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All in the mix? Top team demographics and business performance in UK firms, 2008-9

Max Nathan

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All in the mix? Top team demographics and business performance in UK firms, 2008-9

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List of Contents

Abstract 3
1. Introduction 4
2. Framework and evidence base 6
2.1 Evidence base 7
3. Data 8
3.1 Key variables 9
4. Identification strategy 10
4.1 Estimation 12
4.2 Descriptives 13
5. Main results 16
5.1 Innovation results 16
5.2 Turnover results 19
5.3 Diversity and sameness 21
6. Robustness checks 23
7. Extending the analysis: exports 26
8. Discussion 28
References 30

List of Tables

Table 1. Summary statistics 14
Table 2. Correlation matrix of main variables 15
Table 3. Product innovation 17
Table 4. Process innovation 18
Table 5. Marginal effects for innovation models 19
Table 6. Turnover model. OLS results 20
Table 7. Product and process innovation. Testing diversity and sameness 22
Table 8. Turnover. Testing diversity and sameness 23
Table 9. Sales results, shares and quadratics 27
Table 10. Sales results, diversity and sameness dummies 28

Abstract

High levels of migration to the UK have contributed to growing cultural diversity. Researchers are now exploring the effects of this diversity on firms' productivity. This paper focuses on the owners, partners and directors who set firms' strategic direction. Top team demography might generate production externalities through diversity (a wider range of ideas/ experiences, helping problem solving) and/or 'sameness' (via specialist knowledge or better access to international markets). These channels may be balanced by internal downsides (lower trust) and external barriers (discrimination), so that overall effects on performance are unclear. I create a repeat cross-section of over 6,200 firms from the RDA National Business Survey. I construct measures of diversity and sameness across ethnicity and gender 'bases', alongside information on revenues, exports, product and process innovation. I regress these measures of business performance on top team demographics, plus controls, area, year and industry fixed effects. My results suggest a small but robust inverse-U relationship between the share of minority ethnic top team members and business performance measures - especially process innovation, turnover and exports. For female top team membership, the inverse-U also holds for product innovation and turnover. Further tests on diverse and minority/female-headed firms find positive links for diverse top teams, negative for minority- and female-only top teams. This implies that while diversity has benefits, any kind of homogenous top teams carries performance penalties. For all-minority and all-female groups, these probably result from external constraints such as discrimination, and limits to market access.

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1. Introduction

Like many other countries covered in this volume, the UK has become substantially more ethnically and culturally diverse in recent decades, with net migration a main driver. Between 2001 and 2011, for example, the foreign-born population of England and Wales rose from 4.6 to 7.5m (from 9 to 13% of the population). At the same time, the share of 'white' and 'white British' ethnic groups decreased, from 91.3% to 86%, and from 87.5 % to 80% respectively. Notably, the biggest-growing ethnic group was 'other white', with Polish-born the fastest-growing migrant group (Office of National Statistics, 2012b; Office of National Statistics, 2012a). These demographic changes have been most striking in urban areas: notably, London is now a 'majority minority' city for the first time in its history.

Given the long term nature of these shifts, researchers and policymakers are turning their attention to the dynamic effects of immigrant communities on host country economies – both via the cultural diversity that migration brings, and through a range of production and consumption-side channels at firm and city level (see Kerr and Kerr, 2011; Nathan, 2012; and Ottaviano and Peri, 2013, for recent reviews). This is not the only 'diversity' at stake: gender equality is a major issue for businesses and government (McKinsey, 2007). In the UK, particular public attention is paid to the presence and impact of women in senior positions, and to encouraging female entrepreneurship (Davies Review, 2011).

Owners, partners and directors of firms – the 'top team' – help set the strategic direction of the businesses they run, and play an important role in their success or failure (Certo *et al*, 2006). This chapter asks: what are the links between the demographic composition of senior staff in firms, and measures of business performance? What roles might ethnic and gender diversity have? Are minority- and female-headed firms at an advantage, or held back?

In theory, there are two ways in which 'top team' demography might affect business performance. One argument highlights externalities from diversity: specifically, a range of skills, knowledge, backgrounds and experiences may help teams to generate new ideas and to problem-solve (Page, 2007; Berliant and Fujita, 2012). Both gender and ethnic diversity could produce this advantageous mix. The other perspective emphasises gains from 'sameness' – for example, externalities from social networks or deeper specialist knowledge,

both of which may aid knowledge diffusion and market reach (Docquier and Rapoport, 2012). Both channels may have ambiguous effects – diverse teams may exhibit lower trust, social networks may be constrained, and (say) female-headed firms may experience discrimination. Thus the diversity-performance relationship may be non-linear, with an optimal level of mix after which disadvantages outweigh advantages (Ashraf and Galor, 2011). Note also that diversity and sameness channels are not mutually exclusive. Existing empirical evidence suggests small net positive effects for ethnicity and gender on various business performance measures, but there remain large knowledge gaps (Certo *et al*, 2006; Adams *et al*, 2010; Nathan, 2012).

I use rich microdata from the Regional Development Agencies' National Business Survey to shed light on these issues. I build a repeat cross-sectional dataset for over 6,000 firms in England and Wales, sampled in 2008-9, and test for links between top team composition (diversity or sameness) on firms' innovation, revenue and exports. My results suggest a generally inverse U-shaped link between the share of minority ethnic / female top team members and business performance. That is, as senior teams become more balanced in terms of ethnicity and gender, firm performance rises; more homogenous teams are linked to lower performance. Specifically, I find more ethnically diverse top teams are more likely to deliver process innovations; have higher turnover; and export more. I find similar results for gender-diverse top teams, product innovation and turnover. Note that the turning point in the inverse-U also implies that firms with all-minority and all-female top teams may suffer lower performance. I confirm this with further tests distinguishing diverse and minority/female-headed firms, here finding generally positive diversity-performance links but zero or negative links for minority and female-headed businesses. I speculate that while top team diversity has benefits, all-minority and all-female headed firms may be constrained by discrimination and/or limits to market access. Although these associations are robust to several checks, they should not be taken as causal effects.

The paper makes a number of contributions to this rapidly-growing field. I am able to combine different aspects of diversity and sameness, and to explore links to multiple business outcomes. While a 'top team' focus is common in the management literature, this chapter is unusual in bringing rigorous econometric analysis to a large sample. In a UK policy context, it also provides a useful extension to recent research on diversity and innovation in London (Nathan and Lee, forthcoming).

2. Framework and evidence base

'Diversity' is hard to define in a form suitable for quantitative analysis. In this context, diversity refers to the mix of identity groups in a firm, or more precisely in the top team of owners/partners/directors. Gender diversity is defined in terms of female presence in the top team. Ethnic diversity is defined in terms of Black and Minority Ethnic (BME) group presence; in this I follow UK Office of National Statistics ethnic group definitions, which operate at a fairly high level of generality.

