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The creation function of a junior listing venue: An empirical test on the Alternative Investment Market

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The creation function of a junior listing venue: An empirical test on the Alternative Investment Market*

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Abstract

Stock markets perform a *creation function* if the inflow of financial capital in the birth of new privately-held firms is stimulated by the promise of stock market liquidity at a later point in time. Junior stock market segments, characterized by lighter listing procedures and costs, may be suited to perform a creation function, but their liquidity promise may not be reliable due information opacity. We test the creation function of the Alternative Investment Market (AIM), the junior segment of the London Stock Exchange (LSE), by means of dynamic panel data models, where entry at the sectoral level is regressed on capital raised at IPO on AIM and on the LSE main market, venture capital investments, and control variables. Our sample includes UK manufacturing sectors over the 2004-2012 time span. We find that sectors that raised more capital at IPO on AIM housed more new entrants in the subsequent years, whereas the results on main market IPOs and venture capital financing are mixed. The magnitude of this effect increases as the amounts of raised capital are aggregated over longer time horizons. Results are confirmed after endogeneity tests (pseudo diff-in-diff and 2-stage residual inclusion estimators).

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1 Introduction

As shown by recent research on industrial dynamics, unleashing the growth potential of new firms is what really matters for innovation and employment growth in advanced economies (see Mazzucato, 2011, 2013; Nightingale and Coad, 2014). The collective, cumulative, and uncertain nature of the innovation process is well known as making the exploitation of technological opportunities complex and challenging. However, the innovation process requires financial resources in order to sustain the accumulation of capabilities from the time at which the investments are undertaken to the time when products generate sales. New firms rarely possess these resources and can hardly rely on the traditional banking channel. Banks are reluctant to finance small new firms because of information asymmetries and radical uncertainty (Beck et al., 2005; Beck and Demigurç-Kunt, 2006). In addition, young firms in Europe are facing increasing difficulties since the implementation of the Basel agreements (Saurina and Trucharte, 2007, Scellato and Ughetto, 2010, Cardone-Riportella et al., 2011). Quoting an OECD report (Wehinger, 2012) "With the banking sector expected to shrink considerably other actors, especially institutional investors, and new forms of financial intermediation will have to meet the credit needs of the economy".

Junior stock markets, i.e. stock markets catering to small caps, represent one of these new forms (Giudici and Roosenboom, 2004; Bottazzi and Da Rin, 2005; Posner, 2009). In the last 20 years, business and policy actors have increasingly viewed stock markets as an alternative to the banking system and have pursued an increasing deregulation of financial markets. One deregulation strategy has consisted in lowering the admission requirements and in outsourcing the regulatory responsibilities to specialized financial intermediaries. These are the core principles of a junior stock market. The longest standing and the most capitalized junior stock market is the Alternative Investment Market (AIM), a segment of the London Stock Exchange (LSE). The companies seeking admission in AIM face lighter regulation and disclosure rules with respect to the official list, and incur lower admission and listings costs (see Rousseau, 2007). Companies are not required to comply with corporate governance and internal control standards.

Even if there is no consensus on the desirability of allowing SMEs to go public (Revest and Sapio, 2013a and 2014; Lagneau-Ymonet et al. 2014; Hornok, 2014), the AIM capitalization has been expanding and its architecture has been emulated worldwide (Alternext, Tokyo AIM, JASDAQ, First North, AIM Italia, and so

forth). The deregulation of stock market listing begs the question as to whether the real economy will benefit in terms of job creation and growth. In increasingly market-oriented economic systems, policy-makers tend to identify job creation with new business formation and entrepreneurial activity (Haltiwanger et al., 2013). Yet, to the best of our knowledge, no research has been devoted to assessing whether junior stock markets, seen as a specific form of financial deregulation, foster new business creation.

In this paper, we fill this gap by studying whether the propensity to rely on AIM as a source of new equity translates into a higher rate of new firm formation, using sector-level data on UK manufacturing. This is, we believe, a worthwhile endeavor for more than a reason.

First, the literature offers several insights on new business creation as a dynamic process triggered, among other factors, by the expected availability of capital injections. Michelacci and Suarez (2004) argued that the stock market encourages business creation because it allows recycling of capital proceeds by providers of informed capital, such as venture capitalists (see also Black and Gilson 1999). According to this view, the deregulation of stock market listing would allow a faster rate of capital recycling, and hence a wider availability of financial sources for startups in a given time frame. Similarly, Lazonick (2007) maintains that the stock market exercises a creation function for the innovative enterprise: the liquidity promise implicit in stock market trading (a future option for a startup) stimulates the inflow of equity capital at startup time. On her side, Sevilir (2010) has theorized on the strategic complementarity between the availability of venture capital and the investments in generic knowledge by incumbents, showing that the latter can trigger spinoffs.

Second, in junior stock markets, most listing decisions are enacted through private placements; the percentage of free float is rather negligible (see evidence in Vismara et al. 2012). Investors on junior stock markets are willing to retain their shareholding perhaps even on a longer horizon than venture capital and, similarly to them, target companies with high (albeit uncertain) returns. As argued by Hornok (2014), junior stock markets exemplify structured and formal markets for liquidity, providing exit opportunities to old and new investors.

Third, the increasing depth of stock markets is at least as relevant as other determinants of entry and post-entry growth (Aghion et al. 2007). Stock market depth is more growth-enhancing for industries that rely more on small firms (Beck et al., 2005) and on firms that are more dependent on external financing (Klapper et al., 2006). A focus on how specific forms of capital sourcing affect entry may help dissipate the doubts that have emerged on the stability and linearity of the aggregate finance-growth relationship, with studies highlighting a declining effect of finance for higher income countries (Aghion et al., 2004; Rioja and Valev, 2004;

Koetter and Wedow, 2010; Rousseau and Wachtel, 2011; Arcand et al., 2015).

We analyze the time dynamics of entry at the sectoral aggregation level by estimating dynamic panel data models. Our sample includes UK 3-digit sectors in manufacturing (NACE Rev. 2 codes from 101 to 332) over the 2004-2012 time span. The dependent variable is the number of births to UK manufacturing sectors, as provided by the Office for National Statistics (ONS). In order to catch the intensity of equity market support to new firms, we use the money raised at IPO, measured at the sectoral level, for both AIM and the LSE main market (source: LSE), as well as venture capital investments by sector (source: BVCA). If the junior stock market performs a creation or recycling function, one should observe more entry in sectors that relied more on AIM, ceteris paribus.

Our closest reference in the literature is Popov and Roosenboom (2013), yet instead of studying the impact of VC on new business creation, we focus on the impact of a junior stock market, controlling for VC too. Our approach departs from Aghion et al. (2007) and related literature: rather than focusing on aggregate measures of financial depth, we wish to disentangle the separate effects of a relative liquid junior market (the AIM) from those of its parent exchange and from other non-bank financial channels, such as venture capital. Our contribution is original because we build a bridge between the microeconomic determinants of firm entry, mirroring the motivations of the entrepreneurs, and the functions performed by a specific stock market. On the econometric side, we rely on models that are more suitable to deal with the count nature of the entry data and allow for non-linear effects.

Based on our findings, we conclude that the AIM has performed a creation or recycling function for UK manufacturing firms, unlike the LSE main market or venture capital. All things being equal, sectors that raised more capital at IPO on AIM and with more AIM-listed small caps were also those housing more new entrants in the subsequent years. The magnitude of this effect increases as the amounts of raised capital are aggregated over longer time horizons, when prospective entrants have better chances to disentangle the signals of interest from the short-term noise; and is stronger than for alternative financing sources, such as IPO proceeds on the LSE Main Market, which is negative in some specifications. The effect of AIM funding, moreover, is more delayed in time than the effect of main market IPOs. Venture capital (when measured in deals, but not in disbursements) is a positive driver of entry. These effects survive to various robustness checks, when we control for a possible omitted variables bias through the pseudo diff-in-diff technique introduced by Rajan and Zingales (1998), interacting the stock market variables with industry concentration, and when we estimate a 2-stage residual inclusion model allowing for exogenous variation in the supply of finance by institutional investors.

Our conjecture is that prospective entrepreneurs use information from markets dominated by institutional investors (AIM, venture capital) in order to assess the chances of drawing finance prior to firm foundation, whereas in sectors that rely more on main market IPOs, incumbents may limit entry in order to sustain their stock prices.

The paper is structured as follows. Section 2 outlines the theoretical background, illustrating the principles that guide junior stock markets, the existing evidence on firm entry, and how stock markets may affect the entry process. Data and variables described in Section 3 are used through the empirical methods of Section 4 to obtain the results (Section 5). Section 6 wraps up and concludes.

2 Theoretical background

2.1 Junior stock markets

The main organizational specificity of AIM, and of other junior stock markets modeled after it, is a combination of low admission requirements with information disclosure processes centered on financial intermediaries known as Nominated Advisors, or Nomads. AIM does not set any minimal initial requirement in terms of capitalization, assets, equity capital, trading history, free oat. A Nomad must be appointed by every company seeking admission on AIM (Rousseau, 2007). Nomads assess whether a company is suitable for quotation by carrying out an examination of the applicants' business and activities. Once the company is listed, these intermediaries have to ensure compliance of the issuers supervised by them with the AIM listing rules. Nomads may also play an important role in corporate governance decisions, by persuading their clients to align with the best practice in corporate governance. Nomads act as gatekeepers, advisers and, ultimately, regulators of AIM-listed companies (Mendoza, 2008). Fast admission processes, customized oversight and disclosure systems as well as reduced transaction costs have contributed to the long-term growth of the AIM in terms of issues and capitalization.

