Workplace Flexibility and Entrepreneurship*

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Abstract

Working at home benefits workers with low fixed costs and the ability to engage in joint market and household production. We evaluate a large-scale reform in Singapore that allows the possibility of business creation at one's residential property and study whether the option of home-based entrepreneurship spurs entrepreneurial activities. Difference-in-difference estimate shows that the reform leads to a significantly higher level of business creation. Additional new firms in response to the reform are on average smaller and have a higher survival rate in the long run. The new entrepreneurs are more likely to be the "discouraged workers" (i.e. minority group or too young/old) and from community with lower income. We also exploit the regional variation in the residential land density to assess the impact on aggregate economic outcomes. Regions more exposed to the reform experience higher rate of price growth.

Key words: Entrepreneurship, Home-Base Work, Experimentation

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I. Introduction

Entrepreneurship has long been recognized as a key mechanism for enhancing economic development. The value of supporting entrepreneurship is again confirmed as small businesses acted as one of the most powerful generators of new jobs in the path of global economic recovery from the "Great Recession". Therefore, designing and evaluating policies to remove barriers to entry and foster entrepreneurship intrigues both policy makers and academics. A large body of studies are devoted to investigating factors that discourage entrepreneurship, which include regulation limit, access to capital and downside risk like career concern. At the same time, literature has documented substantial non-pecuniary benefits of self-employment such as enjoyment, control and flexibility, which explain the existence of significant earning differential between self-employment and paid employment (e.g. Hamilton, 2000;Hurst and Pugsley, 2012).

In this paper, we evaluate a large-scale reform that involves both dimensions of reducing the barrier and increasing non-pecuniary benefits to promote entrepreneurship, which is named "Home Office Scheme" and implemented in Singapore in late 2001. The reform is aimed at providing workplace flexibility for potential entrepreneurs and allowing them to set up new business in their homes. The reform provides substantial incentive to promote business creation in three aspects. The forefront benefit is that it reduces the fixed monetary cost that entrepreneurs used to face, including renting office space and commuting expenditure etc. Second, the option of workplace flexibility further enhances the non-pecuniary benefits of being an entrepreneur and allows for engagement in joint market and household production. Third, prior literature has found that social status of entrepreneurs and possible shame from a business failure is an important driving force for the interest in entrepreneurship (Begley and Tan,2001). The reform in this study helps obscure salience of possible business failure and thus avoid experiencing the consequent shame and humiliation. In other words, it reduces the cost of experimentation and enables entrepreneurs to work on an idea with fewer concerns about the possibly negative consequence. This is indeed supported by anecdotal evidence that entry into entrepreneurship increased following the reform[1].

The identification of the reform's impact requires an estimate of the counterfactual level of entrepreneurial activities to filter out the effect of other potential macroeconomic shocks. Our empirical strategy exploits the variation in exposure to the scheme across industries. To ensure that the newly created business do not cause disturbance to the residential neighborhood, the scheme stipulated a negative list of industry type that are prohibited from home-based operation, which constitutes our control group. In contrast, the treatment group contains industries that are allowed under the scheme. Thus, the way that the

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[1] According to Skyline Singapore, "more than 3,000 homeowners have jumped on the bandwagon within the first month to run businesses such as computer design, IT accounting, management consultancy and software programming.."

reform was implemented lends itself to examination with a standard difference-in-difference estimation design.

We start our analysis by verifying the validity of our empirical design. We first confirm the identification assumption that both treatment and control group should display changes in entrepreneurial activity in absence of the program. In addition, we show that the way of classifying treatment and control group is not related with industry-level response to fluctuations in overall economy. The difference-in-difference estimate suggest a positive and significant impact of the reform on new firm formation: firm creation grows by 23 percentage points more following the reform for the treated industries than the control group. We further find that the response to the policy are not uniform but mostly concentrated in the sector of small-scale business. As the reform benefits entrepreneurship by reducing fixed costs of start a new business, we also find that the effect is more pronounced for low-income individuals, for whom the access to capital is most likely to be the foremost barrier to entrepreneurship.

The effective policy to promote entrepreneurship should not only be a short-term endeavor of facilitating entry but the one to create a healthy entrepreneurial ecosystem. We go beyond the focus on the level of entrepreneurial activities and investigate the welfare implication of the reform. In particular, we explore whether the home office scheme leads to a significant change in the quality of newly built firms. Survival analysis indicates that the newly created firms, while they start out in relatively small size, are as likely to exit in the first two years. More interestingly, they exhibit higher level of survival rate in the long horizon. Furthermore, the reform helps mitigate friction in the labor market and leads to a significant entry of "discouraged workers", who are too young/old and from minority group and thus less favored in the labor market.

Finally, we investigate the aggregate impact of the reform and focus on broader outcomes such as house price. The exercise is useful to better understand how the implementation of such reform can affect economic outcomes. To do this, we adopt an empirical design, as in Mian et al. (2015) and Agarwal et al.(2017), to exploit regional heterogeneity in residential density to measure its exposure to the reform because home office scheme mainly targets at redeploying the residential property for the use of starting new business. We document that the program results in a sizable and positive impact on local house price, at least in the near term.