There are two main perspectives on how top team demographics may affect business performance. The first view emphasises the importance of diversity. Diverse firms and teams may benefit from a wider range of ideas, perspectives and backgrounds, which ought to improve problem-solving and ideas generation – thus raising levels of innovation (Page, 2007, Berliant and Fujita, 2012). Diversity may also help firms to handle complex external business environments, and thus improve international market access (Williams and O'Reilly, 1998). In both cases, demographic structure should feed through into higher revenues. These effects may be particularly important in 'knowledge-intensive' settings (Fujita and Weber, 2003). Conversely, trust and bonding social capital may be lower in diverse firms than for homogenous groups (Alesina and Ferrara, 2005). And externally, such firms may face discrimination from customers or suppliers. Both of these forces will have a negative influence on innovation and revenues.

The second view focuses on dimensions of 'sameness'. In part, negative affordances of diversity are simply positive affordances of similarity. However, theory also suggests further externalities that benefit firms. For example, co-ethnic networks may reduce transactions costs and aid knowledge diffusion (Agrawal *et al*, 2008; Docquier and Rapoport, 2012). Identity group membership may aid market access either geographically, through diasporic communities, or in terms of product space – for example, female-headed firms probably have better market knowledge of products and services aimed at women and families (Javorcik *et al*, 2011; Foley and Kerr, 2011). These channels should aid innovation and revenue growth respectively, and may be particularly important under globalisation (Saxenian, 2006; Yeung, 2009). However, a lack of internal diversity may shut off sources of innovation stemming

from unfamiliar perspectives or knowledge (Boschma, 2005). Externally, minority-ethnic or female-headed businesses may experience discrimination, or be limited in the set of markets they can sell into – for example, a given diasporic community may have limited reach (Zenou, 2011; Patacchini and Zenou, 2012). These downsides can limit innovation, and constrain revenues and exports.

Overall, this framework suggests that both diversity and sameness have pros and cons, so *a priori* effects on firms are ambiguous; both operate through distinct channels, so could be complements or substitutes. The shape of the relationship to performance is also unclear: it is possible that (say) cons of diversity outweigh pros after a certain point, so that an 'optimal' level of ethnic/gender diversity exists (Ashraf and Galor, 2013). It is also important to consider how these channels may operate in different parts of the firm. The demographics of senior management and the wider workforce may have different effects on measures of business performance. In theory, 'top team' composition is likely to be highly important: senior managers set the overall direction of the business, take strategic decisions and tend to have the most experience and human capital. Beginning with a seminal paper by Hambrick and Mason (1984), a number of studies in the management literature have developed models of firms' 'upper echelons' or 'top management team' (TMT), where the size, structure and composition of owners, partners and senior management have important direct and indirect effects on business performance (see Certo *et al*, 2006, and Carpenter *et al*, 2004, for recent reviews; and Adams *et al*, 2010, for a related and relevant discussion on corporate boards).

2.1 Evidence base

The existing literature on these issues falls into three broad categories. First, economists are increasingly trying to analyse links between workforce diversity and business outcomes – for example, Ozgen *et al* (2011) and Ozgen and De Graaf (2013) for Dutch firms, Parotta *et al* (2011) for Danish firms, Maré *et al* (2011, 2013) for firms in New Zealand, Trax *et al* (2012) for German firms, and Nathan and Lee (forthcoming) for London companies. These studies typically find small, positive effects of labour diversity in firms (measured either by migrants or ethnic groups), and firms' innovation and/or productivity.

Second, a larger number of studies look at links between team/firm demographics, diasporic groups and market orientation. A large body of quantitative work suggests positive links

between skilled diasporic communities, FDI and trade flows in both sending and receiving countries (see Docquier and Rapoport (2012) for a review), results also echoed in qualitative and mixed methods research. For instance, Saxenian (2006) and Saxenian and Sabel (2008) provide detailed evidence on the roles of migrant diasporas in Silicon Valley, which have strong links to production clusters in India, Taiwan and (increasingly) China. Similarly, Kapur and McHale (2005), Dahlman (2010) and Wadhwa *et al* (2012) detail the roles of diasporas in the development of ICT clusters in Ireland, Israel, South East Asia and the BRICS countries.

Third, the strategic management literature has a long tradition of empirical TMT research. Carpenter *et al* (2004) and Certo *et al* (2006) provide useful reviews of the TMT literature and conduct meta-analyses. Both find that while there are typically modest effects of top team demographic factors on business performance, there are substantial intervening elements both at firm level and in the wider industry / spatial environment.

Some important gaps remain in this literature. Outside the management literature, notably few studies examine multiple diversity bases (although Ostergaard *et al*, 2011, and Brunow and Stockinger, forthcoming, are two exceptions). Within the management literature, while gender-based analyses are common, explorations of ethnic diversity are much rarer (Jackson *et al*, 2003). Dahlin *et al* (2005) find that national diversity in teams has a U-shaped relationship with information sharing and use; Asiedu *et al* (2012) look at US SMEs and access to finance, finding significant differences in loan approvals and interest rates between firms owned by white males and those owned by minority or white females.

3. Data

My main data source is the Regional Development Agencies' National Business Survey (hence NBS), which was conducted in two waves every year from 2003 through to 2009 (the Agencies were formally abolished in 2011). Each wave covered around 5,000 firms across the nine English regions and Wales.[1] Data has been weighted by employee numbers and region, to reflect national patterns (Ipsos MORI, 2009). The NBS included questions about

[1] The full list of regions is the North East, North West, Yorkshire and Humber, West Midlands, East Midlands, East of England, South East, London and the South West.

owner/partner ethnicity and gender in the 2008 and 2009 Autumn waves, and these form the basis of my sample. This is a repeat cross-section comprising 6,235 observations.[2] Each represents a single firm coded to one of 62 two-digit industry categories, geocoded to one of 107 NUTS3 areas and observed in a single year.[3]

The NBS has many strengths. The UK has surprisingly few rich sources of firm-level data, and the NBS is a single source that asks detailed questions about business performance and constraints, as well as top team and firm characteristics. Importantly, the data allows me to separately identify diversity and sameness information along multiple dimensions, alongside multiple measures of business performance. The NBS also includes industry codes at up to four-digit level and detailed spatial identifiers for NUTS1-3 areas, enabling me to fit detailed fixed effects alongside firm-level controls.[4] However, there are also limitations to the data. Information on ethnicity is only available for a couple of years, and there is no panel structure to the data, so a repeat cross-section is the only feasible setup. Some questions vary from wave to wave, so that constructing time-consistent variables is challenging. Importantly, the NBS does not ask directly about individual or workforce human capital. To deal with this, I use a combination of related controls and detailed small-area level human capital and occupational structure information from the Annual Population Survey (APS), which contains a boosted local sample which allows for reliable sub-regional estimates.[5]