Until now, empirical works have assessed the survival rates, operating performances, and stock returns of the companies listed on the AIM. The conclusions about the impact of the AIM on the listed firms are mixed (Gregory et al., 2010; Espenlaub et al., 2012; Vismara et al., 2012; Gerakos et al., 2013; Jenkinson and Ramadorai, 2013; Nielsson, 2013; for reviews, see Revest and Sapio, 2014 and Hornok, 2014). More interestingly for our concerns, few empirical works focus on real performance measures, such as the growth of sales, assets, and productivity of the listed companies (Cassia et al., 2009, Revest and Sapio, 2013b on AIM). The growth rate of the listed firms is positively affected by the presence of intan-

gible assets, the educational level and the experience of the manager (Colombelli, 2010), as well as the quality of the nearby universities (Cassia et al., 2009). The ability of AIM to nurture the growth of its listed companies has been assessed by comparing the growth rates of AIM-listed and private manufacturing companies between 1997 and 2009 (Revest and Sapio, 2013b). The results show that the AIM selects companies with superior performance in terms of operating revenues and total assets growth, and that it is able to nurture the growth of employees of its listed companies. Yet, a negative treatment effect of AIM on productivity is detected, suggesting that growth in employees is not matched by superior growth in value added. Toward a wider assessment of the impact of AIM on the real economy, we choose to turn to another measure, corresponding to one of the original policy-making goals behind the set up of junior stock markets: the birth rate of new firms.

2.2 Finance and entry determinants

The literature on firm entry highlights the heterogeneity of entry determinants (Geroski, 1995; Disney et al., 2003, Bartelsman et al., 2004). Favorable economic conditions, such as economic growth and high technological opportunities, are viewed as progressive determinants, while low wages, poor working conditions, or being unemployed are considered as regressive determinants (Santarelli and Vivarelli, 2007). Individual determinants play a crucial role, such as experience, family tradition, financial status, education, gender, age (see for instance Reynolds et al., 2001; Vivarelli, 2004, among others). Psychological attitudes (desire to be independent and to attain a better social status, fear to be unemployed, optimism) are shown to be positively associated to the propensity to become an entrepreneur (Vivarelli 2004; Astebro et al., 2014, among others). Beside individual determinants, the empirical literature on regional economics sheds light on the importance of local characteristics that influence firms entry (Armington and Acs, 2002; Shane, 2000).

In addition, the sectoral dimension should also be taken into account: the entry process is influenced by the sector-specific combinations of technological opportunities and appropriability and by the sector-specific weight of revolving door firms (Santarelli and Vivarelli, 2007). More precisely, the state ad dynamics of an industry affects the entry opportunities. This is suggested by previous evidence of a multiplier/demonstration effect (Johnson and Parker, 1994; Nyström, 2007), based on the insight that entry in a sector signals the existence of unexploited profit opportunities. Entry by a rm might increase the sectoral probability to attract even more potential entrants. As observed by Geroski (1995), entry comes in bursts. Entry may also be stimulated by the disappearance of incumbent firms, according to the replacement effect (Carree and Thurik,1999). Moreover, one

should expect entry to negatively correlate with past sectoral size, which is a measure of the contendibility of incumbent positions, consistent with industry life cycles (e.g. Klepper 1996) and as shown e.g. by Cetorelli and Strahan (2006) or Castaldi and Sapio (2008).

Access to finance is especially interesting for us among the main determinants of new business creation. Credit constraints and more generally the lack of financial resources should limit new firm formation directly, in terms of entry barriers (Campello 2003), but also indirectly, as they diminish the survival probability and the rate of growth of new firms, thus discouraging potential entrants (Carpenter and Petersen, 2002; Becchetti and Trovato, 2002).

The above mentioned results about the main determinants of firms creation contribute to justify our expectation that a junior stock market may stimulate firm entry across sectors. The mere existence of a junior stock market may be interpreted as a favorable economic condition, a progressive determinant, or an opportunity to enjoy lower financial barriers to entry. The interest in the AIM as a potential determinant of entry is also in line with the literature on regional patterns of firm creation (Armington and Acs, 2002). According to Amini et al. (2010), London-based IPOs have clearly dominated the AIM IPO activity in the previous years (40% of all IPOs), reflecting the dynamism of the London economy as compared to other regions.

To sum up, the literature on firm entry offers several indications that a future entrepreneur may consider, among other pieces of information, measures of IPO activity, considered as a positive signal stimulating business creation decisions, despite IPOs being, in absolute terms, a small percentage in the population of manufacturing firms. The number of IPOs and the money raised could shape the expectations of an attractive funding environment. Even if a newly created firm does not plan to go public, stock market activity nevertheless conveys information on the overall degree of investor confidence. This highlights a peculiar function of stock exchanges, that shall be discussed next.

2.3 Stock market functions and the AIM

Within the broader research agenda on the real impact of financial markets, Lazonick and O'Sullivan (2004) and Lazonick (2007) have outlined the social conditions that must be satisfied for firms to collect the strategic, organizational, and financial resources required for innovation. The authors define five distinct and interrelated functions performed by the stock market for the innovative firm: creation, control, combination, compensation, and cash. Creation indicates the ability of the stock market to encourage the flow of financial resources into new firm formation by providing a promise of liquidity at a later point in time. Control refers to the fact that, by affecting the concentration/fragmentation of shareholding, the stock

market exerts an influence on the relationship between corporate owners and the managerial staff. Combination concerns the status of corporate stock as currency in transfers of the strategic control of firms, as in mergers and acquisitions. Compensation concerns the use of corporate stock as remuneration for employees and managers. Finally, by providing liquidity, the stock market broadens the array of financial sources available to the listed companies (cash function).[1]

Depending on the institutional constraints faced by the actors and on macroeconomic conditions, the relative weight of the stock market functions vary, as well as their possible combinations. According to Lazonick and O'Sullivan, the way these functions combine themselves change over time and orient the market either towards more speculation or more productive investments.[2]

At a first glance, junior stock markets do not seem well suited for fully-fledged performance of the creation function, because of their lesser ability to guarantee liquidity to its issuers (Vismara et al. 2012). The evidence, however, highlights junior stock markets as platforms mainly catering to institutional investors interested in supporting firms that are relatively young and small.

Espenlaub et al. (2012) study post IPO performance and change in ownership structure and leverage for 195 companies listed in the AIM, and 216 companies listed on the main market, from 1995 until 1999. The authors show that ownership, control, and leverage for AIM companies did not change substantially during the IPO. As companies do not systematically deleverage, the money raised at IPO appears as an additional financing but not a substitute to debt. In addition, AIM IPOs issue a smaller percentage of new equity than main market IPOs. Most of the IPOs on this exchange are offered quasi exclusively to institutional investors and are equivalent to private placements (Vismara et al., 2012). Out of a total of 1642 IPO on the AIM, 1572 were placements with no shares offered to the public, the remaining 70 IPOs were hybrid offers. A related mode of operation has been highlighted for the Canadian junior stock market (Toronto Venture Exchange), where holding a stake for investors seems to be motivated by the prospect of high returns, in some cases even higher than from venture capital (Carpentier et al., 2010).

An alternative reason for focusing on AIM is that the existence of a stock

[1]The stock market functions outlined here roughly correspond to the functions highlighted by King and Levine (1993), i.e. revealing the value of the firm and allowing to diversify risk.

[2]Firm-level case studies have shown that, during the late Nineties, top executives of major US high-tech corporations supported the speculative strategies of the investors, transforming market speculation into capital gains through stock options (Lazonick, 2007). Other case studies during the same period illustrate how, in the pharmaceutical and optical sectors, large innovative firms have used the stock market in order to perform various functions, such as revenue consolidation or compensation, most often at the expense of innovation (Mazzucato and Tancioni, 2008; Leaver and Montalban, 2010).

market catering to companies unable to reach the Official List modifies the set of incentives for company sales. The perspective of listing on AIM may increase the price of a private sale, as it increases the number of potential bidders. A private company can choose between soliciting private bids and listing on AIM and thus stimulating more competition for its shares. The expected return for the start-up financiers would therefore be improved by the presence of AIM. Moreover, AIM could serve as a show-room for promising high-tech companies that could become targets of technology acquisitions by large and established companies.

Then, what does the AIM offer to SMEs? Private placements allow the AIM companies to expand their shareholders base, as compared to the case they remain private. Moreover, new investors are more likely to introduce cash with the hope of being able to sell shares in the future, and existing investors feel that they have an exit opportunity. As Hornok (2014) sums up very well, the main advantage of the AIM remains that it provides a structured and formal market for liquidity. The exchange provides finance around the margin both for founders who need some cash, and allows to enact stock compensation programs, aligning the interest of employees with the company performance. A company that uses the AIM may trade in its own stock to grease the market for the benet of its shareholders (stock repurchase strategies). While the AIM significantly underperforms premier exchanges with heavier regulation, it bridges the gap between a premier exchange listing and remaining completely private.

We therefore believe that the creation function described by Lazonick (2007) can serve as a useful interpretative concept for the performance of junior stock markets as well.