To the best of our knowledge, we are among the first to document that policy allowing for workplace flexibility can promote entrepreneurship and facilitate firm formation. Relative to the survey data in previous studies, the firm registry data is with little measurement error and allows us to draw conclusions at a more comprehensive scale. This approach significantly extends the existing literature, which focuses on the general relationship between working place flexibility on productivity and work-home balance (e.g., Kelly et al., 2014; Bloom et al., 2015). The breath of our dataset allows us to investigate the impact on

public transportation commuting activities, which connects our study to the urban economic literature. Working from home greatly reduces the community activity and lower emissions (Bento, Cropper, and Mushfiq Mobarak, 2005).

We are contributing to the growing literature on barriers that discourage entrepreneurship and policy designed to facilitate entry. Existing studies have suggested evidence that country-level variation in entry regulation affect the entry rates across countries (Djankov et al., 2002; Klapper et al., 2006). Other studies focus on country-level reform on entry regulation and investigate how it affect with workers drawn into entrepreneurship (Mullainathan and Schnabl, 2010;Bruhn, 2011;Branstetter et al., 2014). Our study complements these studies by examining how removing barriers in regulation can increase firm creation. Besides regulation barrier, limited access to finance is also viewed as a top factor that dissuades business creation and growth (Evans and Leighton, 1989;Holtz-Eakin et al., 1994;Hurst and Lusardi, 2004) and numerous studies document that relaxing financial constraint is successful in increasing entrepreneurship (Bertrand et al., 2007;De Mel et al., 2008;William R. Kerr, 2010;Adelino et al., 2015;Schmalz, Sraer, and Thesmar (2017). The reform allowing for home-based entrepreneurship in this paper is also equivalent to a form of monetary transfer to entrepreneurs in terms of reducing the fixed cost of business creation (e.g. renting office space, commuting expenditure). We document that these types of subsidies indeed spur entrepreneurial activities in the relevant industries.

Our paper is also related to the literature that takes the experimental view of entrepreneurship. Entrepreneurship is fundamentally about experimentation because the knowledge and skill set required are unlikely to be known in advance (Kerr, Nanda, and Rhodes-Kropf, 2014). Recent studies (Manso, 2016;Dillon and Stanton, 2017) have taken the theoretical approach to quantify the option value of experimenting entrepreneur ideas. The experimental perspective suggests that the foremost hurdle to entrepreneurship is the friction that discourages experimenting with ideas. These frictions include regulation barriers (Klapper, Laeven, and Rajan, 2006), technology (Ewens et al., 2017), financing risk (Nanda and Rhodes-Kropf 2013) or downside career concern (Hombert et al., 2017;Gottlieb et al., 2017). Our results suggest that allowing for workplace flexibility facilitate entrepreneurship by enabling entrepreneurs to experiment with ideas without incurring high level of fixed cost. This finding has important normative implications for government to design program and policy to reduce the cost of experimentation in general.

The remainder of the paper is organized as follows. Section II introduces the home-based entrepreneurship reform and III presents our data and empirical strategy. Section IV reports the results on the effect of the reform on entrepreneur activities. Section V presents the aggregate impact on house price and commuting activities. Section VI concludes.

II. The Reform and Institution Details

II.A. Home-based Entrepreneurship Scheme

Singapore developed a unique dual residential housing system: public housing is developed and managed by the Housing Development Board while private housing is generally administered by the Urban Redevelopment Authority. We evaluate a program implemented by Ministry of National Development of the Singapore government and aimed at reducing costs for potential entrepreneurs to start a new business. Specifically, under the scheme, small-scale businessmen and professionals are allowed to set up new business in their homes. These changes take two steps: starting from November 2001, the Urban Redevelopment Authority launched a pilot Home-Based scheme allow small-scale businesses to operate from homes located in selected mixed zone areas. Later in 10 June 2003, the Housing & Development Board (HDB) and the Urban Redevelopment Authority (URA) jointly introduced the new Home Office Scheme that apply to all residential units. The general goal was to generate incentives for would-be entrepreneurs to create their own business.

Two important notes are worth mentioning with regards to the reform. First, business registration was forbidden under residential address prior to the scheme. The new policy furnishes entrepreneurs with the flexibility to conduct business from their homes. Second, the scheme also stipulated that homeowners must ensure that their small businesses do not cause disturbance to the neighbors or the residential neighbourhood. As the enforcement, the policy requires all applications to go through the approval process and the use of residential property should not fall into a negative list of industry type that are not permitted. The list of non-permissible business enables us to get an estimate of the counterfactual level of entrepreneurial activities in the absence of the program.

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III. Data and Empirical Strategy

We now describe the sources of our data and the construction of our main variables.

III.A. Sample and Data Sources

We use data primarily from two sources in this study. The basic data is obtained from the *Accounting and Corporate Regulatory Authority(ACRA)*, which is the regulation body to overview business entities. According to section 5 of the *Business Names Registration Act*, generally, all forms of businesses must be registered with the ACRA. Therefore, our registry data contains the universe of firm that are created from 1990 to 2015 in Singapore. For each newly built firm, the data include firm name, the industry that the firm operates in, the registry date as well as firm's legal status (Sole Proprietorship, Partnership, Limited Liability Company, Limited Liability Partnership or Corporation). It also provides the cease date for each firm which we use to conduct the survival analysis. More importantly, it provides the name and national identification number of the founders, which enables us to merge with the demographics data discussed below. To avoid any contamination of other relevant policies in the event window that may promote new firm formation, we focus our analysis on the period of January 1999 to March 2005. The ending period is chosen because an Act permitting registration of Limited Liability Partnership comes into operation in April 2005.

