent		0.4 per cent		6.0 per cent		5.2 per cent		8.6 per cent		3.6 per cent		8.0 per cent	
Residual Sum of Squares	1364.2		585.9		11001.2		3097.1		3444.5		340.1		493.7		701.3	
Significance of Model F	**0.00******		**0.00******		**0.02******		**0.00******		**0.00******		**0.01*****		**0.10****		**0.00******	
N	246		184		3464		1363		1622		121		176		297	

**** Significant at p <0.01; *** Significant at p < 0.05; **Significant at p<0.10; *Significant at p<0.20

model used in this study.

In this analysis, trust and pension fund companies stand out. This finding suggests the nature of this particular sector in UK. Trust and pension funds companies are set up for many diverse purposes: for investments, savings, and protecting particular assets of commercial companies and societies. The sample of 7,473 observations has 3,400 such companies, mostly small and newly formed entities. Growth occurs through the formation of new trust fund management companies, instead of growing the size of the companies. Therefore, the negative relationship between own-sector employment and growth will not be very meaningful for this sector. More importantly, the large number of trust and pension fund companies would affect the results if all the sectors are analysed together. Therefore, the atypical results for this sector underscore the decision to examine each sector separately.

Age Related Benefits

Table 6 presents the regression results for equation 2, providing a consideration of the age-augmented cluster variables using the same dataset. Own-sector employment provides weak age-dependent cluster effects, being significant only in two sectors: Insurance Auxiliary, and Market and Securities. The result suggests that clustering effects are significantly greater for mature firms in these two sectors: Insurance Auxiliary, and Market and Securities. This result is important and stands in direct contrast to the finding of Acs et al (1994) that all young firms gain more from clustering. The results would suggest that in many sectors, the age of firms in a cluster is not a factor, and that the gains from clustering are rather homogeneous across different age groups in general.

The age-dependent cluster benefits from related sectors are negative and significant for three sectors: Credit Leasing, Life Insurance, and Insurance Auxiliary. This means young credit leasing firms and life insurance companies enjoy clustering with other related sectors for growth. These firms may depend on other institutions such as banks and securities companies for sources of financing or investments. Perhaps, this is indicative of the market-development taking place with presence of related sectors for such young firms. This finding is supportive of the idea that younger life insurance companies are more likely to be reliant on the resources available within a network of closely related firms in a financial centre. Matured non-life insurance firms also seem to benefit from locating with related sectors in general, as these represent sources of collaboration (cross-selling) within financial services.

Table 6: Sector Specific Age Dependent Effect

Age Dependent Effects by Sector	**Banks and Building Societies**		**Credit and Leasing Firms**		**Trust and Pension Fund Firms**		**Life Insurance Firms**		**Non-Life Insurance Firms**		**Financial Auxiliary Firms**		**Insurance Auxiliary Firms**		**Market and Securities Firms**	
Variables	Coeff	Std Err	Coeff	Std Err	Coeff	Std Err	Coeff	Std Err	Coeff	Std Err	Coeff	Std Err	Coeff	Std Err	Coeff	Std Err
Constant	**7.84*****	2.38	0.42	1.23	**2.34******	0.28	**1.00*****	0.42	**2.32******	0.36	**2.93*****	1.34	0.45	1.53	10.46****	2.05
Performance Change with Firm Age	0.05	0.09	**0.12****	0.06	**-0.02*****	0.01	**0.04*****	0.02	**-0.02*****	0.01	-0.04	0.08	0.05	0.08	0.18	0.22
Effects from own sector employment	**0.30*****	0.18	**0.20***	0.15	**-0.09****	0.05	0.04	0.08	**0.09***	0.06	**0.22****	0.13	**-0.39*****	0.17	**0.40******	0.15
Effects from related sector employment	**-0.68****	0.31	0.02	0.14	**0.08***	0.05	0.05	0.05	-0.06	0.07	-0.17	0.15	**0.50******	0.20	**-0.89******	0.25
Age-Dep Effects from own sector employment	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	-0.01	0.01	**0.02*****	0.01	**0.02***	0.02
Age-Dep Effects from related sector employment	-0.01	0.01	**-0.01****	0.01	0.01	0.01	**-0.01****	0.02	**0.01***	0.01	0.01	0.01	**-0.02***	0.01	-0.03	0.03
Adjusted R^2	20.6 per cent		20.6 per cent		0.5 per cent		6.2 per cent		7.0 per cent		7.7 per cent		15.7 per cent		21.7 per cent	
Residual Sum of Squares	672.6		354.9		5945.7		1240.4		1726.6		203.8		231.3		315.9	
Significance of Model F	**0.00******		**0.00******		**0.00******		**0.000******		**0.00******		**0.00******		**0.00******		**0.00******	
N	225		167		3183		1246		1478		113		159		270	

**** Significant at p <0.01; *** Significant at p < 0.05; **Significant at p<0.10; *Significant at p<0.20

Conclusion

The sector-specific results support earlier findings that localisation enables a firm to obtain superior performance, in this case their growth over the lifetime. The significant and negative effect from related sectors also suggests that too many related firms in a cluster can attenuate a firm employment growth. However, some sectors, for example, trust funds, benefit differently, depending on the very nature and the strategies adopted. Therefore, approaches using en bloc consideration of all sectors in an industry cluster can be flawed.

Shaver and Flyer (2000) strongly argue that the incentive to agglomerate is not justified if the established firm does not benefit. Our findings, in direct contrast to the finding of Acs et al (1994), suggest the establishment of firms in a cluster (whether young or old) is not a factor in six of the eight sectors. The benefit of agglomeration economies can vary by the establishment of the firm and the type of sector. Mature firms in the insurance auxiliary and the market and securities sectors benefit more from localisation in the cluster. Younger firms in credit leasing, life insurance and its auxiliary sectors tend to benefit from related sectors in a cluster as the findings suggest. Taken as a whole, our findings imply that growth of mature firms appears to be dependent upon the availability of sector-specific skills and the labour pooling effect from clustering. In contrast, younger firms appear to be in greater need of external positive agglomeration economies as a result of diversity and complementariness in the related activities.

Our findings have important bearings for Singapore, who seeks to grow its wealth management sector. If this is done independently, it may be important to consider growing the related sectors. A detailed understanding of how young and old firms in a particular sector engage with, and gain benefits from, the cluster may be possible with other research approaches to tease out specific relationships between young and old member firms, in how they are formed and maintained. There are definite benefits in our econometric approach—a cross sectional model at a broad national and exploratory level has the clear advantage of employing a larger number of observations in a structured manner. Our technique also allows us to segment certain effects, like sectorial effects or age-specific effects, in the overall analyses.

The overall finding stresses to policymakers that clusters are still good for company and industry development, but it should not be a simplistic view. Policies should reflect the underlying and identified benefits of clusters. Different sectors within a cluster provide and receive different agglomeration economies. A policy that promotes heterogeneity within a cluster, through attracting newer firms, needs to recognise the congestion

diseconomies on older established firms. Likewise, a policy that promotes an increase of employment/size of a particular sector is unlikely to help the survival of new entrepreneurial firms who have a greater reliance on spill-over effects and supporting inputs from a strong related sector. We propose cluster-based policies that take account of the age profile of cluster members and the identified needs of those members. This view is a more complex appreciation of clustering and hopefully more helpful than simply assuming that bigger financial centres are always better and resulting agglomeration economies are always positive as Porter (1990) and Arthur (1990) propose.

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