3 Data and variables

In selecting the data and the variables, we have been guided by the literature on firm entry and on its financial determinants. The intensity of the creation function performed by AIM could be assessed by measuring how many new firms have been created in the whole UK economy because of the sheer presence of AIM, in comparison with a counterfactual in which the only option available to potential entrepreneurs was to create a privately-held firm. Such a counterfactual could be built by comparing data on the birth of new firms before and after the establishment of AIM, controlling for the time dynamics in all other possible determinants of rm entry. Yet, shortage of industrial and financial data prior to 1995, the year when AIM was inaugurated, was decisive in pushing us to pursue another approach: focusing on the time dynamics of entry at the sectoral level of

disaggregation.[3]

Indeed, the stock market does not move in all directions at the same speed. In some sectors, IPOs are more rare; the amount of money raised can also vary, as firms are highly heterogeneous across sectors as regards their dependence on external providers of finance. In particular, even a cursory glance at the data published by the LSE suggests that the extent to which AIM is used for IPOs varies considerably across industrial sectors. For instance, in the tobacco sector (NACE Rev. 2 code: 120) between 2002 and 2012 there were no money-raising IPOs on either AIM or the main market. On the contrary, manufacture of coke oven products (NACE Rev. 2 code: 191) had 40 money-raising IPOs on AIM in 2005. Money raised at IPO also varies dramatically: for instance, according to LSE data, in 2005 it ranged from 443.01 million pounds (petroleum products), to 98.85 million pounds (electronic and electrical equipment), to 12 million pounds (manufacture of beverages) or even lower values.

All this given, let us proceed with the dataset description.

3.1 Sectoral classifications

The selected data come with different sectoral classifications. Amadeus provides information on the NACE Rev. 2 classification, at both 2 and 4 digits, whereas the ONS data are classified according to SIC 2007, which is equivalent to NACE. We however had to face some conversion issues concerning the stock market data, that are disaggregated according to the Industrial Classication Benchmark (ICB), devised by FTSE and Dow Jones, from 2006 onwards, and according to an older FTSE classication until 2005. After a careful examination of the sector definitions, we have built a correspondence table between the ICB and NACE Rev. 2 sectors, whereas the old FTSE sectors have been converted into ICB sectors based on documentation available at the Dow Jones website. Tables 1 and 2, summarizing these correspondences, are reported in the Appendix. To sum up, stock market data prior to 2006 have been converted from the old FTSE classication to ICB sectors and the latter, in turn, into NACE Rev. 2 sectors. NACE Rev. 2 sector 33 was removed, as no correspondence could be found with the ICB codes. Stock market data for NACE Rev. 2 sectors 13, 14, and 15 were available only from 2006

[3]Even if data were available, the causal effect of AIM would be difficult to disentangle, because the AIM is not the first junior market to be created in the UK. The Unlisted Securities Market (USM) was in operation between 1980 and 1995. Acting as a competitor with other funding sources for young SMEs, it may have influenced entry decisions as well. Some of the early AIM-listed companies were actually transfers from the USM, so the overall performances of AIM and USM were related, at least in the early years. The possible endogeneity of the event "inauguration of AIM" would have to be treated anyway. If the market was established with the goal of fostering entry, reverse causality might be an issue.

onwards.[4]

3.2 ONS data

The number of new firms in sector s and year t, $entry_{s,t}$ is defined here as the number of firms that are reported by the Office of National Statistics (ONS) as births in year t in each sector. This variable allows to focus on *de novo* firms, as opposed to the broader concept of entry into an industry, that also accounts for diversifying entrants. The raw number of entrants is the most obvious candidate as dependent variable. Gross entry, i.e. the sheer change in the number of firms, is less suited to isolating the "genuine" entry of new firms from mergers, acquisitions, and exits. The ONS also provides data on the numbers of firms in each sector and on exits. Considering exit, along with entry, can be interesting as it would provide insights on replacement effects and churning. We also draw, from the ONS, the change in the output per hour index, available at the NACE 2-digit aggregation level. Growing labour productivity would be seen by potential entrepreneurs as an encouraging signal, and notably an indicator of expanding technological opportunities to be tapped.

3.3 LSE data

The LSE website provides measures of stock market activity, the main explanatory variables of interest in this work. One measure is the number of IPOs on AIM, by sector. Another measure is the sector-level amount of money raised at IPO on AIM. This would be a signal of the stock market financing for firms that cannot access the official list. In addition, we consider the number of small caps listed on AIM, taking a 5 million pounds capitalization as a threshold.[5] These variables are aggregated by 3-digit NACE Rev. 2 sectors, after conversion from the original ICB and FTSE classication systems (see Section 3.1 and Appendix). Focusing on only AIM, however, would hide the possibly relevant impact of the LSE Main Market, which is arguably more visible and liquid than AIM. Hence, we also use the number of IPOs and the money raised at IPO on the LSE main market, while the number of small caps is not considered, as there are no companies with capitalization below the 5 million pound threshold on the main market.

[4] A similar concordance problem was faced and solved by Popov and Roosenboom (2013). An ICB-NACE conversion table had been reported in Ortega-Argiles et al. (2008, Appendix A) but it refers to the previous revision of the NACE classication (Rev. 1.1) and is more aggregated (2 digits).

[5] Taking 10 million and 25 million pound thresholds does not change the results in any significant way. These figures have been computed by using data on the capitalization of individual stocks at the year end, published by the LSE on its website.

3.4 Other data sources

Significant partial correlation between entry and the stock market variables may appear as a result of omitting relevant determinants of entry decisions, related to alternative funding sources and to the real side of the economy. Alternative funding sources for potential entrants include venture capital, that can be seen as a competitor with (or complementary to) AIM for entrepreneurial finance.[6] Every year, the annual report of the British Venture Capital Association (BVCA) publishes the amounts invested by sector of destination, using the ICB classication. Although these data do not allow to distinguish between different stages, they still provide a reliable picture of the cross-sectoral patterns of venture capital investments. Similar to AIM, venture capital investments can be seen as a proxy for the propensity of institutional investors to finance young and small firms. The reader is referred to Table 3 (Appendix) for the definitions and notations of all variables.

[Table 3 here]

3.5 Summary statistics and tests

Table 4 reports summary statistics for all variables used in the econometric analysis, whereas Table 5 summarizes their time evolution (see Appendix).

[Tables 4 and 5 here]

Table 4 shows that on average, there were more firm exits than entry in the sample period (159.978 vs. 120.218), presumably because of the post-2008 financial crisis. The change in output per hour, our productivity measure, was positive on average (+3.646) but with a very wide range - from -11.3 (manufacturing of motor vehicles, trailers and semi-trailers, and other transportation equipment in 2009) to 22.8 (the same sectors in 2010).[7] Only 15% of sectors/years have raised money on the LSE Main Market (see the dummy money raised at IPO on the LSE Main market), a percentage that grows up to 60.3% for AIM, consistent with its lighter listing procedures and costs. At the same time, the average amounts of money raised at IPO on the main market are larger than on the AIM (46.990 million pounds vs. 28.776). In fact, if we restrict the statistics to only the sectors/years that feature IPOs (not shown in the table), the minimum of the money raised

[6] We only have aggregate data on bank loans. Fixed sectoral effects may capture, among other things, the sector-specific influence of loan supply on new firm formation.

[7] Other sectors/years in the tails of the productivity change distribution were basic and fabricated metals (-9.3 in 2009) and machinery and equipment (-9.2 in 2009, +19 in 2010).

distribution on the main market lies above the maximum of the AIM money raised at IPO. In nearly all of the sectors/years there were venture capital investments (mean value for the dummy VC invested amounts: 0.929). The number of AIM small caps in a sector-year was on average 8.265, but with a wide range (between 0 and 87).

In Table 5, one finds that the average number of entrants had two peaks in 2004 and 2008 - and dropped to the lowest in 2010, with a slight increase afterwards. Exit, too, had a local peak in 2004; then, after a temporary decline, it surged again to peak in 2009 and then went down again. The change in the output per hour index was also adversely affected by the crisis, but as with exit, it reacted more sluggishly than entry to the changed macroeconomic scenario. In 2008, it was still positive (+2.358), then it collapsed to -3.443 in 2009 and again in 2012 (-3.307). Concerning equity variables, there are interestingly different time patterns. Money raised at IPO on either AIM or the LSE Main Market dropped to nearly zero in 2009, although some signs of weakness were already visible in 2008. While the main market recovered strongly in 2011, the AIM nearly reached an all-time low; both segments fared poorly in 2012. VC investments, instead, recorded higher levels in 2009-2010 than in 2004-2005, although still very far from the very high amounts invested in 2006-2007. The number of AIM small caps (with capitalization below 5 million pounds) reached its highest values in 2008 and 2009, and understandably so, as this was due to stock prices dropping.

4 Empirical methods

We resort to a panel regression in which the unit of observation is sector-year. The capital raised at IPO on AIM ($aim_{s,t}$) and the number of AIM-listed small caps ($aim.small_{s,t}$) are the variables of interest for our analysis, but we also compare their effects with those associated with the capital raised at IPO on the LSE main market ($mm_{s,t}$) and with the value of venture capital investments ($vc_{s,t}$). Control variables include the number of entrants, the number of firm exits, the number of firms. These are meant to capture, respectively, the multiplier/demonstration effect, the substitution effect, the contendibility of incumbent positions, and technological opportunities. Sectoral and time effects are denoted by D_s and D_t, respectively.