The second data source is a unique personal database containing demographic information on more than 2 million individuals in Singapore, constituting nearly 60% of Singaporean residents as of 2012 (Agarwal et al., 2017). The dataset contains demographic information such as gender, date of birth, race, marital status, housing address (public or private), and postal code. Using the unique personal identification numbers, we are able to cleanly match the firm registry database with the personal demographics database to obtain, with a high degree of accuracy, the demographic profile (including age, race, marital status, and gender) of every individual registered with each new firm. Compared with the survey approach to obtain demographic and personal information of the entrepreneurs in previous studies (e.g. SINE survey in Landier and Thesmar, 2009), our merged dataset contains a richer set of debtor demographic variables with less measurement error.

[Insert Table 1 here]

III.B. Empirical Strategy

III.B.1 Empirical Specification

The biggest obstacle in evaluating the impact of the program on outcome variables is to get an estimate of the counterfactual level in the absence of the program in order to separate the effect from any other shock to macroeconomic fundamentals. An important aspect of the policy for our purpose is that it explicitly lays down the list of industries that are prohibited from home-based operation. This enables us to circumvent the obstacle by exploiting variation in exposure to HAMP and define the treatment and control groups using a standard difference-in-difference analysis. Specifically, firms that operates in the non-permissible sectors are ineligible for home office application and, therefore, can serve as a control group for the treatment group.

Our main difference-in-difference specifications to estimate the effect of the reform is as follows

$$Y_{j,t} = \alpha_0 + \alpha_1 \times T_j \times I(Post)_{j,t} + \alpha_2 \times X_{j,t} + \alpha_3 \times T_j \times Macro_t + \delta_t + \theta_j + \varepsilon_{j,t}, \quad (1)$$

$$Y_{j,t} = \alpha_0 + \alpha_{1\_pre} \times T_j \times I(Pre)_{j,t} + \alpha_{1\_post} \times T_j \times I(Post)_{j,t} + \alpha_2 \times X_{j,t} + \alpha_3 \times T_j \times Macro_t + \delta_t + \theta_j + \varepsilon_{j,t}, \quad (2)$$

Where $Y_{j,t}$ is represent industry-level outcomes like log number of newly created firms for industry j in month t. T_j takes a value of 1 for industries in the treatment group, those falling out of the forbidden list in the Home Office Scheme, and 0 for the control group. $I(Post)_{j,t}$ takes the value of 1 for the month after December of 2001 (the program period) and zero otherwise. $X_{j,t}$ contains time-varying industry-level controls including industry productivity defined as the change in value added per work in each industry. $Macro_t$ denotes variables to account for the macroeconomic environment. The standard errors are clustered at the industry level. The coefficient $\alpha_1 \square$ measures the effect of the program on the treatment group relative to the control group. Moreover, Equation (2) implements a test of the validity of our difference-in-difference design, which requires α_{1_pre} tobe statistically and economically insignificant from zero. $I(Pre)_{j,t}$ is a binary variable that equals to 1 for two-year period before the announcement (January 2000 to November 2001)

We also decompose the post-period dummy to study the dynamics of the response at the two stages of the reform.

$$Y_{j,t} = \alpha_0 + \alpha_{1\_post\_1} \times T_j \times I(Post\_Stage\_1)_{j,t} + \alpha_{1\_post\_2} \times T_j \times I(Post\_Stage\_2)_{j,t} + \alpha_2 \times X_{j,t} + \alpha_3 \times T_j \times Macro_t + \delta_t + \theta_j + \varepsilon_{j,t}, \quad (3)$$

where $I(Post\_Stage\_1)_{j,t}$ is a binary variable that equals 1 for the observations in first stage of reform period (December 2011 to June 2003) and zero otherwise; $I(Post\_Stage\_2)_{j,t}$ is a binary variable that equals 1 for the observations in second stage of reform period (July 2003 to March 2005) and zero otherwise.

III.B.2 Discussion of Identification Validity

We face two major concerns in the identification of our estimate. First, the identification of difference-in-difference estimate in the paper hinges on the validity of parallel trend assumption that requires that in the absence of the program, the difference between treatment and control group would display similar pattern in outcome variable during the period of the program. We provide evidence of this assumption by plotting the number of firm creation in Figure 1. As can be observed, there are no differential trends when we compare the treatment with the control group before the program. The second concern goes to the assumption that the way of classifying treatment and control group is not related with industry-level response to fluctuations in overall economy. If the assumption is violated, we might observe that industries in the treatment and control groups display different evolution even without the reform. To mitigate this concern, we include the interaction term of treatment group dummy and macroeconomic variables, $T_j \times Macro_t$, to capture the impact on outcome variables due to variation in the industry-level repose to macroeconomic fluctuations.

[Insert Figure 1 here]

IV. Results

We start our formal analysis by first estimating the impact of the reform on new business creation. Subsequently, we analyze heterogeneity in the response across different types of firms. We next examine the welfare implication of the reform and check the robustness of main finding with a falsification test.

IV.A. Effect on New Firm Creation

IV.A.1 Baseline Estimation

We start our analysis by first validating our research design. Specifically, we interact the pre- and post-reform period dummy D(Pre) with the treatment group indicator D(non-religious) as in Equation (2) and the estimate is shown in Column (1). The coefficients on the interaction term of D(Post) and D(non-religious) suggests that the firm creation for the treatment group during the pre-reform period is on average 1.8 percentage points lower than the control group, which is small and statistically insignificant. This

confirms the validity of the difference-in-difference design. However, the coefficients on the interaction term of D(Post) and D(Treatment) display a both statistically and economically significant effect: firm creation grows by 23 percentage points more following the reform for the treated industries than the control group. In particular, we estimate equation (1) using the log of number of new firm created in industry j at month t as the outcome variable.

