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Evaluating the local business growth effects of the UK City of Culture 2013 and 2017: A simple propensity score matching-difference-in-difference modelling approach

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ABSTRACT

Evaluation of Cities of Culture (CoC) are typically focused on their cultural and tourism dimensions, with less attention often paid to their longer-term economic impacts. Here, we draw on longitudinal data for businesses across the UK to estimate the local business growth effects of CoC 2013 and 2017. Specifically, we use a firm-level, propensity score matching-difference-in-difference modelling approach to compare business growth in each CoC to a matched control group of firms in the other shortlisted cities. For CoC 2013 among the group of matched firms, employment grew 4.6-4.7 per cent faster on average over 2 years after the CoC, and 19.3-20.3 per cent faster over 4 years than in the other shortlisted cities. We find no consistent evidence of significant impacts on firms' sales growth in Derry over either 2 or 4 years after the CoC. For Hull, we find little evidence of any robust effects on either firm sales or employment growth although it is very likely that any longer-term benefits of CoC 2017 were dominated by impacts of the COVID-19 pandemic. Our results suggest that Cities of Culture can lead to significant economic benefits, however, these are not guaranteed.

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Keywords: City of Culture; Employment; Derry; Hull; Propensity score matching

1. INTRODUCTION

In July 2010 the City of Derry[1] in Northern Ireland was selected from a short-list of four UK cities – also including Birmingham, Sheffield and Norwich - to be the UK's first City of Culture (CoC) in 2013. The City's mayor at the time - Colum Eastwood – commented that 'this will bring the jobs, the investment, the regeneration that we need.' A local MP - Gregory Campbell – reflected both the potential for the COC and the background to the decision: CoC 'has great potential, let's realise that potential …We need to try to ensure that the divisions of the past, are the divisions of the past and that this has a unifying potential for the future[2].' Evidence compiled to support the Derry bid included an ex-ante evaluation and projections of potential investment and employment benefits (DCSDC, 2018, p. 14). Benefits were anticipated on three fronts. Socio-economic benefits were anticipated with CoC expected to lead to significant gains in terms of skills, employment, well-being and social exclusion. Cultural benefits were also anticipated through new partnerships and a revitalisation of the cultural and arts sector in the city. Finally, it was anticipated that there might be economic benefits providing around 2,800 new jobs. These economic benefits were seen as all the more important given the relatively high level of deprivation in Derry, poor education and skill levels and limited employment opportunities. In 2013, at the time of the CoC, unemployment in Derry and Strabane numbered around 8,000, 8.4 per cent of the workforce compared to 5.4 in Northern Ireland as a whole (DCSDC, 2018, p. 22). Four years later Hull, one of the unsuccessful bidders for UK City of Culture in 2013, was announced as CoC 2017. Identified as an 'economically isolated' city by Bolton and Hildreth (2013), and a 'stigmatised' city by (Tommarchi and Bianchini, 2022), Hull had experienced a period of deindustrialisation since the 1970s accompanied by a decline in the once prominent fishing industry resulting in 'low levels of education, and higher figures for unemployment, deprivation and mental and physical health problems than the national averages' (Tommarchi and Bianchini, 2022), p. 482.

Prior research suggests that large-scale and localised cultural events such as the CoC have the potential to generate significant economic benefits such as increased GDP, employment, and retail opportunities (e.g. Agha and Taks, 2015; Gursoy et al., 2011; Langen, 2008; Langen and Garcia, 2009; Vetitnev and Bobina, 2015). For example, based on visitor survey data and multiplier estimates, Herrero et al. (2006) examine the impact of the 2002 European CoC on Salamanca in Spain and suggest that total investment of €399.7m led to domestic economic

[1] The naming of Derry/Londonderry is itself contentious. We use the term Derry here as being the most frequently used name for the city.
[2] See https://www.bbc.co.uk/news/uk-northern-ireland-10651854, accesssed 11 January 2021.

impact of €650.1m and international impact of €51.6m[3]. The implied benefit ratio is around 1.7 for every €1 invested. More recently Gomes and Librero-Cano (2018), based on a regional difference-in-difference analysis of GDP per capita between host areas and other regions, suggest that the European CoC increases GDP per capita in the host region by 3.7 per cent 3-5 years after the event and 4.6-4.9 per cent after 5 years.

Evaluation of the economic impact of UK CoC's (i.e. Derry, 2013; Hull, 2017) is more limited and has focussed on visitor numbers, visitor expenditure and short-term job effects. Here, we extend these prior evaluations in both methodological and substantive terms. In substantive terms we examine the longer-term effects of Derry CoC 2013 and Hull CoC 2017 on employment and turnover in local businesses using longitudinal data on all firms taken from the Business Structure Database. In methodological terms we adopt, for the first time in evaluations of the impact of UK CoCs, a firm-level propensity score matching-difference-in-difference estimation approach to control for differences in firm characteristics between comparison areas[4]. To estimate an appropriate counterfactual, we follow the approach suggested by Gomes and Libero-Cano (2018) in comparing the impact of CoC on firms in Derry and Hull with that in other cities which were shortlisted but not awarded CoC status. Our analysis adds to the limited evidence on the impacts of CoC 2013 and CoC 2017, and addresses a wider research gap relating to the ambiguity of many 'impact' studies and the relative absence of long-term impact assessments (Langen and García, 2009; Palmer, 2004; European Capitals of Culture Policy Group, 2010).

[3] Herrero et al. (2006) derive sectoral multipliers from regional input-output tables.
[4] We adopt a simple PSM-DID approach here to illustrate the potential for this type of evaluation approach. Further analysis could consider alternative matching approaches and the use of synthetic control groups.

2. COCS AND THEIR IMPACTS

2.1 European CoCs

The notion of a European CoC was first suggested during the meeting of EU Ministers of Culture in Athens in 1983, and enacted into legislation as an annual event in 1985. Garcia and Cox (2013) distinguish three Phases in the subsequent development of the legislation and implementation of European CoC. Phase 1 from 1985-96 was characterised by short planning cycles with the 12 candidate cities each nominated by their individual countries. Glasgow was the only UK city to be European CoC during this period following a UK wide competition entered by nine UK cities (Myerscroft 1994). Glasgow was designated European CoC for 1990 in August 1986 with the District and Regional Councils taking charge of the event. A budget of £33m allowed over 3,000 events to be undertaken at least one every day of the year (Boyle and Hughes 1991), and left a legacy of cultural venues such as the Arches and Tramway (Cameron 1992). Glasgow CoC was part of an 'intensive campaign to regenerate the city' (Boyle and Hughes 1991, p. 219) following several decades of severe industrial job losses and 'stimulated official rhetoric throughout 1990 on the idea of Glasgow committing itself to regeneration through tourism, the arts and service sector provision' (Boyle and Hughes 1991, p. 220). The CoC year 'delivered a major boost to Glasgow's cultural system [and] touched the lives of four out of five adult residents … tourist visits to arts events were 81 per cent above the level for the last measured year' (Myerscroft 1991, p. iii). As a result, additional jobs were generated primarily in the hospitality sector equivalent to around 1.5 per cent of total employment in the City (Myerscroft 1991, p. 192) Although it has been suggested that many of these jobs were poor quality and not sustained, and that more sustainable impacts may relate to city image and the cultural legacy (Garcia, 2005) despite significant economic and social problems remaining within the city (Turok and Bailey 2004).