In the baseline regressions, we use the 3-year average values of the explanatory variables. Specifically, we define $aim_{s,t-1:3}$, $aim.small_{s,t-1:3}$, $mm_{s,t-1:3}$, $vc_{s,t-1:3}$ as follows:

$$aim_{s,t-1:3} \equiv \frac{1}{3}\sum_{k=1}^{3} aim_{s,t} \qquad aim.small_{s,t-1:3} \equiv \frac{1}{3}\sum_{k=1}^{3} aim.small_{s,t-k}$$

$$mm_{s,t-1:3} \equiv \frac{1}{3}\sum_{k=1}^{3} mm_{s,t-k} \qquad vc_{s,t-1:3} \equiv \frac{1}{3}\sum_{k=1}^{3} vc_{s,t-k}$$

All the other regressors are likewise averaged between $t-1$ and $t-3$, whereas labour productivity growth is computed between $t-4$ and $t-1$. Control variables are included in matrix $X_{s,t-1:3}$.

The reason why we take 3 lags of the financial market variables is that taking just a yearly lag may not allow to fully capture their effects, if any. If new entrants take account of stock market trends, they may not trust short-term signals riddled with idiosyncratic shocks, and may use longer term information (e.g. the average activity over several years back; see also Popov and Roosenboom 2013). Also, creating a new company may be a lengthy process, so that a company incorporated in year t may have taken its entry decision well before year $t-1$. Moreover, as highlighted by Popov (2009), VC staging may give rise to a measurement error problem: a single financing round may provide funds to be spent over 2-3 years. The associated risk of attenuation in the estimated coefficients can be avoided by aggregating the equity variables over periods longer than 1 year.

Due to the count nature of the dependent variable, entry, and the possible over-dispersion of the entry counts, the Negative Binomial model is a natural choice:

$$Prob(entry_{s,t} = y) = \frac{\lambda^y e^{-\lambda_{s,t}}}{y!} \tag{1}$$

where

$$\lambda_{s,t} = E[entry_{s,t}|aim_{s,t-1:3}, aim.small_{s,t-1:3}, mm_{s,t-1:3}, vc_{s,t-1:3}, X_{s,t-1:3}, D_s, D_t]$$

is the expected value of the entry counts, conditional on the explanatory variables. The variance is given by:

$$V[entry_{s,t}|aim_{s,t-1:3}, aim.small_{s,t-1:3}, mm_{s,t-1:3}, vc_{s,t-1:3}, X_{s,t-1:3}] = \lambda_{s,t} + \sigma^2\lambda_{s,t}^2$$

where σ^2 is the variance of an i.i.d. random variable $z_{s,t}$, such that $entry_{s,t}|z_{s,t} \sim$ Poisson$(\lambda_{s,t}z_{s,t})$.

Notice that results from estimating a Poisson model may be inflated, in terms of magnitude and significance, if sector-years with zero entry are also those with

no IPOs. We thus prefer to assume a Negative Binomial model and then test for over-dispersion.

The dependence of $\lambda_{s,t}$ on the explanatory variables is modeled through a log link, i.e.[8]

$$\ln \lambda_{s,t} = \beta_0 + \beta_{aim} aim_{s,t-1:3} + \beta_{as} aim.small_{s,t-1:3} + \beta_{mm} mm_{s,t-1:3} + \tag{2}$$

$$+\beta_{vc} vc_{s,t-1:3} + X_{s,t-1:3}\beta_x + \beta_s D_s + \beta_t D_t$$

The Negative Binomial model coefficients in the above specification measure the marginal response of the (log-)expected entry counts with respect to the regressors. The underlying assumption is that the effects of the predictors are multiplicative.[9]

The above model includes unit-specific (i.e. sector-specific) intercepts. Both Hausman-type and a likelihood-based Breusch-Pagan test suggest to estimate fixed effect (FE) models. In particular, we estimate one-way FE models, including sectoral dummies, as well as two-way FE models that include also yearly dummies and recognize the possible omission of time-varying variables that affect all sectors alike.[10] In all models, the estimation relies on robust standard errors.[11]

Finding positive coefficients for AIM variables ($\beta_{aim} > 0$, $\beta_{as} > 0$) would suggest that sectors relying more on AIM for financing new firms experience more entry subsequently. Comparing AIM and Main Market coefficients may testify to the relative strength of their signals to potential entrepreneurs. Since going public on the main market is a more remote opportunity for young and small firms, we expect $\beta_{aim} > \beta_{mm}$, i.e. AIM to matter more than the Main Market in guiding entry.

[8] The log link allows the predicted values of the expected number of entrants to be nonnegative.

[9] The Negative Binomial model has the welcome feature that, unlike the log-linear model, is not affected by the incidental parameters problem (Lancaster, 2000; Neyman and Scott, 1948), that with the relatively short time length of our panel may be relevant.

[10] This corresponds to demeaning, an approach that is better than the alternative approach of first-differencing, because it does not artificially induce serial correlation of the error term. This also takes care of pro-cyclicality in stock market variables, as in Popov and Roosenboom (2013).

[11] We lack data that would be useful to build an even richer set of explanatory variables, e.g. pre-entry experience and the fraction of diversifying entrants (Bayus and Agarwal, 2007), bank loans (which we can only measure at the aggregate level), as well as some more nuanced measures of entry barriers, such as advertising/sales ratios or the statistical properties of the size distribution of incumbents. Variables sometimes used in cross-country studies on financial depth and entry, such as employee protection, ring costs, and the unemployment rate, instead, would not be relevant in our single-country analysis.

5 Results

Baseline estimates, as well as various robustness exercises, are illustrated in this section.

5.1 Baseline results

Table 6 summarizes the results of estimating the negative binomial model of sectoral entry, using only sectoral fixed effects (column i) or sectoral and time fixed effects (col. ii). Reported in the tables are the elasticities estimated at the mean of the explanatory variables, along with their respective standard errors and overdispersion tests when applicable.

[Table 6 here]

The impact of the capital raising variables differs across sources (*aim*, *mm*, *vc*) in sign and magnitude, although one would expect similar effects from segments of the same stock exchange and venture capital industry, that tend to move together along the business cycle. The elasticity of entry with respect to *aim* is about 9.4% in the 1-way FE model (9.2% with 2-way FE) and statistically significant. The number of AIM small caps has a positive effect, and a significant one in the Poisson 2-way FE model (a 17% elasticity). Quite surprisingly, the effect of main market IPOs is negative and significant, corresponding to a -5.9% elasticity. There is a negative effect of VC investments, but not a robust one in significance terms. Concerning control variables, we observe positive autocorrelation in entry counts, suggesting a multiplier/demonstration effect. We also find a replacement effect: lagged exit significantly affects entry. Expectedly, the coefficients associated to the number of firms and to productivity growth are, respectively, negative and positive, and significant in both cases.

In col. iii we repeat the Negative Binomial estimates by including all three lags of the capital raising variables, with the goal of uncovering time patterns in their influence, which may help explaining the opposite effects of main market and AIM activity. AIM IPO proceeds become significant from the second lag on, whereas *aim.small* only does so from the third lag on. The effect of main market activity, instead, does not stretch back as far: it is significant (and negative) only at the first and second lag. Further differences between AIM and the main market are thus highlighted, as if the two segments conveyed different pieces of information to potential entrepreneurs. We investigate this intuition further, by using alternative measures of stock market activity, namely the number of money-raising IPOs on the AIM and on the main market, as well as the number of VC deals (the first three lags of all these variables). The number of IPOs is often considered as an

indicator for hot market conditions. Consistent with the insight from the previous estimates, col. iv shows that the effect of main market IPOs dries out after two lags, whereas the number of AIM small caps (and now, also the number of VC deals) exercise positive effects on longer lags.

For the sake of comparison, we also report estimates of Poisson (col. v) and log-linear models (col. vi), using 2-way fixed effects. In the Poisson case, capital raising signs are confirmed, but the coefficients to *mm* and *aim.small* lose significance. The demonstration effect and the negative effect of sectoral size are confirmed, with lower magnitudes, whereas the replacement and productivity effect lose ground. Log-linear estimates fail to capture the effects observed through count models, although the elasticity of entry with respect to *aim.small* is significant and equal to nearly 7%.

5.2 Dealing with data issues

Some of the data measurement strategies we have used may be questionable. As always with econometrics, the set of available explanatory variables may not fully overlap with the variables a theorist has in mind. One such issue is the decision to focus on a 3-year horizon in order to assess the effects of interest. In some sectors, entry decisions may react more promptly to the signals coming from stock markets; in others it may take more time, if any. Hence it is worth checking how the results would change if we focused on a longer (4 years) or shorter horizon (1 and 2 years).