Column (2) estimate our main specification (Equation (1)) with only month and industry fixed effects and again we find positive and significant α_1, which indicate that the reform indeed spur entrepreneurial activities. We go on to examine the sensitivity of α_1, to the inclusion of other controls. Column (3) and (4) further include industry controls and account for industry exposure to macroeconomic fluctuations. The inclusion of these additional controls barely affects the estimate of α_1. The fact that our estimate appears stable across specifications suggests that, to the extent that the observable characteristics in our data are representative of unobservable, the estimate of α_1, is not due to an omitted variable bias (Altonji et al. 2005).

The home office scheme is implemented in two phases: first in selected areas and then apply to all residential units. So we also investigate the dynamics of the impact at different stages by decomposing the post-reform period and interacting with dummy for treated industries. The estimated results are shown in Column (5) to (7) with controls included progressively. We find that the growth rate of newly created firms firm for the treated industries is significantly higher than the control group at both stages. Intuitively, we expect a bigger impact for the second phrase as it is implemented at a much larger scale. The evidence is consistent with this notion that the impact of the second stage exhibit much larger impact relatively. Overall, the result suggests that there are no significant differences in entrepreneurial activities between the treatment and control group during pre-policy period, and the number of new firms for the treatment group outrace only after the implementation of the home office scheme.

[Insert Table 2 here]

IV.A.2 Addressing the Infra-marginality Concern

In this section, we address the "infra-marginality" concern, that is the marginal propensity cannot be determined by examining the average outcome given potential omitted-variables problem (Anwar and Fang, 2006). In particular, for each industry in the treatment group, we adjust the growth rate based on that in control industries and plot the distribution of the adjusted monthly growth rate in firm creation in treated industries between pre- (January 1999 to November 2001) and post-reform period (December 2001 to March 2005) in Figure 3. As can be seen, the mode of distribution falls in the range of (0,30%], and more than 30% of industries in the treatment group experience higher growth rate by less than 30% lira after the

reform, relative to the control group. These results suggest that the finding we document in IV.A.1 is unlikely to be driven by outliers.

[Insert Figure 3]

IV.B. Heterogeneity Test

Firm Size -- While the idea of home office benefits entrepreneurship by reducing fixed costs of starting a new business, it should work for sectors that conduct small-scale business without high level of personnel. This is also to comply with the requirement in the policy that the newly established businesses must not cause disturbance to the neighbors or the residential neighborhood. Therefore, we expect that the positive effect of the reform on entrepreneurship is mainly driven by firms with relatively small scale. To test this hypothesis, we classify our full sample of newly created business into two groups based on the size at registration. The new business is considered to be large (small) if the number of individuals is more than (equal or less than) three. We estimate our main specification for the two subsamples respectively and the results are shown in Panel A of Table 4. The coefficients on the interaction term at the most saturated specification is 0.230 (significant at the 1% level) for small-scale firms and -0.002 (insignificant) for firms with large number of employees. The evidence that the increase in new firm creation is mostly concentrated among small-scale business lends further support for the impact of home office scheme in driving the difference-in-difference estimate.

Lowering Entry Cost – According to the experimental perspective, the foremost hurdle to entrepreneurship is the cost related to experiment with new business ideas or projects. Allowing for workplace flexibility promote entrepreneurship by reducing the fixed costs of starting a new business, which includes expenses on renting office space and commuting expenditure etc. Following this idea, the positive effect of the reform on the propensity to start a business is expected to be more prevalent among individuals with financial constraint where such fixed costs are more likely to be the barrier for individuals to enter entrepreneurship. We collect the data on all communities where entrepreneurs live in our sample and use the community-level median income as the proxy for entrepreneur's financial constraint. A community is considered to be rich (or poor) one if the median income is higher (or lower) than the median of the distribution. Columns (1)-(2) and (3)-(4) of Panel B report the results from estimating Equation (1) to obtain estimates of α_1 for the two subsamples separately. The results are again consistent with our hypothesis and unambiguously show that the gap in the sensitivity of entrepreneurial activity to the home office scheme is relatively higher among entrepreneurs with financial constraint than the counterparts.

[Insert Table 3 here]

IV.C. Welfare Implication

IV.C.1 Quality of the Start-ups

Removing barriers to entrepreneurship has been a major objective for policy-makers to design programs. However, evaluating the welfare implication of the policy crucially depends on how individuals self-select into the entrepreneurship because there exists a substantial amount of heterogeneity for would-be entrepreneurs (Hombert et al,2017). We now explore whether the home office scheme lead to a significant change in the quality of newly built firms. The measure we focus on is how well the start-ups can survival in the following years. A high attrition rate (or low survival rate) indicate relative lower firm quality, or in other words, evidence that is less in favor of the welfare-enhancement of this policy.

We first use a Cox-proportional hazard model to explicitly incorporate the history for each firm before they are terminated. In the model we track all newly created firms during the sample period and consider two states depending on whether the firm is ceased or still alive. Regressions are estimated using month, firm's region and industry fixed effects. In Table 5 we present the estimate of hazard ratio using all newly created firm in our sample. As is evident in Panel A, the difference-in-difference result suggests that the exit rate of newly created firms after the home office scheme decreases by 29% relative to that of the comparable start-ups in the control industries. In Column (4) and (5), we report the estimates for firms created in the pre- and post-policy period separately. Before the policy, new firms in the treated industries are 8.8% more likely to exit than the control groups, consistent with existing cross-country evidence on small ventures. However, the start-ups induced by the reform exhibit lower cease rate by 23.1%.