Subsequent developments in the EU City of Culture from 1997-2004 saw the increase in EU funding for European CoC and its incorporation into mainstream EU programming. The introduction of a competitive element for bids and longer planning horizons created the capacity for more innovative and ambitious programmes (Garcia and Cox 2013). No UK city was either a candidate city or awarded EU CoC during this 1997-2004 period (Gomes and Librero-Cano 2018). Since 2005 the EU COC has involved longer lead times and had clearer selection criteria as well as stronger monitoring and post-event evaluation (Garcia and Cox 2013). Liverpool 2008 occurred during this period. Announced originally in 2004, Liverpool's bid won out over a bid from Newcastle-Gateshead, a win attributed by the judging panel to the more inclusive nature of the Liverpool programme (Boland, 2010). Motivations were similar to

that of Glasgow eight years earlier: to change the image of the city internationally and seen as an opportunity to showcase the city's cultural offerings[5]. Total investment in the CoC 2008 was £122m of which £75m came from the City Council at a time when Council was under severe financial pressure (Boland, 2010). 7000 events were reportedly staged during the year. The impacts of CoC 2008 were documented though a research programme commissioned by the City Council from the two local universities (see www.impacts08.net). This highlighted the positive effects on the city's image and tourism although, as ImpactsO8 (2009) note, there were concerns about the sustainability and viability of venues and about the spatial concentration of benefits. Boland (2010, p.639) comments on the CoC's 'spatial bias towards the city centre leading to stylish regeneration and gentrification while senses of marginalisation amongst residents of peripheral housing estates intensified' (Boland, 2010, p. 639).

Aspirations and measured impacts vary across European CoCs but 'cities such as Glasgow, Lille, Liverpool, Pecs and Turku have been successful in repositioning themselves as cultural hubs at a national and/or European level' (Garcia and Cox p. 12). In this sense, Glasgow was the first city to explicitly link the CoC to potential economic benefits (Myerscroft 1994)[6]. In this view culture becomes a means to an (economic) end rather than being entered into for its intrinsic value and local authenticity (Myerscroft 1994). However, economic objectives for EU CoCs are rarely 'well defined' (Palmer/Rae Associates 2004) and economic impacts 'have at times been over-inflated or lacking in robust evidence' (Garcia and Cox, 2013, p. 13).

Long-term evaluations of the impact of large-scale cultural events are few and far between (Langen and Garcia 2009; European Capitals of Culture Policy Group 2010; Gomes and Librero-Cano 2018). Instead, evaluation studies have tended to be short-term with a focus on increased tourist activity or participant spend. Where studies have been undertaken, they have often been based on survey-data (e.g. Steiner et al. 2015) or used the region or city as the unit of analysis (Gomes and Librero-Cano 2018). Generally, such studies have suggested positive impacts on local businesses but estimated impacts vary strongly by sector and firm location.

[5] Evans (2011) emphasises the long-term historical roots of the Liverpool CoC as far back as the Garden Festival of 1984, part of another national competition.

[6] Myerscroft (1994, p. 11) also notes that Glasgow 1990 adopted an 'all encompassing definition of culture to include "everything which makes Glasgow what it is: history, design, engineering, education, architecture, shipbuilding, religion and sport as much as music, dance, visual arts, literature and the theatre'.

2.2 Derry - UK CoC 2013

The award of the Derry CoC in 2010 was greeted locally with considerable celebration and anticipation. The anticipated cultural, social and economic implications were significant with an Oxford Economics report of 2013 anticipating an additional 850 FTE jobs in 2013 itself and a total of an additional 2740 FTE job years (DCSDC, 2018, Box 1, p. 41). However, between the time of the award of CoC in 2010 and 2013 'the economic climate and the public expenditure environment deteriorated sharply … which constrained the availability of both public and private sector funding sources' (DCSDC, 2018, p. 14). This led to some restrictions in the budget for the year with final outturn costs totalling £17.8m of which £14.0m was accounted for by programme costs and £1.9m by marketing costs (DCSDC, 2018, p.6). The programme of CoC 2013 included more than 100 separate events including theatre, music, art - including the 2013 Turner Prize exhibition, film and sporting events (Derry City Council 2012).

Research on the impacts of Derry CoC has also been limited. The Post Project Evaluation (2015) drew on survey data from individuals and other secondary data but concluded 'it is too early to assess the longer-term impact on the city's economy and labour market' (D-L PPE, 2015, p. 6). The Post-project Final Report notes, however, that 'in general terms there is positive evidence of benefit in almost all areas … especially in improved perceptions of the city and increased tourism … Employment and other economic benefits of the project were more limited and would be expected to flow in the longer term from improved perceptions of the city and increased tourism over time' (DCSDC, 2018, p.7). Elements of the legacy of the CoC highlighted in the Post-project Evaluation included significant physical regeneration, additional hotel capacity and a range of new partnerships between local cultural organisations and national and international partners. Boland et al. (2016) in their provocatively entitled paper 'Life or place changing [event] or a 12-month party?' quote a number of actors within the City as well as commentators who reflect on the limited 'legacy' of the CoC in terms of new jobs and growth. They conclude: 'Moving beyond D-L we contend that it is possible for a major cultural event to be life and place changing ... However, we reserve judgement on the economic dimension' (Boland et al. 2016, p. 14).

More recent commentary has focused on community and cultural aspects of the legacy of CoC 2013 rather than its economic effects. (Doak, 2014), for example, considered the legacy of the CoC in the process of re-branding Derry (see also (Doak, 2020)), while (Boland, Murtagh and Shirlow, 2020) reflect the positive impact of cultural events as a 'peace resource' but its (seemingly) limited economic benefits. (Murtagh, Boland and Shirlow, 2017), reflect on the

lack of engagement of CoC 2013 with the history of the city, seeing this as a missed opportunity to contribute to a stable peace. Interestingly, this this type of engagement with the history of the city was central to CoC 2017.

2.3 Hull – UK CoC 2017

Hull, one of the unsuccessful bidders for UK City of Culture in 2013, was announced as COC 2017 on 20 November 2013, with the launch of the programme for the year following on 22nd September 2016. Identified as an 'economically isolated' city by Bolton and Hildreth (2013), and as a 'stigmatised' city by (Tommarchi and Bianchini, 2022), Hull had experienced a period of deindustrialisation since the 1970s accompanied by a decline in the once prominent fishing industry resulting in 'low levels of education, and by higher figures for unemployment, deprivation and mental and physical health problems than the national averages' (Tommarchi and Bianchini, 2022), p. 482. - Hull City of Culture 2017 Ltd had a mission 'to deliver 365 days of transformative culture through a range of diverse and high-profile cultural events and projects' (CPPI 2021). The year programme was divided into four 3-month themes focused on: Made in Hull; Roots and Routes; Freedom; and, Tell the World. The programme aimed to reflect the historical role of the city, celebrate contemporary artists and encourage awareness and pride in the City's heritage (Tommarchi and Bianchini, 2022). Overall, the programme included over 2,800 events, activities, installations and exhibitions generating a total of over 5.3m attendances (CPPI 2021, p. 21). Total programme investment through Hull UK City of Culture 2017 Ltd was £32.8m, of which £22.1m was from public and Lottery sources (CPPI, 2021, p. 75).