3.1 Key variables

My main variables of interest are measures of top team diversity and sameness. The NBS provides information on the ethnic and gender composition of firms' owners, partners and directors. I use these, first, to make continuous variables measuring a) the share of minority

[2] I restrict the analysis to firms for which there is information on innovative activity, turnover, industry and area.
[3] I explore various cell configurations, covering SIC1-4 industry codes and NUTS1-3 area codes. My aim is to get the richest area and industry fixed effects without inducing measurement error through small cell sizes. In diagnostic checks I a) drop cells with NUTS2 and SIC3 frequencies under 10, and b) use SIC1, NUTS2 and NUTS1 fixed effects with very little change to the main results.
[4] As such it is substantially more informative than other business-level datasets such as the ARD, and more comprehensive in its issue coverage than survey-based data such as the Community Innovation Survey or the Workplace Employer Response Survey.
[5] The Annual Population Survey (APS) combines results from the English Labour Force Survey (LFS) and the English, Welsh and Scottish LFS boosts, and asks 155,000 households and 360,000 people per dataset about their own circumstances and experiences regarding a range of subjects including housing, employment and education. The APS' increased sample size provides substantially greater precision than the LFS when working at sub-regional level, as the analysis in this paper requires.

ethnic owner/partners in the firm, and the b) share of female owners/partners. Note that as these shares rise from zero to 0.5, top teams become *more* diverse; after 0.5 firms become *less* diverse, as the share of minority ethnic /female top team members rises towards one. I construct c) quadratic terms to explore the potentially non-linear relationships between diversity, sameness and performance.

I also make a series of dummy variables for both ethnicity and gender, distinguishing firms with all majority ethnic (white British) owners/partners, and all-male owners/partners ('homogenous firms'), a mix ('diverse firms') and all minority ethnic / female owners/partners ('minority ethnic-headed' / 'female-headed' firms). This allows me to look more precisely at affordances of diversity and sameness, across both bases.

My dependent variables are innovative activity, turnover and exports, which are also well covered in the NBS. For innovative activity, I fit dummies taking the value 1 if the firm has, in the past 12 months, introduced 1) a new product innovation or 2) a new process innovation. These definitions are deliberately broad, as survey-based analyses need to capture very different innovation conditions across manufacturing and service sector firms. [6] Annual turnover information is provided in bands – f or the full regressions I fit a time-consistent four-band turnover variable (<£100k, £100-999k, £1-5m, >£5m); in robustness checks on the 2008 cross-section I use richer seven-band information. Exports are simply measured by the share of sales outside the UK, which are given in seven bands (0%, 1-10%, 11-25%, 26-50%, 51-75%, 76-99%, 100%).

4. Identification strategy

My identification strategy is based on linking variations in ethnic and gender team composition to variations in firms' turnover and innovative activity, while controlling for other firm, industry, area and time characteristics. I am particularly interested in 1) whether an increase in senior management diversity is linked to an improvement in business performance; 2) whether diversity and sameness are substitutes or complements, and the relative size and direction of their effects, and 3) which dimensions of diversity (sameness) matter, that is, the relative roles of ethnicity and gender as 'bases'.

[6] An inherent limit of this approach is that it risks capturing some trivial innovations, particularly in the process innovation category. Surveys may also risk a response bias towards innovating firms (Smith, 2005).

Identifying *causal effects* of diversity / sameness on business performance presents a number of widely recognised challenges. A first issue is to try and isolate team/group-level effects from individual characteristics, other firm-level characteristics and wider contextual factors deriving from industry, time trends, local area conditions or policy shocks (Certo *et al*, 2006; Carpenter *et al*, 2004). Each of these presents potential intervening factors which may affect both group demographics and business performance; for example, a technology shock might lower entry barriers in a given industry, enabling innovation and influencing top team composition as new firms form. Omitting these variables in regressions may lead to imprecision or worse, spurious correlations. A second, related issue is the chance of simultaneity or causation at area level; innovative and/or successful firms may select into the largest markets, which *ceteris paribus* will tend to have larger and more diverse populations (Duranton and Puga, 2001; Card, 2010). Not controlling for this means that coefficients of top team composition are likely to be biased upwards.

I am able to deal with these two challenges using a combination of careful controls at firm level, as well as detailed industry, time and area fixed effects that handle specific shocks and time-invariant area characteristics. Since demographic trends may be simultaneously area- and time-varying, I also fit area-level controls for historic minority ethnic population shares. I further exploit my choice of sample years: the UK was in recession in 2008-9 and the pull of successful areas will have been dampened during this time.

A third issue is both-ways causation within the firm. If businesses observe a positive (negative) effect of top team composition on business performance, they may adjust team composition to maximise (minimise) any positive (negative) consequences for the firm (Ozgen *et al*, 2011; Parrotta *et al*, 2011; Nathan and Lee, forthcoming). Finally, unobservable firm-level factors are likely to influence both top team composition and firm performance (Adams *et al*, 2010).

The ideal setting would then allow for panel data with worker-firm fixed effects, plus a natural experiment that acted as an exogenous shifter of top team composition. Neither is available to me, so I interpret results as associations rather than causal effects.[7]

4.1 Estimation

For the innovation and turnover analysis, I fit the data to a production-function type model, where for firm *i*, industry *j*, area *a* and year *t* I estimate:

$$Y_{ijat} = a + \mathbf{ETEAM}\boldsymbol{b}_{\mathbf{ijat}} + \mathbf{FTEAM}\boldsymbol{c}_{\mathbf{ijat}} + \mathbf{CONTROLS}\boldsymbol{d}_{\mathbf{ijat}} + J_j + A_a + T_t + e \qquad (1)$$

Here Y is variously a dummy for product or process innovation, or the firm's turnover. Both models relate measures of business performance to top team demographics (ETEAM, FTEAM), a vector of firm-level controls (CONTROLS) and fixed effects.

ETEAM covers top team characteristics by ethnicity. In the main results it is the share of minority ethnic owners/partners and its quadratic, which is my measure of diversity. Coefficients of ETEAM reflect the joint 'effect' of changes in ethnic composition on Y; I am particularly interested in whether increases in diversity have a linear relationship with business performance, or whether an 'optimal' level of diversity exists. In extensions to the main analysis ETEAM includes dummies for minority ethnic-diverse and minority ethnic-headed firms. This specification enables me to explore the relationship between diversity and sameness: coefficients are 'effects' relative to being in a homogenous firm, the reference category. FTEAM is organised along the same lines for gender composition.