We further assess the robustness of our results and investigate how the policy influences the firm's probability of exit in different time horizons. Specifically, we run OLS using dummies for start-up's survival during the first till five years. We present the estimates in Panel B. As can be observed, the coefficients on the interaction term are all positive and significant except for the first two years. In other words, the additional firms created by the reform are as likely to exit during the first two years but exhibit much higher survival rate in a longer time horizon. The estimates are, once again, economically meaningful. For example, if we consider 5-year survival, the rate for the additional firms created by the reform is higher in absolute terms by about 5.4%, which is equivalent to 6.9% increase relative to the sample mean as reported in Table 1. Overall, the evidence in this section indicates that the home office scheme effectively spurs entrepreneurial activities and attract more entry into self-employment without significantly lowering the average quality of the pool. Instead, the additional start-ups exhibit higher survival rate due to the benefit in fixed cost reduction.

[Insert Table 4 here]

IV.C.2 Composition of New Entrepreneurs

In the world's path of recovering from the "Great Recession", small businesses have been among the most powerful generators of new jobs historically, confirming the value of a stronger focus on supporting small businesses and encouraging entrepreneurship. While no crisis overlaps with our sample period, one welfare implication of the home office scheme we can examine is its success in mitigating frictions of local labor market. One such example is that literature has shown evidence of labor market discrimination against certain groups of job searchers that are termed as "discouraged workers" in the literature (e.g. Schweitzer and Smith, 1974; Stern, 1990). In this section, we provide further evaluation of the policy by examining its impact on the composition of new entrepreneurs. One caveat is that we can investigate the impact on demographics conditional on the entrepreneur being a Singaporean because personal database only contains information for Singaporeans. But given the comprehensive coverage of the personal database, the analysis exhibits enough statistical power to provide convincing evidence.

We start our analysis with the full sample and look at the impact on Singaporean entrepreneur vs foreigners. The test is related to long-standing issue of employer's preferential hiring of foreigners and also the government correspondent action in downsizing the quota for foreign workforce in recent years[2]. The estimate in Column (1) reflects that the home office scheme changes the pool of new entrepreneurs by adding significantly more local people. We continue to check the impact using various demographics as dependent variables and work on the sample of Singaporean entrepreneurs. Column (2) and (3) indicates that the newly created firms induced by the reform involves more "discouraged workers", namely the ratio of entrepreneurs young/old and minority group increases by 2.1 and 0.8 percentage points respectively. The estimates are also economically meaningful and equivalent to 9.3% and 7.8% relative to the sample mean. Column (4) and (5) shows no significant change in the composition of entrepreneurs by gender and marital status. Overall, these results are consistent with the view the home office scheme improve the well-being by easing the labor market friction and attracting "discouraged workers", who are shown to be marginally attached or disfavored in the labor market, into self-employment.

[Insert Table 5 here]

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[2] http://www.straitstimes.com/singapore/manpower/workplace-discrimination-complaints-down-but-bias-towards-foreigners-still-the; http://www.transitioning.org/2012/02/16/eight-reasons-why-foreign-workers-are-preferred-over-local-ones/

IV.D. Falsification Test

Finally, we perform a falsification test to further examine the robustness of the results. We examine the impact of the home office scheme by randomly assigning 81 industries into treatment and control group. This specification checks the validity of our design to identify the effect and exclude the possibility that we are establishing a spurious relation between the reform and entrepreneurial outcome. Table 7 reports the result for the falsification test. Specifically, instead of using the non-permissible list of sectors to define the treated industries, we create an indicator variable and randomly assign all industries into treatment and control group. We re-estimate the equation (1) based on this randomized sample. A positive and significant relationship would raise the concern that the documented impact of a chair is driven by simple spurious variation. However, the coefficients on interaction term in Table 7 are indistinguishable from zero and indicate that the identification of our main findings is not due to random variation.

[Insert Table 6 here]

V. Aggregate Impact on House Price and Public Transportation Activity

In this section, we explore the impact of the reform on regional variables such as house prices and public transportation commuting activities to shed light on a broader set of economic outcomes. To do this, we use an empirical design to exploit regional heterogeneity in exposure to the reform. The key idea is that home office scheme mainly targets at redeploying the residential property for the use of starting new business and therefore regions with high level of residential density are expected to have more exposure to the program. To do this, we collect the data on distribution of land with different uses in each region and exploit variation in residential land density to capture the regional exposure to the home office scheme. Specifically, we compute the proportion of residential land in each region. In addition, we create a dummy as an indicator for regions with high(low) level of residential land density. This approach is similar to that used by Mian and Sufi (2012) in their study of the effects of the "Cash-for-Clunkers" program and Agarwal et al.(2017) to evaluate the Home Affordable Modification Program.