In economic terms CoC 2017 aimed to strengthen the local economy – by increasing visitor numbers and delivering economic benefits – and to increase public and private investment (Aims 5 and 6). Visitor numbers did increase by 9.7 per cent between 2016-2017 and there was growth in employment in creative industries of 5.4 per cent between 2016-2017 (CPPI 2021, p. 49). Hull CoC was the focus of a range of evaluation studies including quarterly monitoring reports during the CoC year itself, case studies of high-profile projects (e.g. (Tomlinson, 2021), process evaluation, and analyses of the experience of young people (Ploner and Jones, 2020), and the CoC volunteering programme (Whitfield, 2023). Evaluation was based on surveys of local (Hull and East Riding) residents, firms, audiences at key events and UK-wide research on perceptions of Hull undertaken during 2016-2018. A final, independent value for money evaluation was undertaken in 2019. The summary evaluation notes, however, 'more detailed analysis of performance is limited by lags in data, which means that in many cases we are not yet able to see the extent to which the impacts of 2017 have

been sustained' (CPPI, 2021, p. 50). Commentary on CoC 2017 since the final evaluation has focused primarily on its cultural and reputational legacy rather than any economic benefits. (Tommarchi and Bianchini, 2022) provide an overview of the legacy of CoC and its contribution to offsetting Hull's position as a stigmatised city. In a related study, (Howcroft, 2023) focuses on the role of CoC in restoring civic pride, while (Ploner and Jones, 2020) and (Umney and Symon, 2020) focus on the cultural and artistic legacy of CoC 2017.

3. DATA AND METHODS

Our empirical approach uses propensity score matching and difference-in-difference modelling to compare the employment and turnover growth of employer businesses pre- and post-CoC in Derry to that of the other three cities shortlisted for CoC 2013 (Birmingham, Norwich and Sheffield). We compare business growth in Hull to that in the shortlisted areas for CoC 2017 (Dundee, Swansea Bay and Leicester).

3.1 Firm-level data

We take firm-level data from the ONS Business Structure Database (BSD), accessed through the UK Data Service and covering the whole population of businesses in the UK between 1997 and 2022 (ONS 2023). The BSD is compiled from annual snapshots of the Inter-departmental Business Register (IDBR) which is itself based on PAYE and VAT data provided by firms to HMRC. As such the BSD covers almost all UK firms including data on around 5m individual enterprises of which around 1.1m have employees ('employer businesses'). The BSD provides information on firms' age, ownership, turnover, employment, industrial classification at the SIC 4-digit level and postcode sector (i.e., the first three or four digits of the postcode). We structure the longitudinal BSD data as a panel to assess the impact of the CoC on firms' employment and turnover growth. Postcode sectors are then used to identify employer businesses in the CoC and other short-listed cities.

3.2 Using propensity score matching

A critical issue in any impact evaluation is the identification of an appropriate counterfactual, i.e. what would have happened if a firm had not been subject to the treatment, here the potential benefits of CoC. This is important as the award of the CoC is selective, perhaps reflecting local economic or social factors (see above), and firms in Derry and Hull may have different characteristics to those in the other shortlisted cities which may have a strong impact on any growth effects. To overcome this issue, we adopt a propensity score matching (PSM) technique at the firm level to create a control group of non-treated firms from the other short-

listed cities which is as similar as possible to the group of treated firms located in each CoC. By using PSM we hope to control for any selection bias in the choice of CoC, while our use of a difference-in-difference modelling approach should help to consider any otherwise unobserved heterogeneity between firms in different areas (Heckman et al. 1997; Imbens 2004).

More specifically, we measure the average growth rate of the outcome variables y^1_{t+n}, employment and turnover, as the difference between the pre-treatment log level at time *t-n* and the levels in the short-term (ST) 2 years after the treatment, and in the medium-term (MT) 4 years after the treatment.[7] Since we are interested in identifying the differences in firms' performance after the CoC, we express the average treatment effect (τ_{ATT}) in terms of performance growth after the CoC at time *t+n* as $E(y^1_{t+n}|\, S_t = 1)$, and the counterfactual performance growth for the same group of firms had they not benefitted from the CoC as $E(y^0_{t+n}|\, S_t = 1)$:

$$\tau_{ATT} = E(y^1_{t+n} - y^0_{t+n}|\, S_t = 1) = E(y^1_{t+n}|\, S_t = 1) - E(y^0_{t+n}|\, S_t = 1)$$

where *S* denotes the two groups of firms, *S=1* is the treated group participating in the CoC project and *S=0* is the untreated group. The fundamental problem is that only one of the two possible cases is observed for each firm, i.e. whether a firm participated in the CoC $E(y^1_{t+n}|\, S_t = 1)$ or not $E(y^0_{t+n}|\, S_t = 0)$. Hence, we need to build a suitable control group by considering instead the effect of no treatment on the performance growth of similar firms which did not participate in the CoC.

To build the control group we use a propensity score matching technique in order to select suitable controls from the population of firms in the other shortlisted cities, matching observed characteristics as closely as possible to those of treated firms before the CoC (Rosenbaum and Rubin 1983; Heckman et al. 1997; Becker and Ichino 2002; Lechner 2002). To estimate the propensity score we use a probit model using covariates which may explain the probability that specific firms are in the treated group. We include a set of firm-level characteristics - employment, log(sales per employee) – a commonly used measure of productivity, firm age, and sector. Descriptives for the key variables are given in Tables 1 and 2.

7 Superscript 1 in y^1_{t+n} indicates a treated firm (i.e. a firm located in Derry) n denotes the number of years after the 2013 CoC.

Probit models used to estimate the propensity scores are included in Tables 3 and 4 for CoC 2013 and 2017. In each case the estimation sample comprises firms from the CoC and the three other short-listed cities. We estimate separate models for the short (n=2 years) and longer-term (n=4 years) growth effects of employment and turnover. Some significant differences emerge between firms in Derry and the other shortlisted cities which might bias any growth comparison without the PSM or some other matching approach. Notably, firms in Derry appear older, and more likely to be in construction or hospitality, and less likely to be in business services than those in the other shortlisted cities (Table 3). Firms in Hull were also less likely to be in business services than those in the other shortlisted cities (Table 4).

After estimating the probability of benefitting from the CoC, we match firms in the CoC with those in the other shortlisted cities according to their estimated propensity score to identify a matched control group. We use two different matching approaches to ensure consistency of results. First, we apply a Nearest-Neighbour matching technique matching each treated firm with the three closest matches in the other shortlisted cities, an approach which Guerzoni and Raiteri (2015) suggest yields efficiency gains in matching. Second, we apply a single Nearest-Neighbour match with a very strict Caliper bandwidth (0.10 of the standard deviation of the propensity scores). This approach provides less biased estimates although variances may be larger (Almus & Czarnitzki 2003; Czarnitzki et al. 2011; Czarnitzki & Lopes-Bento 2013). Our results prove robust to either matching approach although the on-support samples, i.e. those firms matched successfully, vary marginally between matching approaches.

3.3 Balancing tests

Balancing tests provide an indication of the quality of matching achieved. The results of the propensity score matching for long-term employment and turnover growth are summarised in in Tables A2 to A5. In each case we report the mean differences between the unmatched and matched samples and related t-tests. For example, Table A2 reports balancing tests for the nearest neighbour matching (N=3) for employment growth four years before and four years after the 2013 CoC. After matching the t-tests suggest no remaining differences in characteristics between the matched treatment and control groups. Remaining differences in growth performance may therefore be attributed to the effects of the 2013 CoC. Matching proves equally effective in each of the other analyses (see Tables A3 to A5).