We thus replace the main market, AIM, and VC variables in the baseline specification of the 2-way FE Negative Binomial models with the amounts of capital raised by each sector in the 1, 2, or 4 years before, i.e. $\frac{1}{p}\sum_{k=1}^{p} aim_{s,t}$, $\frac{1}{p}\sum_{k=1}^{p} aim.small_{s,t-k}$, $\frac{1}{p}\sum_{k=1}^{p} mm_{s,t-k}$, and $\frac{1}{p}\sum_{k=1}^{p} vc_{s,t-k}$, with alternatively $p = 1$, $p = 2$, $p = 4$. We similarly replace lagged entry, exit, and the number of firms with their averages over 1, 2, and 4 years before. Productivity growth is recomputed as the change over the same spells in the output-per-hour index published by the ONS.[12]

[Table 7 here]

Shorter lags allow to obtain less distinctive results, as expected (Table 7, col. i and ii). Capital raised at IPO on AIM has positive elasticities (less than 1% in the 1-year horizon model, 4.5% in the 2-year horizon case), that are significant only in the 2-year horizon estimates. The number of AIM small caps is not significant,

[12]When estimating the model on shorter lags, we nevertheless use the same sample as in the 3-year horizon estimates, i.e. the earliest entry observations refer to 2005. We wish to avoid these new results to be driven by unobserved factors that were specific of years before 2005.

nor is venture capital; whereas capital raised at IPO in the main market displays negative and significant elasticities.

In addition to the above results, the significant multiplier/demonstration effect is confirmed (related to positive and significant lagged entry coefficients). There is a positive replacement effect, losing significance over the 1-year horizon. The negative effect of the number of firms is confirmed, whereas the positive elasticity of entry with respect to the growth of labour productivity is not statistically significant.

In the 4-years horizon case (col. iii), the elasticity of entry with respect to the capital raised at IPO on AIM is equal to 12.3%, whereas the effects of AIM small caps, main market capital raised at IPO, and venture capital lose significance. Lagged entry, the lagged number of firms, and labour productivity growth enter significantly, whereas no significant replacement effect is detected in this case.

By performing the main estimates on 3- and 4-year lags, we indirectly had taken care of an additional issue with the previous estimates. Indeed, the sign and significance of the coefficients attached to IPO proceeds in shorter horizons may be driven by the presence of zeros, and so they may conflate an extensive margin effect - due to the sheer presence of IPOs - with an intensive margin effect, according to which what stimulates entry is the amount of money raised at IPO. Yet, the percentage of sectors-years that launched IPOs on the LSE Main Market over a 4 years time span was 74.5%, and 97.6% on AIM; 99.1% of sector-years received venture capital. Hence, the coefficients based on longer horizons can be seen as mainly capturing an intensive margin effect.

Nonetheless, we repeat the estimates of the baseline model (2-way FE, 3-year horizon) while replacing aim, mm, and vc by means of dummies taking unit values whenever there was a positive amount of raised capital, and zero otherwise. Coefficients associated to these variables convey information on the extensive margin effect of stock market listing and venture capital. Consistent with the above insight, the estimates, reported in Table 7 (col. iv), show that the extensive margin effect lacks statistical significance. The baseline estimates, thus, can be taken as measuring the intensive margin effect on entry of capital raised on the stock market.

Next, baseline results may have been biased if sectors with larger IPO proceeds are also those with more entry, since the pool of potential IPO firms is fed by the process of firm creation itself. Hence we remove the sectors with the highest and the lowest raised capital at IPO on AIM between 2002 and 2012 (namely, NACE 192 Manufacture of refined petroleum products and NACE 120 Manufacture of tobacco products, respectively). In col. v the baseline results are largely confirmed, although with slightly weaker elasticities with respect to AIM capital raised (a 5.7% elasticity now) and AIM small caps (15.4%).

5.3 Omitted variables and endogeneity

Models such as the above, despite the use of fixed effects, are unable to properly deal with the omitted variables bias. Omitting non-observed or non-observable variables that affect firm creation decisions would induce correlation between the stock market variables and the error term. One cure for this problem is the pseudo diff-in-diff approach pioneered by Rajan and Zingales (1998), that includes interaction terms in order to take care of sector-time effects. Our capital raising variables (*mm*, *aim*, *vc*) are hereby interacted with a measure of entry barriers, i.e. the sectoral averages of the Herfindahl-Hirschman index, built from Amadeus data on UK manufacturing companies for the period 1997-2009. A similar approach was followed by Popov and Roosenboom (2013), who used US sectoral entry rates to proxy entry barriers in a relatively frictionless economy. This exercise is also in line with Beck et al. (2005), who explored the growth-enhancing properties of financial expansion in sectors that rely more on small firms. We depart from the Rajan-Zingales approach of taking the US as a benchmark, because the UK is already one of the countries with the most frictionless stock markets in the world.

In Table 8, 2-way FE Negative Binomial with 3 lags are augmented with interaction terms. AIM raised capital keeps affecting entry, but only in its stand-alone version (with an elasticity of 8.4% with respect to capital raised, and 17% to small caps), whereas capital raised through main market IPOs loses its significance. The AIM effect, however, is not channeled through interaction terms, whose coefficients lack significance. The main message from the baseline estimates is confirmed.

[Table 8 here]

The analysis performed so far could also be criticized on the grounds of reverse causality: it could be entry that drives IPOs and not the opposite. Arguably, there can hardly be IPOs in sectors where entry is rare. Regulatory and technological barriers that deter entry, thus, constrain the pool of potential IPOs. Moreover, firms in concentrated sectors may rather look at the main market as the venue for IPO financing, as they are characterized by relatively large efficient scale at entry and thus can afford to bear the higher costs of an official listing. It is worth noting that low barriers make entry easier, but this need not translate into more IPOs if the fixed component of quotation costs is disproportionally born by smaller and younger firms. Also, whereas IPOs are more rare in concentrated sectors, the average amount of money raised per IPO in those sectors is supposed to be relatively large, reflecting a larger firm size. In fact, we do control for main market activity, for the past number of entrants, and for the size of the sectors in the regressions. We have already shown (Table 6, col. v) that our results hold even after excluding sectors with the highest and lowest IPO proceeds. Sectors with less

entry today will probably have less IPOs tomorrow, but sectors with more entry today need not have more IPOs tomorrow - casting doubts on reverse causation.

Nonetheless, we implement an estimator based on instrumental variables and attempt to identify the causal effect of our financial variables. Besides the AIM IPO proceeds, VC investments could also be considered as endogenous for very similar reasons. Main market IPOs, instead, are hardly endogenous with respect to the rates of new business creation, since the official listing requirements are typically unattainable by infant firms.

In order to take care of the endogeneity of *aim* and *vc*, we need instrumental variables that are correlated with capital raising on AIM and through VC, but not with the error term of the firm creation equation, that can be seen as collecting the unobserved component of entrepreneurial opportunities. More specifically, we know that new firm creation increases the demand for funding, which is why *aim* and *vc* could be endogenous. Hence, for the identification of the causal effects we need to consider exogenous variation in the supply of funding. Some papers have used lagged values of the endogenous variable to this end, but in our case longer lags of *vc* and *aim* may still be correlated with entrepreneurial opportunities (see Sections 4, 5.1 and 5.2 for a discussion on this point). Hence we follow Popov and Roosenboom (2013) and works cited therein and use instrumental variables based on buyout assets and the size of pension funds (data source: Eurostat). Indeed, both buyout fund-raising and pension funds measure the spending capacity of institutional investors, who are key in both VC and AIM.

We generate three instrumental variables. The first is buyout fund-raising interacted with the sectoral shares of VC investments (with respect to total annual VC). Buyout fund-raising is an aggregate variable, hence interacting it with sectoral VC shares allows to provide a rough estimate of how much buyout assets would be potentially available to each sectors. We take the 3-years lag of this interaction term.

The second variable is the size of pension funds, as a ratio of GDP, interacted with the sectoral amounts of VC before the adoption of the pension funds directive by the European Commission in 2003, and with a dummy equal to 1 after the adoption (cf. Popov and Roosenboom 2013). The idea is that after this directive, the UK, which had liberalized years before, became a potential market for investments by pension funds in other EU countries. The third variable is the size of pension funds, as a ratio of GDP, times the sectoral amounts of AIM IPO proceeds before the amendments to the stamp duty regime of ETFs in 2007, which enhanced the possibility of non-UK European issuers to list on AIM (see interview to LSE official Gillian Walmsley for Morningstar, 20 July, 2010); times a dummy equal to 1 from 2007 on.

The insight behind the two latter IVs is that risky investments, such as those

in VC and in AIM-listed companies, should attract more financing if pension funds are larger, but more so in sectors that attracted VC and AIM IPOs even before the reforms, and taking account that liberalization events allowed the UK market to be targeted by a larger "audience". Caveats on the two latter instruments are discussed in Popov and Roosenboom (2013) on VC, and similar remarks can be made on AIM.

Our firm creation model is a Negative Binomial model. In case one or more regressors are suspected of endogeneity, Wooldridge (2002) and Terza et al. (2008) suggest using the two-stage residual inclusion (2SRI) method to identify causal effects. In the first stage, the possibly endogenous variables are regressed on the excluded and included instruments. In the second stage, the non-linear model at hand (in our case, Negative Binomial) is estimated by including the first-stage residuals along with all regressors (both exogenous and endogenous). First-stage residuals, indeed, approximate for the unobservable variable that is supposed to jointly cause the outcome variable and the endogenous regressors. The number of IVs must be no less than the number of endogenous regressors, and the usual criteria (instrument relevance, exclusion restriction) must be satisfied. In the second stage, standard errors need to be corrected, e.g. by means of bootstrapping.[13] Exogeneity of *aim* and *vc* can be tested by means of a joint F-test on the coefficients associated to the first-stage residuals in the second-stage equation. The null is that all those coefficients are jointly zero.