Controls are chosen to on the basis of the wider literature on business innovation and performance. Both firm age and firm size will influence the performance of the company: for instance, large or established firms often generate large amounts of patent activity, but small and/or new firms may introduce disruptive innovations (Griffith *et al*, 2006). Young, small firms also account for substantial shares of national output and employment growth (through rapid scaling) (Haltiwanger *et al*, 2010; Biosca *et al*, 2011; Lee, 2012). In turn, age and size

[7] I experiment various instruments to try and deal with the selection issue, but none pass first-stage tests. Further research could make use of finite mixture settings to proxy for firm-level unobservables.

may shape the composition of the firm's senior team. I therefore fit controls for the number of owners/partners, the age of the firm and the number of its employees.

Company type is likely to influence both top team demographics and corporate performance; for example, subsidiaries and joint ventures of foreign-owned firms are more likely to benefit from knowledge spillovers and technology transfer (Aitken and Harrison, 1999; Javorcik, 2004; Harrison and Rodríguez-Clare, 2009). The NBS provides detailed information on company type, so I fit dummies for UK subsidiaries, foreign subsidiaries, ultimate holding companies, independents and LLPs (unknown status being the reference category). The NBS asks if firms have attempted to improve their skills base through internal or external training; I use this as a proxy human capital control. Urban location helps firms to innovate, via local knowledge spillovers (Jaffe *et al*, 1993; Audretsch and Feldman, 1996; Duranton and Puga, 2001); urban areas also tend to have more diverse populations, which may influence top team characteristics. To control for this I fit NUTS3 population density lagged to 2001.[8]

Finally I fit two controls for precision; namely dummies which take the value 1 if the firm has a codified growth plan, and if it is operating at capacity. Both should be positively correlated with innovation and with levels of revenue. Finally, J, A and T represent two-digit industry, NUTS3 and year fixed effects respectively.

4.2 Descriptives

Tables 1 and 2 provide some brief descriptive analysis. Table 1 gives summary statistics. The first panel covers my dependent variables: under a quarter of firms have introduced a product innovation, just under 10 percent a process innovation. Turnover is banded in four broad categories, and suggests the average firm has a turnover of between £100-999k (more detailed information available for 2008 suggests the average firm has turnover between £100-499k). The average firm makes relatively few sales outside the UK: 70% of firms in the sample do no exporting at all, although 16.4% make over 10% of their sales abroad.

[8] In robustness checks I also fit population density lagged to 1991, with little difference to the main results. I also experiment with simpler urban/rural and metro hierarchies, but these provide substantially less precision than population density measures.

Table 1. Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
New product innovation in last 12 months	6235	0.239	0.426	0	1
New process innovation in last 12 months	6235	0.088	0.284	0	1
Turnover at site in 4 bands	6235	2.039	0.832	1	4
Share of foreign sales in 7 bands	6235	0.703	1.427	0	6
% minority ethnic owners/partners/directors	6235	0.030	0.159	0	1
Minority ethnic-diverse firm	6235	0.018	0.132	0	1
Minority ethnic-headed firm	6235	0.023	0.149	0	1
% female owners/partners/directors	6235	0.259	0.332	0	1
Minority female-diverse firm	6235	0.346	0.476	0	1
Minority female-headed firm	6235	0.099	0.298	0	1
Number of owners/partners/directors	6227	2.1	3.6	1	100
No. of employees who receive a salary (excl. owners)	6235	25.9	374.9	0	20000
Years firm in operation (banded 1-4)	6226	3.478	0.807	1	4
Firm is subsidiary of uk parent	6235	0.028	0.166	0	1
Firm is subsidiary of foreign parent	6235	0.015	0.123	0	1
Firm is ultimate holding company	6235	0.042	0.200	0	1
Firm is independent	6235	0.688	0.463	0	1
Firm is LLP	6235	0.077	0.267	0	1
Business provided some training in past 12 months	6235	0.281	0.450	0	1
Growth plan dummy	6051	0.333	0.471	0	1
Business is operating below capacity	6235	0.684	0.465	0	1
Share of foreign inputs in 7 bands	6235	4.044	2.592	0	6
Firm expects to do R&D investment in next 12 months	2894	0.621	0.485	0	1
Business uses U-I links for R&D	1734	0.196	0.397	0	1
Business uses specialist networks for info	2169	0.416	0.493	0	1

Source: RDA NBS.
Note: ownership truncated to 100 owners / firm.

The second panel covers the main independent variables: the average share of minority ethnic owners/partners is around three percent; with 2.3 percent of firms being minority-ethnic headed. Female owner/partnership is much more common, the average firm having nearly 26 percent female owners/partners; female-headed firms comprise just under 10% of the sample. The third and fourth panels cover control variables. Controls in the fourth panel are used for robustness checks, as some are only available for 2008.

Table 2. Correlation matrix of main variables

	prodin	procin	turnover	Ethownsh	eth~h_sq	eth_div	eth_head	f..ownsh	f…sh_sq	fem_div	f.._head
New product innovation in last 12 months	1										
New process innovation in last 12 months	-0.1744	1									
Turnover at site in 4 bands	0.1251	0.0729	1								
% ethnic owners/partners/ directors	0.0066	0.0142	-0.0278	1							
(% ethnic owners/partners/ directors)^2	0.0042	0.0097	-0.0364	0.9828	1						
Minority ethnic-diverse firm	0.0135	0.0227	0.0464	0.318	0.1429	1					
Minority ethnic-headed firm	0.0002	0.0055	-0.0421	0.9331	0.9822	-0.0205	1				
% female owners/partners/ directors	0.0042	0.0179	-0.1663	0.0164	0.0152	0.0131	0.0144	1			
(% female owners/partners/ directors)^2	-0.0051	0.0167	-0.1955	0.0133	0.0167	-0.0125	0.0197	0.9398	1		
Female-diverse firm	0.0294	0.0136	0.0467	0.0118	-0.0012	0.0793	-0.0115	0.4505	0.1224	1	
Female-headed firm	-0.0099	0.0107	-0.187	0.0071	0.015	-0.0402	0.0216	0.7391	0.9185	-0.2405	1

Source: RDA NBS.
Note: Obs = 6235. Correlation matrices for main variables and full controls are available on request.

Table 2 shows a correlation matrix for the main dependent, independent and control variables. Pairwise correlations are generally low, suggesting few collinearity issues.[9]

[9] Matrices for the full set of variables also suggest no collinearity. Results available on request.