4. EMPIRICAL RESULTS

We explore the impact of CoC on turnover and employment growth over a 2- and 4-year time horizon comparing the growth of firms in Derry and Hull with those in other shortlisted cities. Figures 1 and 2 provide a time-series perspective on the average employment and turnover growth of firms in the CoC and shortlisted cities. Figure 1 suggests that prior to 2014 average employment growth in Derry lagged that among matched firms in the other cities. Post-2014 employment growth of firms in Derry was higher than the matched groups in each other city (Figure 1b). The timing of this transition is consistent with a positive benefit from the CoC 2013. Its notable also that in terms of average sales growth this is higher in Derry than in the other shortlisted cities in the post-2016 period. Figure 2 relating to CoC 2017 suggests a rather different picture with the most recent years inevitably shaped by the impact of COVID-19. Employment growth is negative in Hull and each of the shortlisted cities for CoC 2017 from 2019 onwards (Figure 2a) as is turnover growth in 2021 and 2022 (Figure 2b). In neither case is there any very consistent difference between growth in employer businesses in Hull and that in matched firms in the other short-listed cities.

Treatment effects for both Derry and Hull using two alternative approaches for matching treated and untreated firms are included in Table 5. Overall, as might be expected from Figure 1a, our results suggest robust and significant employment growth effects arising from CoC 2014 after both 2 and 4 years, with the scale of employment growth effects largely consistent across matching methods. Employment grew 4.6-4.7 per cent faster on average in Derry over 2 years and 19.3-20.3 per cent faster over 4 years than in the other shortlisted cities. In contrast to the significant impacts of CoC 2013 on employment we find no statistically significant treatment effects on the growth in sales of businesses in Derry after either 2 or 4 years (Table 5). On average our results suggest additional growth in sales – albeit statistically insignificant – of 1.1-1.6 per cent after two years and 1.8-3.2 per cent after four years. The suggestion is that the effect of CoC 2013 was primarily on jobs rather than on firms' sales, at least over the period considered here.

For CoC 2017 we find no significant employment growth effect relative to firms in the other shortlisted cities (Table 5). Sales growth effects also prove insignificant in the short-term (2 years), although there is some evidence of a more positive medium term sales growth effect. Two important caveats are required here, however. First, we only find a significant growth effect using one of the two matching approaches, and second. This period was marked by the effects of COVID-19 which significantly impacted firms' overall sales growth (Figure 2).

5. DISCUSSION

Previous studies have drawn attention to the lack of longer-term impact assessments of Cities of Culture and the narrow focus of many assessments on tourism and cultural impacts. Here, drawing on a comparison of the first two UK CoC and other shortlisted cities, we provide some initial evidence on the economic impacts of CoCs. For CoC 2013 the results are more positive, suggesting that among a group of matched firms employment grew 4.6-4.7 per cent faster on average in Derry over 2 years after the CoC, and 19.3-20.3 per cent faster over 4 years than in the other shortlisted cities. A similar analysis for turnover suggests few significant impacts from CoC 2013. The context may be important here. In 2007 the unemployment rate in Derry was 3.8 per cent, a figure which had risen to 8.5 per cent by 2013[8]. The CoC reversed the decline in employment and led to a period of four years of job growth which was stronger and more consistent than that in any of the other cities shortlisted for the 2013 CoC (Figure 1). Perhaps unsurprisingly this was reflected in a consistent fall in the unemployment rate in the city from 8.5 per cent in January 2013 to 4.3 per cent in January 2020. Note, however, that this reflected the wider Northern Ireland unemployment rate trend which fell from 5.7 per cent in 2013 to 2.6 per cent by 2020[9].

Results for CoC 2017 are less positive with little evidence of either significant employment or turnover growth effects over two or four years. While this reflects uncertainty about the economic legacy of Hull 2017 as voiced elsewhere (CPPI, 2021). It is important also to acknowledge that the COVID-19 pandemic may have significantly impacted any longer-term legacy of CoC 2017. In particular, the hospitality and visitor economy which experienced benefits from CoC 2017 (CPPI 2021; Tomlinson, 2021) were impacted significantly by the COVID-19 lockdowns and mobility restrictions from March 2020 onwards.

It is also important to be aware of what our job and sales impact estimates do and do not include. First, the estimates are based on a comparison of the growth performance of individual firms in and in the other shortlisted cities before and after the CoC. To be included in the analysis, firms needed to be in business in 2 or 4 years before the CoC and survive 2 or 4 years afterwards. This means that new firms established in the period immediately before or after the CoC are excluded from the estimates. If, as we might anticipate, the CoC stimulated some additional entrepreneurial activity in the city this would mean our estimates

[8] See https://www.derrystrabane.com/getmedia/b5f3fc8c-0fe9-4ef4-8ad6-324d8b433ce3/Unemployment-210420.pdf.
[9] Ibid.

actually under-estimate the total benefits of the CoC. As new firms generally start at modest scale, however, any under-estimate of new jobs may not be very significant in absolute terms.

Second, the analysis considers job growth in private businesses located in the CoC and the other short-listed cities and does not include any additional employment created in public sector arts or cultural organisations. To the extent that the CoC stimulated job growth in public sector arts or cultural organisations our estimates may again under-estimate the total level of job creation in the city. Third, as the analysis considers the relative growth of all firms in the city it does capture any local multiplier effects which might have arisen from CoC stimulated activity. Jobs generated in retail or hospitality activities, for example, would be captured here.

Also note, however, that our analysis reflects the jobs effect of the CoC. We do not capture whether these new jobs were filled by residents of the CoC or whether these were filled by those resident in other areas. Understanding the nature of these job flows and potential changes in commuting patterns may be helpful in assessing the extent to which the benefits of CoC 2013 were captured within the city or spilled over into surrounding areas.

In evaluating the scale of our employment and sales growth estimates it is important also to recognise that each CoC took place in a very specific context shaped both by the history of the cities themselves and wider events. In the case of Derry, job numbers had fallen sharply and unemployment risen rapidly in the years immediately prior to the CoC. Our results suggest clearly that CoC 2013 helped to reverse this decline and stimulated a period of consistent job growth which lasted for at least 4 years after the CoC itself. This pattern was not reflected in any of the other shortlisted cities. For Hull, aggregate employment estimates suggest that Hull experienced a similar (although less dramatic) fall in employment in the years immediately prior to the CoC 2017. Here, our results suggest that CoC 2017 did little to reverse this trend although any legacy was inevitably dampened by COVID-19. Employment estimates suggest that Coventry too experienced a small decline in employment between September 2019 and September 2020, immediately prior to the CoC 2021. In the latter case, however, the impacts of the COVID-19 pandemic on the operation of the CoC itself, and more generally on employment in local firms, seem likely to dominate any CoC 2021 employment effects.