In Table 9 we report the estimates from the 2SRI procedure: the two left-most columns include the first-stage results (assuming, respectively, AIM IPO capital raised and VC proceeds as endogenous variables), whereas the right-most column reports the second-stage results. The joint F-test on the instruments coefficients in the first-stage regressions confirm the relevance of the instruments: in the AIM equation, the F(3,429) statistic is 19.76 (p-value: 0.000); F(3,429) = 26.71 in the VC equation (p-value = 0.0000). Correlations between the instruments and the second-stage Pearson error term are negligible, as shown in the bottom-right of the table, motivating us to believe in the exclusion restriction. Our choice of instrumental variables is in line with the usual requirements. Though, it is worth noting that the coefficients attached to the first-stage residuals in the second-stage equation are not statistically significant. Hence, we can conclude that capital raised at IPO on AIM and that VC investments are exogenous with respect to sectoral entry counts. Consequently, the estimates obtained in the previous subsections can be seen as measuring the causal effects of capital raising on sectoral entry.[14]

In Table 10, the 2SRI estimates are repeated, but this time we use as financial variables the IPO and VC investment counts instead of their monetary values.

[13] See however Wooldridge (2002) for an exact computation of standard errors.

[14] Similar results obtain if we include instrumental variables one at a time.

The previous results are confirmed: again, the three instruments are relevant, as they are significantly correlated with both the possibly endogenous variables; in the second stage, the first-stage residuals display non-significant coefficients; the second-stage residuals are nearly uncorrelated with the outcome variable.

[Tables 9 and 10 here]

5.4 Summary and discussion of results

Our results suggest that entry decisions take account of stock market information even though, in all likelihood, very few firms plan to ever go public. Sectors that raise more capital at IPO on AIM are also those housing more entrants in subsequent years, ceteris paribus, whereas sectors raising more capital through main market IPOs are characterized, on the margin, by less new entrants. We can give a causal interpretation to these results, since our tests indicate that capital raised through AIM and VC are exogenous with respect to entrepreneurial opportunities.

The negative association between new firm formation and main market IPOs is a surprising result that can be interpreted in two (not mutually exclusive) ways, possibly throwing light on the role of AIM in firm creation, too.

One interpretation is that in more "financialized" sectors, incumbents compete more aggressively, thereby preventing entry or harshly responding to it. Consider listed companies where ownership and control are separated and the managers are instructed to maximize shareholders value, but are imperfectly monitored. Rotemberg and Scharfstein (1990) showed that a firm can boost its stock price - and thereby its shareholders value - by competing aggressively on the product market: indeed, this is a way to enhance its profitability and to cause the rivals' performance to fall, an information that would be incorporated in higher stock prices. Kraus and Rubin (2010) build a theoretical model through which they conclude that the higher the shareholders diversification, the higher the propensity of managers to initiate "cannibalistic projects that decrease their rivals' market shares, as opposed to "economy-increasing" projects that would instead open up entry opportunities. The empirical analysis in Khanna and Tice (2000) showed that privately-held incumbents and those with higher inside ownership in the department store industry reacted more aggressively to entry by Wal-Mart. One implication is that listed incumbents would manage to sustain their stock prices by limiting entry.

Ownership-control separation is mandated by corporate governance rules for listed companies, specifically in the London Stock Exchange main market, but not for AIM-listed companies. An industry that relies more on stock market financing is therefore also an industry in which more companies adopt the "best practice"

governance structure and suffer from the associated agency issues. No discrepancy between shareholders value maximization and profit maximization ought to occur outside of the stock market. Hence, less main market IPOs in an industry implies lower incentives for incumbents to compete aggressively. If so, more entry should be observed in industries that rely less on the main market, all else being given.

As said, such financialization incentives are expected to be weaker among AIM-listed companies. Although Nomads may advice to adopt the standard governance, that is not mandatory. In AIM-listed companies, management and ownership can coincide, let alone that most of their shares are held by institutional investors and are not actively traded (see Vismara et al. 2012). The relatively higher involvement of institutional investors in the capital of AIM-listed companies, moreover, could make them more inclined to adopt option-based compensation schemes, thereby mitigating the incentives for managers to use cannibalization as a threat against potential entrants (Kraus and Rubin 2010).

Another story is that potential entrants face higher financial barriers to entry in sectors that rely more on stock market funding, especially if access to stock markets is limited. This is rooted in the negative association between product market entry and concentration among financiers, previously observed in the literature mainly with respect to banking competition (see e.g. Campello 2003). That evidence may be relevant for stock market financing too. Indeed, listing requirements set by the main market effectively reduce the access to finance, as smaller and younger firms can only rely on loans or private equity if they do not have enough own funding. This cannot be said about AIM, wherein listing requirements ultimately are tailored by Nomads in a case-wise fashion. What is less convincing about this story is that stock market listing need not be the primary financial source of choice for newcomers - and indeed, it is not, as shown by the evidence on the pecking order hypothesis (Myers 1984). Even in market-based financial systems, however, what constrains entry and growth is the lack of internal funds; external financial constraints (mainly related to credit) are binding only at a later stage of a firm's life (see Dosi et al. 2016). The latter explanation is related to the possible joint causation of entry barriers and stock market financing. This has been already explored are taken care of through the 2SRI method (Tables 9 and 10) and the estimates on a sample excluding sectors with large IPO proceeds (Table 7, col. v).

Where is venture capital in this picture? The venture capital coefficient is only significant with a positive sign in our estimates when we consider the number of deals. The value of VC disbursements does not seem to be relevant in entrepreneurial decisions. Perhaps, data on the size of venture capital deals are less transparent than stock market data; alternatively, prospective firm founders know that the size of venture capital deals is a poor proxy for the overall value of venture capital, which includes advice on governance, technological, and commer-

cial matters. This is only apparently contrasting with Popov and Roosenboom's (2013) results. Their analysis focused on a cross-section including countries with dramatic differences in terms of venture capital development. By focusing on just one country, it is likely that venture capital affects most sectors alike.

One limitation of our analysis relates to the lack of debt data at the sectoral level. We have partly accounted for this omission by using sectoral and time fixed effects, as well as through the pseudo diff-in-diff method. The trend in banking deregulation has apparently magnified both entrepreneurship and business closures (Bertrand et al. 2007; Kerr and Nanda 2009). At the same time, the behaviors of banks during the crisis in the UK may have changed the appetite for equity as compared to debt capital. On a broader note, it must be remarked that the UK has experienced a growing amount of credit in the period of interest, but not a monotonic trend in new firm formation. The hint in the available statistical information is that bank-based financing has satisfied mainly the needs of large and established companies. UK statistics show that in the last decade, credit trends display different dynamics according to firm size (Monteiro, 2013). Especially lending to SMEs has been characterized by a continued retraction from 2004 until 2012, meanwhile between 2004 and 2008, and between 2010 and 2012, credit flows oriented toward larger corporate firms were increasing. So, our results would probably survive to including sectoral credit data.

6 Conclusion

In the years under examination, 2004-2012, a period characterized by the emergence and subsequent crash of the subprime bubble, the AIM seems to have performed a creation function for UK manufacturing firms. All things being equal, sectors that raised more capital at IPO on AIM and with more AIM-listed small caps were also those housing more new entrants in the subsequent years. The magnitude of this effect increases as the amounts of raised capital are aggregated over longer time horizons, and is stronger than for alternative financing sources, such as IPOs on the LSE Main Market and VC investments. Our robustness checks show that this statistical relationship captures an intensive margin effect, i.e. the effect is related to more IPO proceeds, not to more IPOs; and it is not driven by a few sectors that rely on very large IPOs. The results are robust when we control for an omitted variables bias through pseudo diff-in-diff estimates, interacting capital raised with market concentration indices, and when we allow for exogenous variation in the supply of finance from institutional investors, through a 2-stage residual inclusion method.

All is not well with the real effects of financial markets, though. The celebrated hero of startup finance, venture capital, is not systematically associated with entry

in our sample, possibly reflecting the flow of venture capital finance towards sectors with lower entry opportunities, as already observed in previous periods (see Murray, 1999; Jeng and Wells, 2000; Mayer et al., 2005 and the discussion in Revest and Sapio, 2012). In this latter respect, our results question the beneficial effect of VC theorized by Michelacci and Suarez (2004) in their recycling hypothesis and estimated by Popov and Roosenboom (2013), who however used a cross-country sample.

Quite surprisingly, more capital raised at IPO in the main market does not translate into a greater flow of new firms, possibly because financialized incumbents, under ownership-control separation, have incentives to compete fiercely in order to sustain their stock prices.

As suggested by our results, the relative illiquidity of a junior listing venue such as AIM is not, as such, a limiting factor with respect to providing signals for new firm formation, despite previous evidence highlighting the opacity and speculative behaviors typical of this listing venue (see e.g. the debate on the survival rates in Espenlaub et al., 2012 and Gerakos et al., 2013), and the unsatisfactory real and financial performances of AIM-listed firms (see for instance the results on the declining labour productivity by Revest and Sapio, 2013b). The number of small caps and the amounts of raised capital on the junior stock market may have been taken as indicators by prospective firm founders, helping mitigate the uncertainty faced in launching their entrepreneurial activities. Yet, this does not mean that junior markets are able to provide reliable estimates of the fundamental value of the listed shares. Rather, the risk is that founders and managers of new firms place much too weight on market value in their decision processes. The number of entrants can be inflated by false expectations, disconnected from the real value of the existing firms. Fostering entry is, after all, a necessary but not sufficient condition for generating highly-skilled, innovative jobs.