5. Main results

Results for the main regression analysis are given in Tables 3-5 (innovation models) and 6 (turnover / revenue model). In each table column 1 fits a simple share of minority ethnic owners / partners; column 2 adds controls; column 3 fits the share and its quadratic; column 4 adds controls to this; column 5 adds the share of female owners and its quadratic. Squared variables and their root terms are centered. Innovation models are estimated in logit form, and point estimates are shown as raw coefficients; for these models Table 5 presents marginal effects. Turnover models are estimated as fixed effects OLS models.

5.1 Innovation results

Product innovation results are given in Table 3. The simplest specifications (columns 1 and 2) show no linear link between the share of minority ethnic top team members and the probability of innovation. Including the share of minority ethnic owners/partners and its quadratic shows a small positive coefficient on the share, and a slightly smaller negative coefficient on the squared term. This is suggestive of a non-linear relationship where the joint effect is a small net positive – echoing the discussion in Section 2 – although neither is statistically significant. However, adding controls reduces coefficient size and – surprisingly – reverses their signs. The most fully specified model (column 5) fits shares and quadratics of both ETEAM and FTEAM. Coefficients of FTEAM are positive on the share (0.276, significant at 5%) and negative on the quadratic (-0.571, significant at 10%). this suggests an inverse-U relationship between top team composition and product innovation: there are positive affordances of diversity, and negative affordances of non-diversity, whether this is all-male or all-female.

Table 3. Product innovation

	(1)	(2)	(3)	(4)	(5)
% minority ethnic	0.103	0.053	0.508	-0.379	-0.528
owners/partners/directors	(0.189)	(0.221)	(0.654)	(0.714)	(0.699)
(% minority ethnic O/P/D)^2			-0.465	0.494	0.658
% female					0.276**
owners/partners/directors					(0.108)
(% female O/P/D)^2					-0.571*
					(0.337)
Number of owners		0.009		0.009	0.008
		(0.007)		(0.007)	(0.007)
Number of salaried employees		0.000		0.000	0.000
(excl. owners)		(0.000)		(0.000)	(0.000)
Years business in operation		-0.061		-0.061	-0.064
		(0.049)		(0.049)	(0.048)
Subsidiary of UK parent		0.427**		0.430**	0.452**
		(0.188)		(0.187)	(0.185)
Subsidiary of foreign parent		0.549**		0.547**	0.591**
		(0.262)		(0.262)	(0.264)
Ultimate holding company		0.313**		0.313**	0.321**
		(0.159)		(0.159)	(0.161)
Independent firm		0.122*		0.122*	0.128*
		(0.068)		(0.068)	(0.070)
LLP firm		0.204		0.206	0.206
		(0.142)		(0.143)	(0.143)
Provided some training		0.238***		0.237***	0.235***
in past 12 months		(0.059)		(0.059)	(0.059)
Has a growth plan		0.809***		0.810***	0.808***
		(0.094)		(0.095)	(0.097)
Is operating below capacity		0.111		0.110	0.112
		(0.072)		(0.072)	(0.072)
NUTS3 population density 2001		0.000		0.000	0.000
		(0.000)		(0.000)	(0.000)
Observations	6203	5996	6203	5996	5996
Log-likelihood	-3144.216	-2936.078	-3144.125	-2935.989	-2933.979

Source. RDA NBS. All models use year, SIC2 and NUTS3 dummies. Raw coefficients. Squared variables and their root terms are centered. HAC standard errors clustered on SIC2. Constant not shown. * = significant at 10%, ** = 5%, *** = 1%.

Table 4 switches attention to process innovation. As before, fitting the share of minority ethnic owners/partners shows no effect (columns 1 and 2), while fitting the share and its quadratic generates a robust and marginally significant relationship, where the joint effect is a small net positive (column 3). Interestingly, while the coefficients shrink as controls are added back in, ETEAM remains significant at 10%. Specifically, in the most fully specified model (column 5) the coefficient of the share of minority ethnic owners/partners is 1.944,

significant at 10%, while the point estimate on the quadratic is -1.815. This suggests a positive diversity-innovation link, until a turning point is reached around a 0.54 minority top team share; after this a rising share of minority ethnic top team members is linked to lower prospects of innovative activity. As with the FTEAM result, the positive link (diversity) is statistically stronger than the negative (sameness).

Table 4. Process innovation

	(1)	(2)	(3)	(4)	(5)
owners/partners/directors	(0.200)	(0.210)	(0.977)	(1.047)	(1.046)
(% minority ethnic O/P/D)^2			-1.656	-1.762	-1.815
			(1.115)	(1.200)	(1.199)
% female					0.111
owners/partners/directors					(0.197)
(% female O/P/D)^2					0.322
					(0.314)
Number of owners		0.008		0.007	0.007
		(0.005)		(0.006)	(0.005)
Number of salaried employees		0.000		0.000	0.000
(excl. owners)		(0.000)		(0.000)	(0.000)
Years business in operation		-0.034		-0.036	-0.023
		(0.070)		(0.070)	(0.073)
Subsidiary of uk parent		0.335		0.328	0.331
		(0.257)		(0.258)	(0.258)
Subsidiary of foreign parent		-0.033		-0.026	0.000
		(0.397)		(0.398)	(0.405)
Ultimate holding company		0.046		0.044	0.067
		(0.182)		(0.180)	(0.180)
Independent firm		0.126		0.124	0.128
		(0.135)		(0.134)	(0.134)
LLP firm		0.292		0.287	0.301
		(0.261)		(0.260)	(0.261)
Provided some training		0.394***		0.394***	0.394***
in past 12 months		(0.111)		(0.112)	(0.112)
Has a growth plan		0.825***		0.822***	0.826***
		(0.107)		(0.107)	(0.106)
Is operating below capacity		-0.083		-0.082	-0.074
		(0.083)		(0.083)	(0.082)
NUTS3 population density 2001		0.002		0.002	0.002
		(0.032)		(0.032)	(0.032)
Observations	6139	5942	6139	5942	5942
Log-likelihood	-1759.031	-1655.201	-1758.332	-1654.464	-1653.216

Source. RDA NBS. All models use year, SIC2 and NUTS3 dummies. Raw coefficients. Squared variables and their root terms are centered. HAC standard errors clustered on SIC2. Constant not shown. * = significant at 10%, ** = 5%, *** = 1%.