Our analysis demonstrates the feasibility of this type of localised propensity score matching-difference in difference approach to modelling the effects of City of Culture. A number of extensions of this initial analysis are possible. First, the analysis could be extended to areas surrounding the CoC and short-listed cities to capture geographically dispersed multiplier or displacement effects. Second, other modelling approaches could be considered aside from

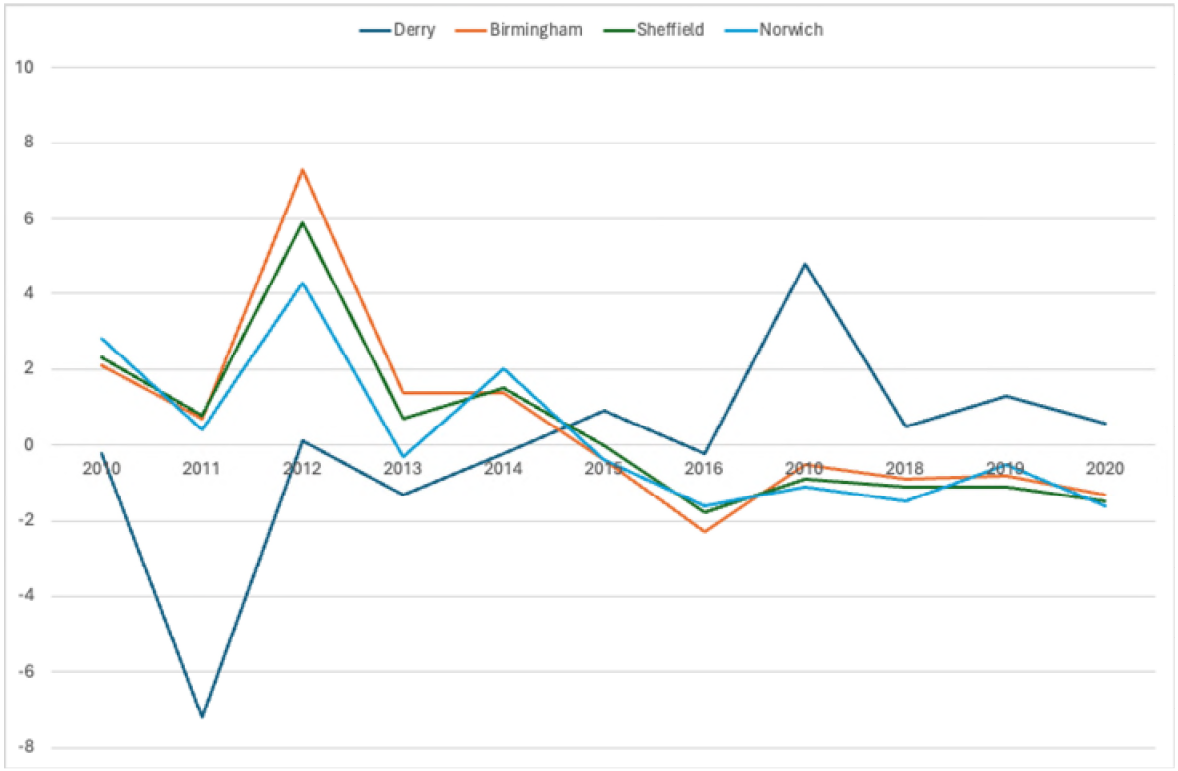
the PSM-DID approach adopted here. CoC represents a spatially specific discontinuity and this could be exploited to compare pre- and post- CoC growth in different areas. Such an approach has both advantages and disadvantages relative to the PSM-DID modelling approach. A discontinuity approach does not naturally allow for differences in the characteristics of businesses in comparator areas which is allowed for in PSM-type matching analysis. However, the discontinuity approach is less data demanding than PSM type approaches. Both the PSM-DID and discontinuity type approach, however, rely on longitudinal data and measurable effects on firm behaviour or performance. Third, in some situations it may also be possible to use PSM-DID approaches, or discontinuity type analyses, to consider the impacts on firms in different sectors. CoC impacts on the hospitality sector, for example, may be significantly greater than those on manufacturing. (In the case of Derry this type of sectoral analysis proved unreliable due to the relatively small size of the city and the relatively low number of firms in any specific sector. For larger cities this sectoral approach may be more applicable). Finally, and in more technical terms, adding further covariates to the probit models and using more sophisticated matching approaches may also be useful in future studies.

6. CONCLUSIONS

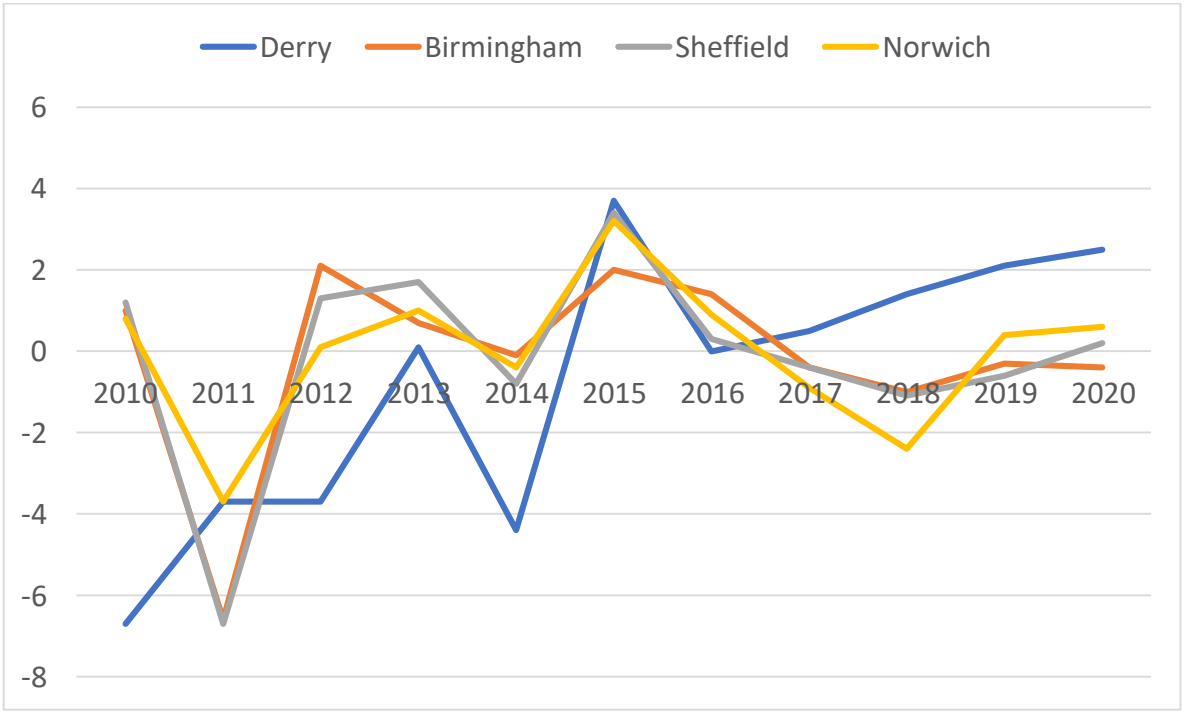
For the first time we apply a propensity score matching-difference in difference approach to consider the longer term employment and sales impact of UK City of Culture 2013 and 2017. This matches firms in each CoC with very similar companies in the other shortlisted cities and examines their growth pre- and post-CoC. Alternative matching approaches also suggest similar approaches suggesting the robustness of our results. We find that CoC 2013 delivered significant job growth benefits over 2 and 4 years although it had little significant impact on firms' sales. This reflects other recent analyses of the EU CoC which have also suggested its significant longer-term benefits (Gomes and Librero-Cano, 2018). Our results for CoC 2017 are less positive suggesting no sustained impacts on either employment or firms' sales. Any longer-term legacy effects of CoC 2017 are likely to have been impacted by the COVID-19 pandemic.