V.A. House Price

To estimate the effect of the home office scheme on house price during the implementation period, we follow Mian, Sufi and Trebbi (2015) and adopt the following region-level specification:

$$Ln(Y_{post,s}) - Ln(Y_{pre,s}) = \alpha_0 + \alpha_1 \times Exposure_s + X_s + \varepsilon_s, \quad (5)$$

Where the left-hand side variable is the growth rate of house price in region s from the pre-reform to post-reform period. $Exposure_s$ denotes our measures of the program exposure in region s as discussed above. X_s represents region-level controls, including median income and unemployment rate. Table 9 presents the OLS estimate of the impact of home office scheme on house price growth. Columns (1) to (4) focus on different measures of the program exposure. As the estimate show, the home office scheme induces a positive effect on house price growth locally. For example, the coefficient suggests that a one-standard-deviation increase in regional residential land density leads to a 4.1% to 4.7% relative rise in house price growth, which is a 23%- to 27%-standard-deviation increase in house price growth. In other words, the estimate in column (1) implies that moving from a region with the 25th percentile residential land density to the region with the 75th percentile foreclosure rate leads to 6.5% higher house price growth from the pre-reform to post-reform period. The inclusion of control variables does not have a large effect on the magnitude of the estimates. We find similar results when the continuous measure is replaced with an indicator variable in Column (3) and (4).

As an alternative way to illustrate the finding above, we also plot the time series evolution of house price growth in regions with high and low reform exposure in Figure 5. While the difference between low and high exposure regions remains relatively stable before the program announcement, the gap between these groups grows starting from the implementation of the home office scheme. In other words, regions with significant exposure to the program saw a meaningful relative increase in house prices after the program's introduction. By the end of our sample period, the difference in house price growth rate is almost exactly zero, which corresponds with the period of the post-reform.

[Insert Table 7, Figure 5 here]

VI. Conclusion

Entrepreneurship has long been embraced as a critical contributor to innovation, job creation and growth of overall economy (e.g. King and Levine, 1993; Guiso, Sapienza, and Zingales, 2004). Reducing the impediments to new business creation and promoting the entrepreneurial ecosystem has become the focus of both policy makers and academics in the policy design and analysis. Such policies come with a variety of forms including funding support, training, access to mentoring and expertise. In this paper, we examine a policy reform that facilitates entry into entrepreneurship by allowing for workplace flexibility. The availability of the option of home-based entrepreneurship reduces the fixed costs of starting a new business, and at the same time, enables would-be entrepreneurs to engage in joint market and household production. Relying on the difference-in-difference strategy, we find that the policy leads to a significant increase in the level of new firm creation, especially in the sector of small-scale business. Moreover, the effect is more

pronounced for low-income individuals, for whom the access to capital is most likely to be the foremost barrier to entrepreneurship.

We also go beyond the focus on the level of entrepreneurial activities and investigate the welfare implication of the reform. While the additional firms induced by the policy start out relatively small at creation, they do not quickly fail but are as likely to exit during the first two years. More interestingly, our findings suggest that newly created firms exhibit much higher survival rate in a longer time horizon. In addition, the reform helps easing the labor market friction and attracting "discouraged workers", who are shown to be marginally attached or disfavored in the labor market, into self-employment. Although we study the effect of an entrepreneurial policy reform in Singapore, our results propose a broader link that applies to all relevant settings. Our result highlights the importance of providing flexibility and also the necessity of accounting for heterogeneity in would-be entrepreneur's ability in designing policies of entrepreneurship promotion.

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Figure 1 Business Creation: Treated vs Control

The figure plots the 12-month moving average of the number of business created in the treated and control industries from January 2000 to March 2005 (1999 does not appear because of the 12-month average). The vertical lines correspond to the reform period (1st stage, December 2001 to June 2003; 2nd stage, July 2003-)
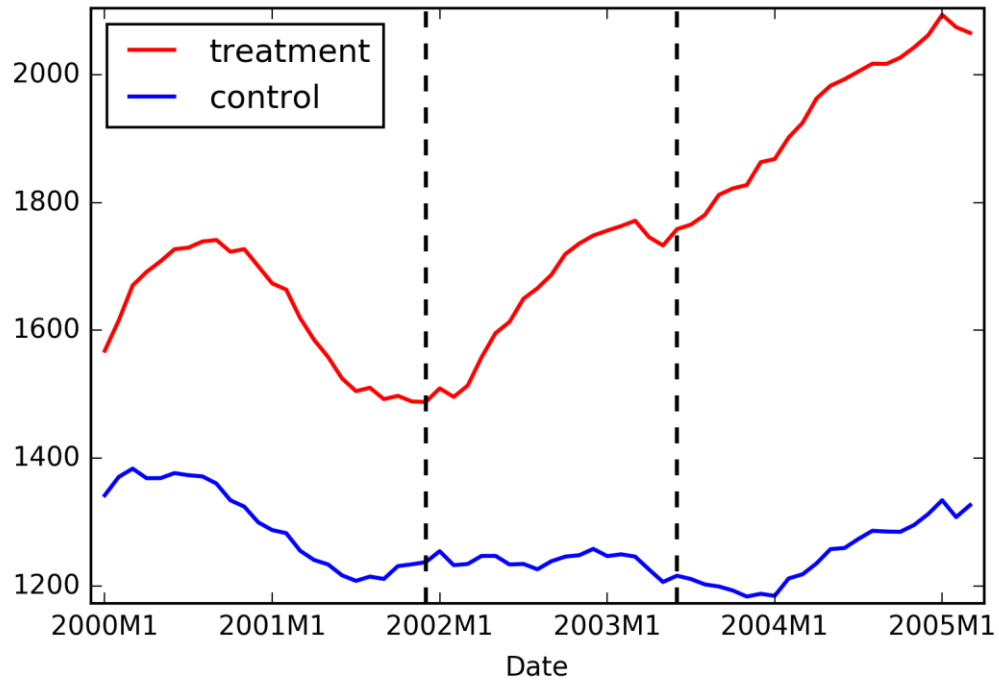
Figure 2 Distribution of Firm Creation in Treated vs Control Industries