Table 5 gives marginal effects for the innovation models. As per the wider literature, marginal effects of diversity shifts are generally small. The left hand panel covers production innovation, and suggests that before the turning point, a 10 percentage point rise in the share of female top team members is linked to a 0.46% higher chance of product innovation. For

process innovation, a 10 percentage point rise in the minority ethnic top team membership is linked to a 1.24% higher chance of a process innovation

Table 5. Marginal effects for innovation models

	Product innovation			Process innovation		
	(1)	**(2)**	**(3)**	**(1)**	**(2)**	**(3)**
% minority ethnic owners/partners/directors	0.086 (0.111)	-0.063 (0.118)	-0.087 (0.115)	0.124* (0.067)	0.121* (0.068)	0.124* (0.064)
(% minority ethnic O/P/D)^2	-0.079 (0.112)	0.082 (0.124)	0.109 (0.122)	-0.115 (0.076)	-0.113 (0.077)	-0.116 (0.074)
% female owners/partners/directors			0.046** (0.018)			0.007 (0.012)
(% female O/P/D)^2			-0.094* (0.056)			0.021 (0.020)
Controls	N	Y	Y	N	Y	Y
Observations	6203	5996	5996	6139	5942	5942
Log-likelihood	-3144.125	-2935.989	-2933.979	-1758.332	-1654.464	-1653.216

Source. RDA NBS. All models use year, SIC2 and NUTS3 dummies. Squared variables and their root terms are centered. HAC standard errors clustered on 2-digit sector. Controls as in Tables 3 and 4. Constant not shown. * = significant at 10%, ** = 5%, *** = 1%.

5.2 Turnover results

Table 6 shows results for the turnover model. Unlike the innovation models, columns 1 and 2 find a small negative association between the share of minority ethnic owners / partners and turnover levels. Column 3 fits the share and its quadratic, and shows a large, strong positive linear link – but a slightly stronger negative link on the quadratic. Both coefficients are significant at 1%. Columns 4-5 add in controls. As expected, this shrinks the point estimates but the basic shape of the result survives.

Table 6. Turnover model. OLS results

	(1)	(2)	(3)	(4)	(5)
% minority ethnic owners/partners/directors	-0.110	0.016	0.925***	0.733**	0.628**
	(0.070)	(0.052)	(0.342)	(0.285)	(0.291)
(% minority ethnic O/P/D)^2			-1.186***	-0.819***	-0.707**
			(0.354)	(0.299)	(0.302)
% female owners/partners/directors					-0.049
					(0.047)
(% female O/P/D)^2					-0.561***
					(0.079)
Number of owners		0.012***		0.012***	0.011***
		(0.004)		(0.004)	(0.004)
Number of salaried employees (excl. owners)		0.000***		0.000***	0.000***
		(0.000)		(0.000)	(0.000)
Years business in operation		0.229***		0.228***	0.214***
		(0.017)		(0.017)	(0.017)
Subsidiary of uk parent		0.375***		0.372***	0.377***
		(0.089)		(0.087)	(0.088)
Subsidiary of foreign parent		0.818***		0.821***	0.807***
		(0.094)		(0.094)	(0.093)
Ultimate holding company		0.319***		0.319***	0.299***
		(0.063)		(0.062)	(0.063)
Independent firm		0.023		0.022	0.021
		(0.029)		(0.029)	(0.027)
LLP firm		0.171***		0.169***	0.156***
		(0.032)		(0.032)	(0.034)
Provided some training in past 12 months		0.483***		0.483***	0.483***
		(0.025)		(0.025)	(0.024)
Has a growth plan		0.301***		0.300***	0.296***
		(0.022)		(0.022)	(0.022)
Is operating below capacity		-0.051***		-0.051***	-0.059***
		(0.018)		(0.018)	(0.018)
NUTS3 population density 2001		0.000*		0.000*	0.000**
		(0.000)		(0.000)	(0.000)
Observations	6235	6034	6235	6034	6034
R^2	0.136	0.372	0.138	0.372	0.383

Source. RDA NBS. All models use year, SIC2 and NUTS3 dummies. Squared variables and roots centred. HAC standard errors clustered on SIC2. Constant not shown. * = significant at 10%, ** = 5%, *** = 1%.

In column 5, the coefficient of the share of minority ethnic owners / partners is 0.628, significant at 5%, while its square is -0.707, significant at 1%. Column 5 also adds FTEAM coefficients and finds a similar non-linear link. Point estimates are substantially smaller than ETEAM. As with the innovation results, the inverse-U relationship suggests the connection is *positive* as the diversity of the top team rises, so that a 10 percentage point rise in minority ethnic team members is linked to a 0.628-unit rise in turnover. This holds until a turning point is reached at a minority ethnic top team share of about 0.44. After this, the link turns negative as the share of minority ethnic (female) members rises, and top teams become *less* balanced. Note that this strong result also controls for the age and size of the firm, company type and some measures of firm capacity, as well as industry, area and time fixed effects.

5.3 Diversity and sameness: a second cut

The main results strongly suggest positive affordances of top team diversity on business performance, with drawbacks from lack of balance (and that gender and ethnic diversity play different roles). However, this leaves open the question of whether diversity and sameness act as complements or substitutes across the whole set of businesses. In order to explore this further, I run further regressions distinguishing between diverse firms (with a mixed top team) and those headed by minority ethnic or female bosses. This allows me to look at whether diversity and 'sameness' are substitutes or complements *across the set of firms as a whole* – and whether different identity bases play out differently when re-cut this way.

In these models I fit dummies for ethnic / gender 'diverse' and minority ethnic/female 'headed' firms, with coefficients interpreted as relative effects of being this type of firm against being a 'homogenous' firm, the reference category. Descriptive analysis in Section 5 shows that a majority of firms are homogenous, with a minority of diverse firms and a much smaller group of minority ethnic and female-headed businesses.

Table 7. Product and process innovation. Testing diversity and sameness

	Product innovation		Process innovation	
	RAW	**MFX**	**RAW**	**MFX**
Minority ethnic-diverse firm	-0.109 (0.175)	-0.017 (0.027)	0.387 (0.243)	0.029 (0.033)
Minority ethnic-headed firm	0.067 (0.215)	0.011 (0.037)	0.245 (0.252)	0.017 (0.019)
Gender-diverse firm	0.159*** (0.059)	0.027*** (0.010)	0.062 (0.094)	0.004 (0.008)
Female-headed firm	0.042 (0.118)	0.007 (0.020)	0.230 (0.210)	0.016 (0.024)
Controls	Y	Y	Y	Y
Observations	5996	5996	5942	5942
Log-likelihood	-2933.651	-2933.651	-1654.075	-1654.075

Source. RDA NBS. All models use year, SIC2 and NUTS3 dummies. HAC standard errors clustered on 2-digit sector. Controls as in Tables 3 and 4. Constant not shown. * = significant at 10%, ** = 5%, *** = 1%.