Figure 1: Average percentage growth rate in matched companies by city: CoC 2013

(a) Employment



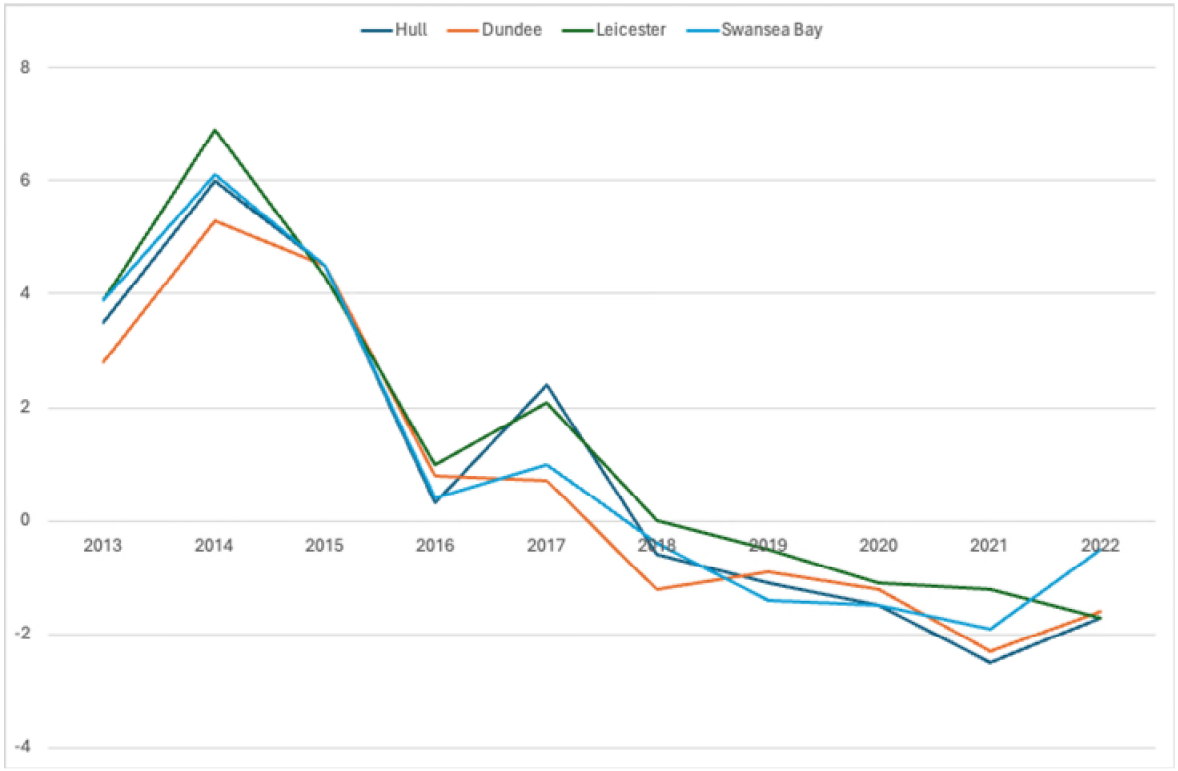
(b) Turnover



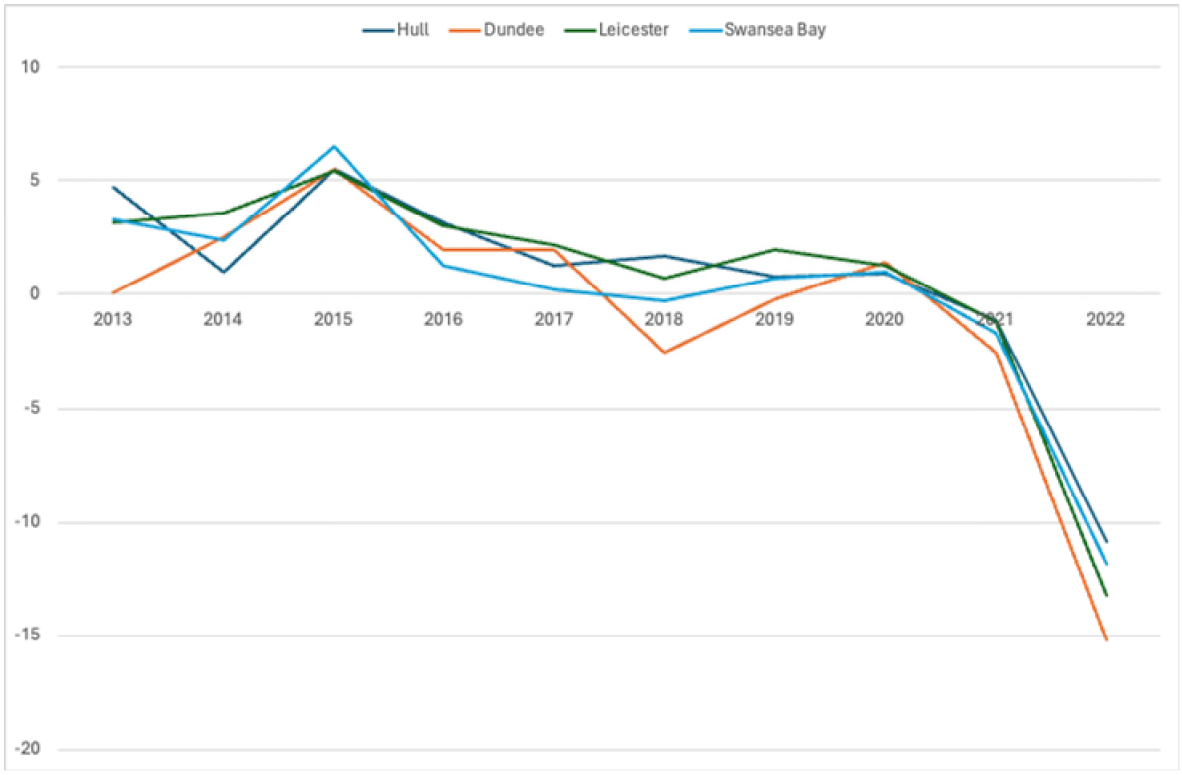
Sources: Author's analysis of Business Structure Database. Matched firms.

Figure 2: Average percentage growth rate in matched companies by city: CoC 2017

(a) Employment



(b) Turnover



Sources: Author's analysis of Business Structure Database. Matched firms.

Table 1: Descriptive analysis for firms in each city in 2013

	Derry		Birmingham		Sheffield		Norwich		All	
	N=2,337		N=34,793		N=22,282		N=14,839		N=74,251	
	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev
Employment	17.70	383.23	21.17	461.58	26.74	1147.62	13.68	217.88	21.23	713.57
Sales per employee (log)	-2.72	1.13	-2.74	1.06	-2.79	1.04	-2.78	1.01	-2.76	1.05
Firm age (log)	2.64	0.71	2.38	0.77	2.41	0.76	2.52	0.76	2.43	0.76
Sector (% firms)										
Production	0.13	0.33	0.11	0.32	0.13	0.33	0.14	0.34	0.12	0.33
Construction	0.19	0.40	0.12	0.32	0.15	0.35	0.13	0.34	0.13	0.34
Retail, Wholesale	0.21	0.40	0.20	0.40	0.20	0.40	0.18	0.38	0.19	0.40
Transport, Logistics	0.03	0.16	0.03	0.17	0.03	0.17	0.03	0.16	0.03	0.17
Hospitality	0.08	0.27	0.06	0.23	0.07	0.25	0.08	0.27	0.07	0.25
Business Services	0.17	0.38	0.34	0.47	0.28	0.45	0.29	0.46	0.31	0.46
Other services	0.20	0.40	0.15	0.36	0.15	0.36	0.15	0.35	0.15	0.36

Source: Business Structures Database. Probit estimation sample.