The figure plots the regional distribution of *Treated Firm Creation Intensity*, defined as the ratio of number of firm created in treated industries to the total number in both treated and control industries within a Singaporean district, during our sample period (January 1999 to March 2005).
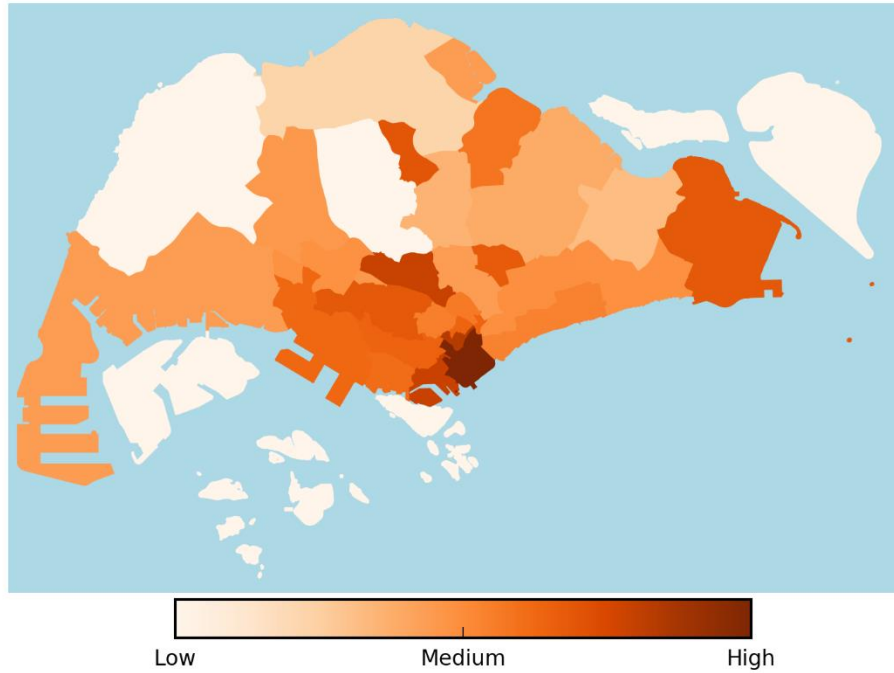
Figure 3 Distribution of Growth Rate in Firm Creation

The figure plots the distribution of the monthly growth rate in firm creation in treated industries between pre-(January 1999 to November 2001) and post-reform period (December 2001 to March 2005). The growth rate is adjusted based on that in control industries.
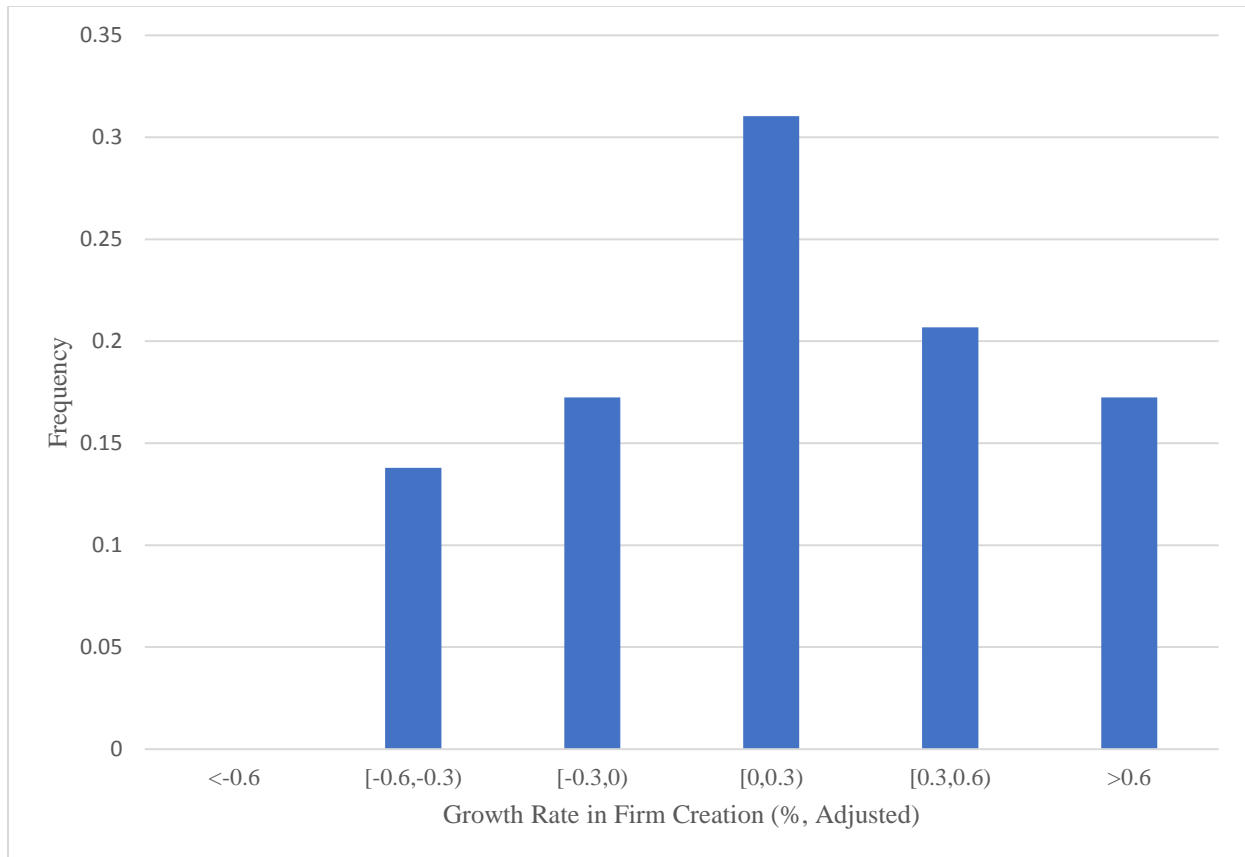
Figure 4 Survival Rate of New Business Created