Table 7 gives results for product innovation (left-hand panel) and process innovation (right hand panel). For product innovation, ethnic diversity has a negative coefficient and ethnic-headed status a positive coefficient, reflecting the relationship found in the previous results; neither is significant. Gender diversity has a positive link significant at 1%; female-headed firm status is also positive, but much smaller and non-significant. For process innovation, all coefficients of interest are positive but non-significant.

Table 8. Turnover. Testing diversity and sameness

	(1)
Minority ethnic-diverse firm	0.143*
	(0.078)
Minority ethnic-headed firm	-0.034
	(0.052)
Gender-diverse firm	0.014
	(0.023)
Female-headed firm	-0.276***
	(0.026)
Controls	Y
Observations	6034
R^2	0.382

Source. RDA NBS. All models use year, sic2 and nuts3 dummies. HAC standard errors clustered on 2-digit sector. Controls as in Tables 3 and 4. Constant not shown. * = significant at 10%, ** = 5%, *** = 1%.

Table 8 gives results for the turnover model. Here, diversity measures have a strongly positive link to turnover, with measures of minority ethnic and female-headed firms showing negative links. For example, the coefficient for ethnic diverse top teams is 0.143, significant at 10%, while the beta of minority-ethnic headed firms is -0.034. For gender, respective coefficients are 0.014 and -0.276 (1%). Overall, these results confirm the pattern of the previous findings, and suggest that diversity and aspects of 'sameness' (all-minority, all-female) act as substitutes, not complements.

6. Robustness checks

I run a series of checks to test for potential specification and endogeneity issues. Results are not shown here, but are available on request. Overall, the main results are robust to these checks, although innovation models are sensitive to the inclusion of richer controls.

I first explore potential amplifying / dampening effects of urban environments. Cities – and urban areas more generally – may amplify these channels (through demographic compositional effects or agglomeration economies) or dampen them (through greater competition or demographic segregation) (Jacobs, 1969; Berliant and Fujita, 2009; Zenou, 2009; Goldin *et al*, 2011). Ethnic-diverse firms in cities/urban environments may therefore experience different outcomes from similar firms in smaller, less urban locations. In the UK context these phenomena are perhaps most likely in London (Nathan and Lee, forthcoming), but may also be present in other big cities and urban cores. Firm-level demographics and urban 'critical mass' may therefore interact in a way not captured by my existing control structure.

To test this, I code firms' locations using either a four-fold Eurostat metropolitan hierarchy, a three-fold ONS urban-rural hierarchy, or a simple dummy for firms in the Greater London NUTS2 area.[10] I then fit interaction terms for area type with ethnic diversity. If London / big cities / urban areas amplify outcomes for firms, we should expect coefficients of interaction terms to be positive. If there is a dampening effect, interactions' point estimates will be negative. Results show little consistent pattern, however, with interaction effects almost all insignificant.

Next, I repeat the main results adding in NUTS3-level workforce composition controls, drawn from the Annual Population Survey for England and Wales. Specifically, I fit sequentially the a) share of directors, managers and senior officials employed in the NUTS3 working-age population, which functions as a measure of the pool of TMT personnel; b) a measure of workforce skills, the share of NUTS3 working-age population with degree-level qualifications; and c) the share of degree holders / senior and management employees. These are designed both to provide additional area-level information, and to proxy for the firm-level human capital information not present in the NBS. As such they are less precise than one would wish, and some coefficients are fitted quite imprecisely.

[10] Specifically, I use two different classifications developed by Eurostat and the UK Office for National Statistics (ONS). The Eurostat typology has four categories: 'predominantly urban regions' (coded 4), 'intermediate regions, close to a city' (3), 'intermediate, remote regions' (2) and 'predominantly rural regions, close to a city' (1). The ONS typology has three broad groups, 'predominantly urban' (coded 3), 'significant rural' (2) and 'predominantly rural' (1).

For product innovation; there is little change when the extra controls are fitted. For process innovation; fitting the area-level skills control slightly raises the beta of ethnic diverse firms (from 0.384 to 0.415) and makes it significant at 10%. For turnover, coefficients of ethnic diverse teams get larger but also shift from 5 to 10% significance; the beta of minority ethnic-headed firms also gets large and becomes marginally significant. As with the other two dependent variables, there is very little change to measures of FTEAM.

I then fit a series of further checks for specific models. I first add in a number of innovation-related controls and re-run (1) for product and process innovation, using the 2008 cross-section. The 2008 NBS contains information on whether firms are planning to invest in R&D; whether they use university-industry links for R&D purposes; and whether they use specialist networks to obtain information. The innovation literature suggests all three will have a positive effect on innovative activity (Romer, 1990; Von Hippel; 2005, D'Este *et al*, 2011). Networking and U-I activity may also influence, and be influenced by top team composition. In the basic specification, cross-sectional coefficients are similar to the larger sample. For product innovation, coefficients of ETEAM change sign once controls are added, so that the share is positive and quadratic negative. For process innovation, positive effects of ETEAM disappear once additional controls are added. This suggests that the innovation results are conditioned by the additional elements included here.

Second, I re-run the turnover models including innovation variables on the right hand side. Intuitively, successfully commercialised innovative activity should feed through into greater market share, and thus higher revenue. Point estimates for both ETEAM and FTEAM change slightly, but the overall pattern of the main results stays unchanged.

Third, and as a further check on the turnover models, I refit the model for 2008 data using more detailed seven-band turnover information. The rich information on the left hand side of the model might reduce or amplify the observed diversity effects. The results are given in table 14: column 1 fits the pooled sample, column 2 the 2008 data and column 3 the 2008 data with seven-band turnover. Fitting the more detailed turnover information does not change the significance levels of the main results, although point estimates for individual variables of interest get a little bigger.

7. Extending the analysis: exports

Does top management team diversity influence firms' ability to access international markets? As set out in Section 2, both diversity and sameness in senior teams may help firms to export. Diversity can allow firms to better handle external complexity, such as that implied by operating in multiple markets; equally, individual team members' networks may help firms access specific overseas markets. Sameness may also aid access to specific international markets where teams have (say) a diasporic connection. Conversely, firms may prefer to plug into complex or cosmopolitan home markets, especially in 'global cities' like London.

To test these possibilities, I re-estimate equation (1) but plug in firms' share of foreign or domestic sales as the independent variable. The controls vector now also includes firms' share of foreign or domestic inputs. High-performing firms are more likely to export and work in international markets (Rodrik, 2004); supply chain and customer market geographies may also influence the make-up of firms' senior management. I estimate the model as seemingly unrelated regressions, which provides substantial efficiency gains over OLS.[11]

Results are given in Tables 9 and 10. Table 9 fits models with diversity shares and quadratics: column 1 includes only ETEAM shares, column 2 adds quadratics, column 3 adds FTEAM shares and quadratics. Overall, there is a positive link from the share of minority ethnic top team members to exports, which again develops an inverse-U shape when quadratics are added. In the fully specified model (column 3) the coefficient of minority ethnic share is 1.378, significant at 5%, while the coefficient on the quadratic is -1.457, also significant at 5%. This implies that pre turning-point, firms with a 10% more ethnically diverse top teams have a 13.8 percentage point greater share of foreign sales. After the share of minority ethnic top team members is higher than 0.47, the link turns negative, and a 10% increase in top team diversity is linked to a 14.6 point lower share of foreign sales. Coefficients of FTEAM are non-significant.