Table 2: Descriptive analysis for firms in each city in 2017

	Hull		Dundee		Leicester		Swansea Bay		All	
	N=4,366		N=2,760		N=14,944		N=10,452		N=32,522	
	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev	Mean	Std dev
Employment	19.30	156.60	20.94	285.56	20.88	460.81	15.22	241.92	18.85	355.80
Sales per employee (log)	-2.73	0.97	-2.77	0.99	-2.71	0.98	-2.80	0.99	-2.75	0.99
Firm age (log)	2.40	0.82	2.39	0.85	2.31	0.82	2.46	0.81	2.37	0.82
Sector (% firms)										
Production	0.13	0.34	0.09	0.29	0.12	0.33	0.11	0.32	0.12	0.32
Construction	0.13	0.33	0.13	0.33	0.10	0.31	0.13	0.34	0.12	0.32
Retail, Wholesale	0.20	0.40	0.17	0.37	0.19	0.39	0.17	0.38	0.18	0.39
Transport, Logistics	0.04	0.20	0.02	0.14	0.05	0.21	0.03	0.18	0.04	0.19
Hospitality	0.08	0.27	0.08	0.27	0.05	0.23	0.10	0.29	0.07	0.26
Business Services	0.25	0.43	0.33	0.47	0.32	0.47	0.28	0.45	0.30	0.46
Other services	0.17	0.38	0.18	0.39	0.16	0.36	0.17	0.38	0.17	0.37

Source: Business Structures Database. Probit estimation sample.

Table 3: Probit models for propensity score matching for 2013

	ST Employment			LT Employment			ST Sales			LT Sales		
	Coeff	Std. Err	Z	Coeff	Std. Err	Z	Coeff	Std. Err	Z	Coeff	Std. Err	Z
Employment	0.000	0.000	-0.830	0.000	0.000	-0.840	0.000	0.000	-0.890	0.000	0.000	-0.890
Empl.-squared	0.000	0.000	0.540	0.000	0.000	0.550	0.000	0.000	0.600	0.000	0.000	0.600
Sales per employee (log)	0.010	0.009	1.080	0.002	0.011	0.150	0.008	0.009	0.850	0.001	0.010	0.080
Firm age (log)	0.158	0.013	12.340	0.155	0.018	8.690	0.152	0.012	12.290	0.138	0.017	8.160
Construction	0.231	0.034	6.750	0.206	0.040	5.220	0.189	0.032	5.830	0.142	0.036	3.890
Retail, Wholesale	0.038	0.033	1.150	0.074	0.037	2.000	-0.021	0.031	-0.670	-0.003	0.034	-0.100
Transport, Logistics	-0.003	0.061	-0.050	-0.012	0.071	-0.170	-0.028	0.058	-0.490	-0.064	0.066	-0.970
Hospitality	0.146	0.043	3.420	0.176	0.049	3.570	0.082	0.041	2.010	0.106	0.046	2.300
Business Services	-0.177	0.034	-5.270	-0.141	0.038	-3.700	-0.235	0.032	-7.400	-0.226	0.035	-6.420
Other services	0.156	0.034	4.570	0.174	0.039	4.510	0.087	0.033	2.650	0.054	0.036	1.480
Constant	-2.266	0.051	-44.150	-2.300	0.068	-34.060	-2.188	0.049	-44.590	-2.153	0.063	-34.080
Number of obs	74,251			53,634			76,561			56,429		
LR chi2(9)	434.81			244.53			457.01			251.72		
Prob > chi2	0			0			0			0		
Log likelihood	-10165.1			-7787.32			-10818.6			-8583.92		
Pseudo R2	0.0209			0.0155			0.0207			0.0145		

Notes: Reference sector is Production.

Table 4: Probit models for propensity score matching for 2017

	ST Employment			LT Employment			ST Sales			LT Sales		
	Coeff	Std. Err	Z	Coeff	Std. Err	Z	Coeff	Std. Err	Z	Coeff	Std. Err	Z
Employment	0.001	0.000	4.86	0.001	0.000	4.31	0.001	0.000	4.99	0.001	0.000	4.51
Empl.-squared	0.000	0.000	-3.87	0.000	0.000	-3.49	0.000	0.000	-3.97	0.000	0.000	-3.62
Sales per employee (log)	0.011	0.009	1.16	0.011	0.011	1.01	0.009	0.009	0.97	0.011	0.011	0.97
Firm age (log)	0.000	0.011	-0.02	0.000	0.017	0.02	-0.002	0.011	-0.19	-0.003	0.017	-0.17
Construction	-0.021	0.035	-0.6	-0.044	0.042	-1.07	-0.012	0.035	-0.34	-0.027	0.041	-0.67
Retail, Wholesale	-0.010	0.032	-0.33	-0.010	0.037	-0.29	0.006	0.032	0.18	0.020	0.036	0.54
Transport, Logistics	-0.020	0.050	-0.39	0.014	0.063	0.22	-0.013	0.050	-0.27	0.015	0.062	0.24
Hospitality	-0.018	0.041	-0.44	-0.168	0.053	-3.18	-0.004	0.041	-0.1	-0.128	0.052	-2.48
Business Services	-0.160	0.030	-5.25	-0.163	0.036	-4.51	-0.146	0.030	-4.84	-0.135	0.036	-3.78
Other services	-0.050	0.033	-1.51	-0.086	0.039	-2.21	-0.037	0.033	-1.13	-0.054	0.039	-1.39
Constant	-1.023	0.046	-22.09	-0.994	0.065	-15.29	-1.041	0.046	-22.67	-1.021	0.064	-15.98
Number of obs	32,522			21,869			33,131			22,656		
LR chi2(10)	84.18			67.17			81.89			61.42		
Prob > chi2	0			0			0			0		
Log likelihood	-12784			-8728.27			-12958.5			-8962.91		
Pseudo R2	0.0033			0.0038			0.0031			0.0034		

Notes: Reference sector is Production.