In line with the literature on economic geography, an interesting future direction of research would be to focus on the regional level of firm formation. Does the influence of AIM on firms birth rates differs according to the region concerned? Are the more active industrial sectors in the firms creation located in London and in the south-eastern region? This may extend works on the influence of VC on entry across regions (Mollica and Zingales 2007; Samila and Sorenson 2011).

On a final note, our econometric approach implicitly assumes that public and private equity are substitutes. Carpentier et al. (2010) offered an example of this, as the Toronto Stock Exchange Venture market, dedicated to micro-cap firms at a pre-revenue stage, was found to offer comparable returns to investors as VC. Yet, future research may need to develop econometric models able to account for the dual relationship between private and public equity, which can be viewed as complementary (stock market quotation is a possible exit route for venture

capitalists, see e.g. Jeng and Wells 2000) or substitutes (junior markets and VC funds may target the same firm types), and thus provide new answers to the question posed by Black and Gilson (1999) on stock market activity as a prerequisite for developed venture capital industries.

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Appendix

Table 1: Correspondence table: NACE Rev. 2, ICB, FTSE.

	NACE Rev. 2	**ICB**	**FTSE**
100	Manufacture of food products	3570	43
110	Manufacture of beverages	3530	41
120	Manufacture of tobacco products	3780	49
160	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	1730	15
171	Manufacture of pulp, paper and paperboard	”	”
172	Manufacture of articles of paper and paperboard	3720	47
180	Printing and reproduction of recorded media	5550	54
191	Manufacture of coke oven products	1770	4
192	Manufacture of refined petroleum products	530	7
200	Manufacture of chemicals and chemical products	1350	11
210	Manufacture of basic pharmaceutical products and pharmaceutical preparations	4570	48
221	Manufacture of rubber products	3350	31
222	Manufacture of plastic products	3720	47
230	Manufacture of other non-metallic mineral products	2350	13
240	Manufacture of basic metals	1750	18
251	Manufacture of structural metal products	2350	13
252	Manufacture of tanks, reservoirs and containers of metal	3720	47
253	Manufacture of steam generators, except central heating hot water boilers	2750	26
254	Manufacture of weapons and ammunition	2710	21
255	Forging, pressing, stamping and roll-forming of metal; powder metallurgy	1750	18
256	Treatment and coating of metals; machining	”	”
257	Manufacture of cutlery, tools and general hardware	3720	47
259	Manufacture of other fabricated metal products	2350	13

Table 2: Correspondence table: NACE Rev. 2, ICB, FTSE (continued).

	NACE Rev. 2	ICB	FTSE
261	Manufacture of electronic components and boards	2730	25
262	Manufacture of computers and peripheral equipment	9570	93
263	Manufacture of communication equipment	”	”
264	Manufacture of consumer electronics	3740	34
265	Manufacture of instruments and appliances for measuring, testing and navigation; watches and clocks	2730	25
266	Manufacture of irradiation, electromedical and electrotherapeutic equipment	4530	44
267	Manufacture of optical instruments and photographic equipment	4530	44
270	Manufacture of electrical equipment	2730	25
280	Manufacture of machinery and equipment n.e.c.	2750	26
290	Manufacture of motor vehicles, trailers and semi-trailers	3350	31
301	Building of ships and boats	2750	26
302	Manufacture of railway locomotives and rolling stock	”	”
303	Manufacture of air and spacecraft and related machinery	2710	21
309	Manufacture of transport equipment n.e.c.	3350	31
310	Manufacture of furniture	3720	34
322	Manufacture of musical instruments	3740	53
323	Manufacture of sports goods	”	”
324	Manufacture of games and toys	”	”
325	Manufacture of medical and dental instruments and supplies	4530	44

Table 3: Summary statistics of the variables used in the econometric analysis.

Variable	Obs.	Mean	Std. Dev.	Min	Max
Entry	814	122.039	263.96	0	2640
Exit	814	165.424	387.708	0	3720
Number of firms	814	1862.383	4433.417	0	35840
Output per hour, annual rate of growth (%)	814	2.881	5.870	-13.6	22.8
Money raised at IPO, AIM (million pounds)	814	28.776	56.053	0	443.01
Money raised at IPO, LSE Main Market (million pounds)	814	46.990	288.020	0	7036.58
Venture capital invested amounts (million pounds)	814	103.085	200.712	0	2890
Money raised at IPO, AIM (dummy)	814	.603	.490	0	1
Money raised at IPO, LSE Main Market (dummy)	814	.150	.357	0	1
Venture capital invested amounts (dummy)	814	.929	.257	0	1
Number of AIM small caps (cap. < 5 million pounds)	814	8.265	9.129	0	87

Table 4: Time evolution of the variables used in the econometric analysis: annual averages across manufacturing sectors between 2004 and 2012.

Year	Entry	Exit	N. of firms	Output per h., annual change	M. raised IPO, MM (mill. GBP)	M. raised IPO, AIM (mill. GBP)	VC invest. (mill. GBP)	N. AIM small caps
2004	176.960	218.446	2207.568	6.396	60.218	41.461	71.965	6.551
2005	162.905	194.662	2158.986	3.897	151.906	50.574	68.696	8.764
2006	144.189	169.662	2117.230	4.812	29.561	87.383	260.867	8.702
2007	152.095	174.460	2098.986	4.286	56.186	53.830	464.102	8.702
2008	171.892	210.338	2514.257	2.358	15.094	23.396	86.091	14.646
2009	145.473	247.905	2513.784	-3.443	.837	.568	93.977	9.108
2010	128.446	224.324	2397.297	4.500	41.063	33.052	99.160	5.972
2011	130.473	190.135	2264.865	2.180	100.221	7.896	80.306	6.782
2012	130	189.730	2213.243	-3.307	2.222	6.644	51.865	6.918

Table 5: Nomenclature.

Symbols	**Definitions**	**Data sources**
s	NACE Rev. 2 sector	(see Tables 1 and 2)
t	Year	
$entry_{s,t}$	Firm births	ONS
$exit_{s,t}$	Firm deaths	ONS
$n_{s,t}$	Number of firms	ONS
$\Delta oph_{s,t-1:p}$	Change in output per hour between years $t-p$ and $t-1$	ONS
$aim_{s,t}$	Money raised at IPO on AIM	LSE
$aim.small_{s,t}$	Number of AIM-listed firms with capitalization < 5 million GBP	own comput. on LSE
$mm_{s,t}$	Money raised at IPO on the LSE Main Market	LSE
$vc_{s,t}$	Venture capital amounts invested by sector of destination	BVCA
$x_{s,t-p}$	$\frac{1}{p}\sum_{k=1}^{p} x_{s,t-k}$	
	where $x \in \{entry, exit, n, aim, aim.small, mm, vc\}$	own computation
HHI_s	Herfindahl-Hirschman index, average between 1997 and 2009	own comput. on Amadeus

Table 6: NegBin, Poisson, and log-linear models of entry; one-way and two-way FE estimators.

	(i) $entry_{s,t}$, NegBin elast.		(ii) $entry_{s,t}$, NegBin elast.		(iii) $entry_{s,t}$, NegBin elast.		(iv) $entry_{s,t}$, NegBin elast.		(v) $entry_{s,t}$, Poisson elast.		(vi) $log(entry_{s,t})$, OLS elast.	
											(logs)	
$entry_{s,t-1:3}$	0.321***	(5.73)	0.282***	(5.17)	0.265***	(4.47)	0.286***	(5.10)	0.163***	(3.31)	0.865***	(11.86)
$exit_{s,t-1:3}$	0.170**	(2.26)	0.101	(1.35)	0.153*	(1.75)	0.159*	(1.88)	0.0895	(1.35)	-0.267*	(-1.81)
$n_{s,t-1:3}$	-0.401***	(-3.82)	-0.279***	(-2.65)	-0.326***	(-2.78)	-0.359***	(-3.03)	-0.204**	(-2.11)	0.243	(1.29)
$\Delta oph_{s,t-1:4}$	0.0856***	(4.78)	0.0346*	(1.67)	0.0357*	(1.67)	0.0384*	(1.80)	0.0196	(0.87)	0.00197	(0.82)
											(logs)	
$mm_{s,t-1:3}$	-0.0325**	(-2.23)	-0.0569***	(-3.65)					-0.0127	(-0.77)	-0.00799	(-0.21)
$aim_{s,t-1:3}$	0.0939***	(3.13)	0.0919***	(3.03)					0.0755***	(2.67)	0.0330	(0.78)
$vc_{s,t-1:3}$	-0.0232	(-1.21)	-0.0190	(-1.01)					-0.0175	(-1.30)	-0.00682	(-0.26)
$aim.small_{s,t-1:3}$	-0.000836	(-0.01)	0.172***	(2.61)					0.107	(1.53)	0.0686*	(1.92)
					(IPO value)		(IPO counts)					
$mm_{s,t-1}$					-0.0252***	(-3.35)	-0.0237**	(-2.34)				
$mm_{s,t-2}$					-0.0234***	(-2.78)	-0.0204*	(-1.74)				
$mm_{s,t-3}$					-0.00425	(-0.57)	-0.00335	(-0.29)				
$aim_{s,t-1}$					0.0212	(1.55)	0.0282	(1.19)				
$aim_{s,t-2}$					0.0489***	(3.55)	0.0517	(1.47)				
$aim_{s,t-3}$					0.0365***	(2.85)	-0.00292	(-0.12)				
					(VC value)		(VC counts)					
$vc_{s,t-1}$					-0.0154	(-1.61)	-0.0443	(-1.11)				
$vc_{s,t-2}$					-0.00734	(-0.84)	0.0730*	(1.67)				
$vc_{s,t-3}$					0.00831	(0.73)	0.119***	(3.17)				
$aim.small_{s,t-1}$					-0.00804	(-0.15)	-0.0510	(-0.97)				
$aim.small_{s,t-2}$					-0.0254	(-0.49)	0.0125	(0.24)				
$aim.small_{s,t-3}$					0.200***	(3.14)	0.216***	(3.22)				
Constant											-0.235	(-0.33)
Sector FE	yes		yes		yes		yes		yes		yes	
Time FE	no		yes		yes		yes		yes		yes	
Observations	518		518		518		518		518		518	

t statistics in parentheses. Legend: see Table 5.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Negative Binomial models of entry: two-way FE estimator accounting for various data issues.