[11] Specifically, I run a Bresuch-Pagan test to check with the standard errors in the two equations are correlated. The null hypothesis is that errors are uncorrelated, so that the estimator is identical to OLS. The statistic is always at least 1900, indicating that the seemingly unrelated estimator is more appropriate.

Table 9. Sales results, shares and quadratics

	(1)		(2)		(3)	
	% foreign sales	**% domestic**	**% foreign sales**	**% domestic**	**% foreign sales**	**% domestic**
% minority ethnic owners/partners/ directors	0.100	-0.179	1.342**	-1.195**	1.378**	-1.243**
	(0.106)	(0.109)	(0.537)	(0.553)	(0.539)	(0.554)
(% minority ethnic O/P/D)^2			-1.419**	1.161*	-1.457**	1.212*
			(0.602)	(0.619)	(0.603)	(0.620)
% female owners/partners/ directors					-0.004	-0.045
					(0.072)	(0.074)
(% female O/P/D)^2					0.174	-0.271
					(0.165)	(0.169)
R^2	0.209	0.175	0.210	0.176	0.210	0.177
Joint sig test chi^2 statistic	1936.065	1698.007	1943.347	1700.123	1944.334	1709.667
p-value of joint sig test	0.000	0.000	0.000	0.000	0.000	0.000
Controls	Y		Y		Y	
Observations	6034		6034		6034	
Log-Likelihood	-18822.993		-18819.997		-18815.685	
Breusch-Pagan test chi^2 statistic	1907.426		1905.337		1903.789	

Source. RDA NBS. All models use year, SIC2 and NUTS3 dummies. Squared variables and their root terms are centered. HAC standard errors clustered on 2-digit sector. Controls as in Tables 3 and 4. Constant not shown. * = significant at 10%, ** = 5%, *** = 1%.

I explore these patterns further using dummies for diverse and all-minority / all-female top teams (Table 10). These confirm the previous results: firms with diverse top teams have a greater exports share and a lower share of domestic sales. By contrast, there is a small and non-significant link between all-minority firms and sales geography. This largely holds for FTEAM, although I also find a strong negative link from firms with all-female top teams to domestic sales.

Table 10. Sales results, diversity and sameness dummies

	(1)		(2)	
	% foreign sales	**% domestic**	**% foreign sales**	**% domestic**
Minority ethnic-diverse firm	0.256**	-0.314**	0.260**	-0.324**
	(0.129)	(0.133)	(0.130)	(0.133)
Minority ethnic-headed firm	0.007	-0.095	0.008	-0.095
	(0.112)	(0.115)	(0.112)	(0.115)
Gender-diverse firm			0.016	-0.024
			(0.037)	(0.038)
Female-headed firm			0.091	-0.170***
			(0.059)	(0.060)
R^2	0.209	0.176	0.210	0.177
Joint sig test chi^2 statistic	1940.566	1700.672	1941.819	1709.636
P-value of joint sig test	0.000	0.000	0.000	0.000
Controls	Y		Y	
Observations	6034		6034	
Log-Likelihood	-18820.844		-18816.865	
Breusch-Pagan test chi^2 statistic	1906.030		1904.050	

Source. RDA NBS. All models use year, SIC2 and NUTS3 dummies. HAC standard errors clustered on 2-digit sector. Controls as in Tables 3 and 4. Constant not shown.
* = significant at 10%, ** = 5%, *** = 1%.

8. Discussion

This paper explores the connections between top team ethnic and gender composition, innovation and revenue levels at the firm level, using a rich dataset of English firms. The paper makes a number of contributions to the small, but growing literature on dynamic effects of diversity, co-ethnicity and gender composition on business performance. It is one of very few firm-level European studies, and is (I think) the first of its kind in the UK.

There are three headline findings. First, I find evidence that suggests a non-linear, inverse-U relationship between the share of minority ethnic and female members of top teams, and various measures of business performance. This provides support for the 'diversity' strand in the literature, and represents evidence against 'sameness' arguments. Specifically, it suggests that positive affordances of diversity on innovation (ideas pooling, knowledge spillovers) outweigh any negatives (lower trust and social capital, discrimination).Notably, in innovation models the positive (diversity) connection is significantly stronger than the negative (sameness) link.

Second, the sign and strength of these connections differ across business outcomes. For innovation models, there is a strong and robust link between ethnic diversity and process innovation, though none for product innovation. I find no links for gender diversity. For turnover models, I find strong, significant joint effects for both ethnic and gender diversity, the former larger than the latter. For sales models, I find strong evidence that firms with ethnically diverse top teams have a greater share of foreign sales, while firms with more homogenous top teams sell more into UK markets.

Third, distinguishing between diverse and minority/female-headed businesses is important to explain these results. For process innovation and exports, I find positive links to ethnically diverse firms but none to minority-headed firms. For turnover, I find positive to ethnic and gender-diverse firms, but negative links to minority and female-headed businesses. This confirms that while business diversity has (internal and external) benefits for innovation and turnover, a lack of *any* top team balance is disadvantageous - both for (say) all-majority top teams *and* for all-minority teams. This may be due to external constraints to the firm (such as discrimination, for the all-minority group), to internal problems (forms of group-think or lock-in?) or both. Further research is needed to unpick these.

The persistence of the main results suggests robust associations between top team demographics, process innovation, turnover and exports. However, my results cannot be seen as causal – because I cannot observe firms' reactions to any diversity or sameness 'effects', and because of firm-level endogeneity. This is a common problem in the field: as Adams *et al* (ibid) point out, 'causality, in the usual sense, is often impossible to determine.' (p 97).

Further research could pursue a number of different avenues. First, and most crucially for UK businesses and policymakers, future studies need to use instruments or other identification techniques that can identify causal effects of diversity and sameness on firm-level outcomes as far as possible. Second, differences between top team and wider workforce demographics-performance channels need better exploration, ideally through large, rich employer-employee datasets. Third, as noted above, better geo-coded data would allow clearer identification of city and urban-level intervening factors. Working with large public datasets and matching across microdata, or pursuing 'big data' strategies are both promising ways forward.

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