Table 5: Treatment effects

	ST Employment			LT Employment			ST Sales			LT Sales		
	Coeff	Std. Err	Z	Coeff	Std. Err	Z	Coeff	Std. Err	Z	Coeff	Std. Err	Z
A. Derry 2013												
Nearest neighbour	0.047	0.018	2.610	0.193	0.027	7.150	0.016	0.029	0.540	0.018	0.038	0.460
Caliper matching	0.046	0.021	2.180	0.203	0.031	6.650	0.011	0.035	0.330	0.032	0.045	0.710
B. Hull 2017												
Nearest neighbour	-0.012	0.012	-1.000	0.002	0.019	0.080	0.020	0.021	0.970	0.058	0.029	2.030
Caliper matching	-0.003	0.014	-0.190	0.008	0.022	0.380	0.017	0.023	0.720	0.047	0.033	1.440

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ANNEX TABLES

Table A1: Variable definitions and sources

Variable label	Definition	Source
Employment growth	Mean annual employment growth of firms in each area	BSD
Sales growth	Mean annual sales growth of firms in each area	BSD
Firm size (employ)	Employment in each firm in 2013 or 2017	BSD
Sales per emp. (log)	Log of sales per employee (£000) in each firm in 2013 or 2017	BSD
Vintage (log)	Log age of each firm at date of CoC	BSD

Table A2: Balancing tests: long term employment in Derry 2013

		Mean	Mean		% reduction bias	t-test	
		Treated	Control	%bias		t-value	rho
Employment	Unmatched	11.113	13.865	-0.6		-0.32	0.75
	Matched	21.164	18.778	0.5	13.3	0.2	0.84
Empl. squared	Unmatched	84696	3.00E+05	-0.4		-0.19	0.852
	Matched	1.90E+05	65157	0.2	42.3	0.6	0.545
Sales per emp (log)	Unmatched	-2.7295	-2.7391	0.9		0.54	0.59
	Matched	-2.7199	-2.748	2.6	-195.1	0.79	0.427
Firm age (log)	Unmatched	2.3331	2.1093	24.4		18.2	0
	Matched	2.8015	2.8086	-0.8	96.8	-0.36	0.721
Construction	Unmatched	0.21297	0.11372	27.1		29.3	0
	Matched	0.17302	0.16363	2.6	90.5	0.76	0.45
Retail, Wholesale	Unmatched	0.17502	0.15136	6.4		6.23	0
	Matched	0.21614	0.21633	0	99.2	-0.01	0.989
Transport, Logistics	Unmatched	0.03314	0.05531	-10.8		-9.2	0
	Matched	0.02432	0.02635	-1	90.9	-0.39	0.698
Hospitality	Unmatched	0.08182	0.08302	-0.4		-0.41	0.682
	Matched	0.07794	0.0667	4.1	-838.7	1.31	0.192
Business Services	Unmatched	0.20444	0.36928	-37.1		-32.38	0
	Matched	0.17247	0.1756	-0.7	98.1	-0.25	0.804
Other services	Unmatched	0.17742	0.14885	7.7		7.57	0
	Matched	0.20343	0.22222	-5.1	34.2	-1.38	0.167

Table A3: Balancing tests: long term sales in Derry 2013

		Mean	Mean		% reduction bias	t-test	
Variable	Matched	Treated	Control	%bias		t-value	rho
Employment	Unmatched	11.113	13.865	-0.6		-0.32	0.75
	Matched	19.089	20.42	-0.3	51.7	-0.13	0.897
Empl. squared	Unmatched	84696	3.00E+05	-0.4		-0.19	0.852
	Matched	1.70E+05	44296	0.2	41.8	0.73	0.468
Sales per emp (log)	Unmatched	-2.7391	0.9			0.54	0.59
	Matched	-2.6967	-0.1	91		-0.03	0.98
Firm age (log)	Unmatched	2.3331	2.1093	24.4		18.2	0
	Matched	2.7887	2.7929	-0.5	98.1	-0.22	0.829
Construction	Unmatched	0.21297	0.11372	27.1		29.3	0
	Matched	0.17624	0.1731	0.9	96.8	0.26	0.793
Retail, Wholesale	Unmatched	0.17502	0.15136	6.4		6.23	0
	Matched	0.21535	0.21155	1	84	0.29	0.769
Transport, Logistics	Unmatched	0.03314	0.05531	-10.8		-9.2	0
	Matched	0.02574	0.02624	-0.2	97.8	-0.1	0.921
Hospitality	Unmatched	0.08182	0.08302	-0.4		-0.41	0.682
	Matched	0.07822	0.07574	0.9	-106.7	0.3	0.768
Business Services	Unmatched	0.20444	0.36928	-37.1		-32.38	0
	Matched	0.16733	0.16881	-0.3	99.1	-0.13	0.9
Other services	Unmatched	0.17742	0.14885	7.7		7.57	0
	Matched	0.17822	0.18861	-2.8	63.6	-0.85	0.393

Table A4: Balancing tests: long term employment in Hull 2017

		Mean	Mean		% reduction bias	t-test	
Variable		Treated	Control	%bias		t-value	rho
Employment	Unmatched	12.8	12.121	0.3		0.2	0.84
	Matched	25.206	30.167	-2.3	-630.6	-0.82	0.412
Empl. squared	Unmatched	14671	82325	-1.1		-0.64	0.52
	Matched	35865	75916	-0.6	40.8	-1.11	0.267
Sales per emp (log)	Unmatched	-2.7408	1.6			1.28	0.201
	Matched	-2.6376	-2.7	-65.1		-1.02	0.307
Firm age (log)	Unmatched	2.3059	2.3315	-3.2		-3.54	0
	Matched	2.7306	2.7296	0.1	96.2	0.06	0.953
Construction	Unmatched	0.12796	0.11182	5		6.45	0
	Matched	0.12757	0.12525	0.7	85.6	0.27	0.786
Retail, Wholesale	Unmatched	0.16124	0.17774	-4.4		-5.52	0
	Matched	0.22193	0.22148	0.1	97.3	0.04	0.967
Transport, Logistics	Unmatched	0.05106	0.0492	0.9		1.09	0.275
	Matched	0.03787	0.0371	0.4	58.3	0.16	0.874
Hospitality	Unmatched	0.12662	0.09742	9.3		12.3	0
	Matched	0.05515	0.05526	0	99.6	-0.02	0.985
Business Services	Unmatched	0.24585	0.30749	-13.8		-17.14	0
	Matched	0.2392	0.23721	0.4	96.8	0.18	0.856
Other services	Unmatched	0.19851	0.15362	11.8		15.58	0
	Matched	0.1691	0.17165	-0.7	94.3	-0.26	0.793

Table A5: Balancing tests: long term sales in Hull 2017

		Mean	Mean		% reduction bias	t-test	
Variable		Treated	Control	%bias		t-value	rho
Employment	Unmatched	12.8	12.121	0.3		0.2	0.84
	Matched	24.724	26.016	-0.6	-90.4	-0.24	0.809
Empl. squared	Unmatched	14671	82325	-1.1		-0.64	0.52
	Matched	35130	54329	-0.3	71.6	-0.6	0.548
Sales per emp (log)	Unmatched	-2.7408	1.6			1.28	0.201
	Matched	-2.6308	-2.7	-68.6		-1.05	0.294
Firm age (log)	Unmatched	2.3059	2.3315	-3.2		-3.54	0
	Matched	2.7229	2.71	1.6	49.5	0.79	0.429
Construction	Unmatched	0.12796	0.11182	5		6.45	0
	Matched	0.12691	0.1242	0.8	83.2	0.32	0.748
Retail, Wholesale	Unmatched	0.16124	0.17774	-4.4		-5.52	0
	Matched	0.22681	0.23538	-2.3	48.1	-0.8	0.426
Transport, Logistics	Unmatched	0.05106	0.0492	0.9		1.09	0.275
	Matched	0.03807	0.03525	1.3	-51.6	0.59	0.556
Hospitality	Unmatched	0.12662	0.09742	9.3		12.3	0
	Matched	0.0563	0.05651	-0.1	99.3	-0.04	0.971
Business Services	Unmatched	0.24585	0.30749	-13.8		-17.14	0
	Matched	0.23755	0.23603	0.3	97.5	0.14	0.889
Other services	Unmatched	0.19851	0.15362	11.8		15.58	0
	Matched	0.16661	0.1665	0.0	99.8	0.01	0.991

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