	(i) 1-year horiz. elast.		(ii) 2-year horiz. elast.		(iii) 4-year horiz. elast.		(iv) Extens. marg. elast.		(v) Trimming elast.	
$entry_{s,t-1}$	0.241***	(4.28)								
$exit_{s,t-1}$	0.0425	(0.84)								
$n_{s,t-1}$	-0.152**	(-2.10)								
$\Delta oph_{s,t-1:2}$	0.00505	(0.56)								
$mm_{s,t-1}$	-0.0260***	(-3.59)								
$aim_{s,t-1}$	0.00879	(0.63)								
$vc_{s,t-1}$	-0.00584	(-0.70)								
$aim.small_{s,t-1}$	-0.00805	(-0.14)								
$entry_{s,t-1:2}$			0.274***	(5.20)						
$exit_{s,t-1:2}$			0.0852*	(1.72)						
$n_{s,t-1:2}$			-0.240***	(-3.44)						
$\Delta oph_{s,t-1:3}$			0.0166	(1.18)						
$mm_{s,t-1:2}$			-0.0407***	(-3.91)						
$aim_{s,t-1:2}$			0.0450**	(2.19)						
$vc_{s,t-1:2}$			-0.0131	(-1.04)						
$aim.small_{s,t-1:2}$			0.0388	(0.53)						
$entry_{s,t-1:4}$					0.277***	(3.68)				
$exit_{s,t-1:4}$					0.124	(1.23)				
$n_{s,t-1:4}$					-0.343**	(-2.45)				
$\Delta oph_{s,t-1:5}$					0.0575*	(1.73)				
$mm_{s,t-1:4}$					-0.0317	(-1.37)				
$aim_{s,t-1:4}$					0.123**	(2.41)				
$vc_{s,t-1:4}$					-0.00137	(-0.04)				
$aim.small_{s,t-1:4}$					0.0825	(0.74)				
$entry_{s,t-1:3}$							0.315***	(5.81)	0.306***	(5.42)
$exit_{s,t-1:3}$							0.0861	(1.24)	0.106	(1.41)
$n_{s,t-1:3}$							-0.294***	(-3.03)	-0.305***	(-2.86)
$\Delta oph_{s,t-1:4}$							0.0614***	(2.85)	0.0425**	(2.07)
$mm_{s,t-1:3} > 0$							0.00681	(0.32)		
$aim_{s,t-1:3} > 0$							-0.0640	(-1.21)		
$vc_{s,t-1:3} > 0$							0.0125	(0.01)		
$aim.small_{s,t-1:3}$							0.0532	(0.71)	0.154**	(2.36)
$mm_{s,t-1:3}$									-0.0476***	(-3.12)
$aim_{s,t-1:3}$									0.0572*	(1.73)
$vc_{s,t-1:3}$									-0.0151	(-0.77)
Sector FE	yes		yes		yes		yes		yes	
Time FE	yes		yes		yes		yes		yes	
Observations	592		592		444		518		504	

t statistics in parentheses. Legend: see Table 5.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Pseudo diff-in-diff estimates of the Negative Binomial model of entry.

	elast.	
$entry_{s,t-1:3}$	0.2730***	(4.94)
$exit_{s,t-1:3}$	0.0927	(1.22)
$n_{s,t-1:3}$	-0.2640**	(-2.43)
$\Delta oph_{s,t-1:4}$	0.0370*	(1.77)
$mm_{s,t-1:3}$	-0.0337	(-1.10)
$aim_{s,t-1:3}$	0.0843*	(1.70)
$vc_{s,t-1:3}$	-0.0257	(-0.81)
$aim.small_{s,t-1:3}$	0.1710***	(2.60)
$mm_{s,t-1:3} * HHI_s$	-0.0259	(-0.61)
$aim_{s,t-1:3} * HHI_s$	0.0025	(0.04)
$vc_{s,t-1:3} * HHI_s$	0.0087	(0.18)
Sector FE	yes	
Time FE	yes	
Observations	518	

t statistics in parentheses. Legend: see Table 5.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: 2-Stage Residual Inclusion estimates of the Negative Binomial model of entry.

	1st stage, AIM IPO m. raised $aim_{s,t-1:3}$		1^{st} stage, VC invest. $vc_{s,t-1:3}$		2^{nd} stage $entry_{s,t}$	
	elast.		elast.		elast.	
$entry_{s,t-1:3}$	.0030***	(2.70)	-.0006	(-0.16)	.2579***	(3.78)
$exit_{s,t-1:3}$	.0006	(0.44	-.0060	(-1.21)	.0927	(1.14)
$n_{s,t-1:3}$	-.0002	(-1.20)	.0007	(1.26)	-.2534	(-1.94)
$\Delta oph_{s,t-1:4}$	.0145*	(1.96)	.0270	(1.03)	.0342	(1.25)
$mm_{s,t-1:3}$	-.0355*	(-2.82)	0086	(0.19)	-.0538**	(-2.59)
$aim_{s,t-1:3}$					.1345**	(2.01)
$vc_{s,t-1:3}$					-.0343	(-0.52)
$aim.small_{s,t-1:3}$	-.0221***	(-4.01)	.0338*	(1.72)	.1922**	(2.10)
IV: buyouts	.0018***	(3.20)	.0020	(0.98)		
IV: pension f. reform	-.0014***	(-5.02)	.0042***	(4.21)		
IV: pension f. stamp	1.4537***	(6.15)	2.6016***	(3.09)		
1^{st} stage resid: aim					-1.25e-11	(-0.65)
1^{st} stage resid: vc					-2.17e-11	(-0.29)
constant	1.3186***	(7.16)	.9411	(1.43)		
Sector FE	yes		yes		yes	
Time FE	yes		yes		yes	
$\mid -ruleObservations$	518		518		518	
Groups	74		74		74	
corr. resid. - buyouts					.0764	
corr. resid. - p.funds ref.					.0195	
corr. resid. - p. funds stamp					-.0515	

t statistics in parentheses. Legend: see Table 5.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10: 2-Stage Residual Inclusion estimates of the Negative Binomial model of entry, when AIM IPO counts and VC investment counts are suspected of endogeneity.

	1^{st} stage, AIM IPO counts $aim_{s,t-1:3}$, counts		1^{st} stage, VC invest. counts $vc_{s,t-1:3}$, counts		2^{nd} stage $entry_{s,t}$	
	elast.		elast.		elast.	
$entry_{s,t-1:3}$	.0176**	(2.57)	.0692**	(2.44)	.1674**	(2.46)
$exit_{s,t-1:3}$	.0118	(1.40)	.0669*	(1.92)	-.0493	(-0.42)
$n_{s,t-1:3}$	-.0017*	(-1.72)	-.0087**	(-2.08)	-.0673	(-0.49)
$\Delta oph_{s,t-1:4}$	.0528	(1.18)	.2955	(1.59)	.0251	(1.06)
$mm_{s,t-1:3}$ counts	-.5865***	(-7.65)	.0898	(0.28)	-.0381	(-1.30)
$aim_{s,t-1:3}$ counts					.1116	(1.19)
$vc_{s,t-1:3}$ counts					.6085**	(2.12)
$aim.small_{s,t-1:3}$	-.1255***	(-3.74)	-.4901***	(-3.52)	.2698***	(3.31)
IV: buyouts	.0021	(0.61)	.0631***	(4.39)		
IV: pension f. reform	-.0077***	(-4.54)	-.0284***	(-4.06)		
IV: pension f. stamp	4.910***	(3.42)	15.6025***	(2.62)		
resid 1^{st} stage: aim					-3.68e-11	(-1.39)
resid 1^{st} stage: vc					1.36e-11	(1.14)
constant	12.7487***	(11.39)	83.9535***	(18.08)		
Sector FE	yes		yes		yes	
Time FE	yes		yes		yes	
Observations	518		518		518	
Groups	74	74	74		74	
corr. resid. - buyouts					.0589	
corr. resid. - p.funds ref.					.0265	
corr. resid. - p. funds stamp					-.0778	

t statistics in parentheses. Legend: see Table 5.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$