The figure plots the Kaplan-Meier survival curve by treated and control group during pre-(January 1999 to November 2001) and post-reform period (December 2001 to March 2005).

Kaplan-Meier estimate: Pre-reform

treatment = 0   treatment = 1

Kaplan-Meier estimate: Post-reform

treatment = 0   treatment = 1
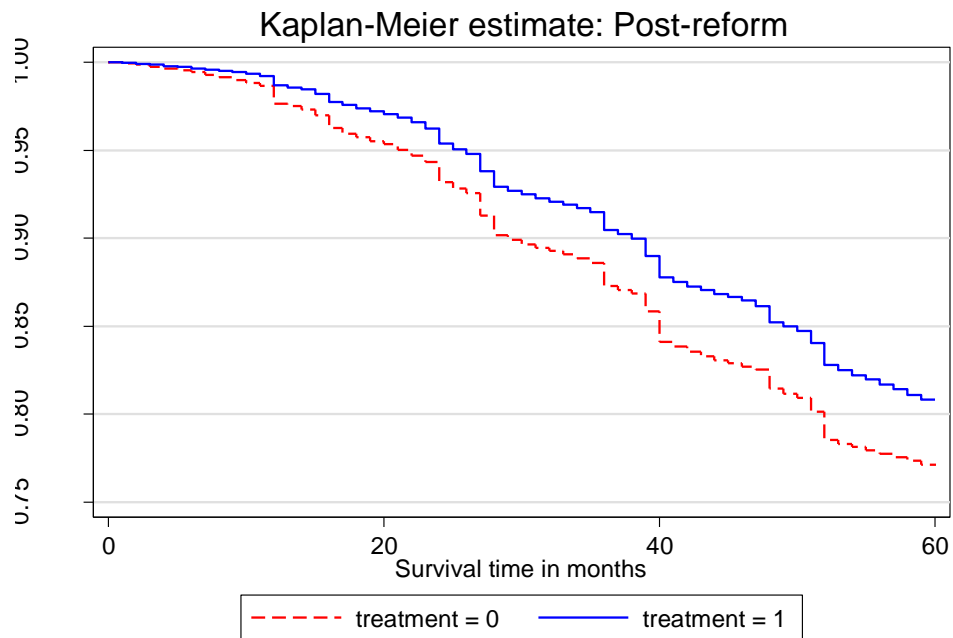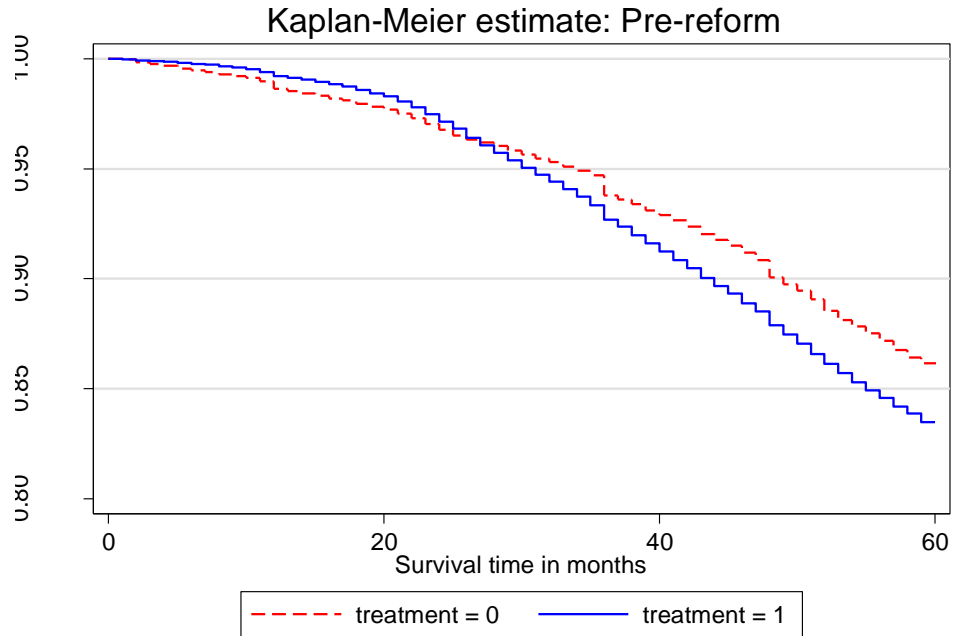
Figure 5 Quarterly House Price Growth in High and Low Exposure Areas

The figure shows the time series evolution of the average house price growth rates during our sample period (1999Q1 to 2005Q1). The high exposure group is represented by the solid line, and the low exposure group is represented by the dashed line.
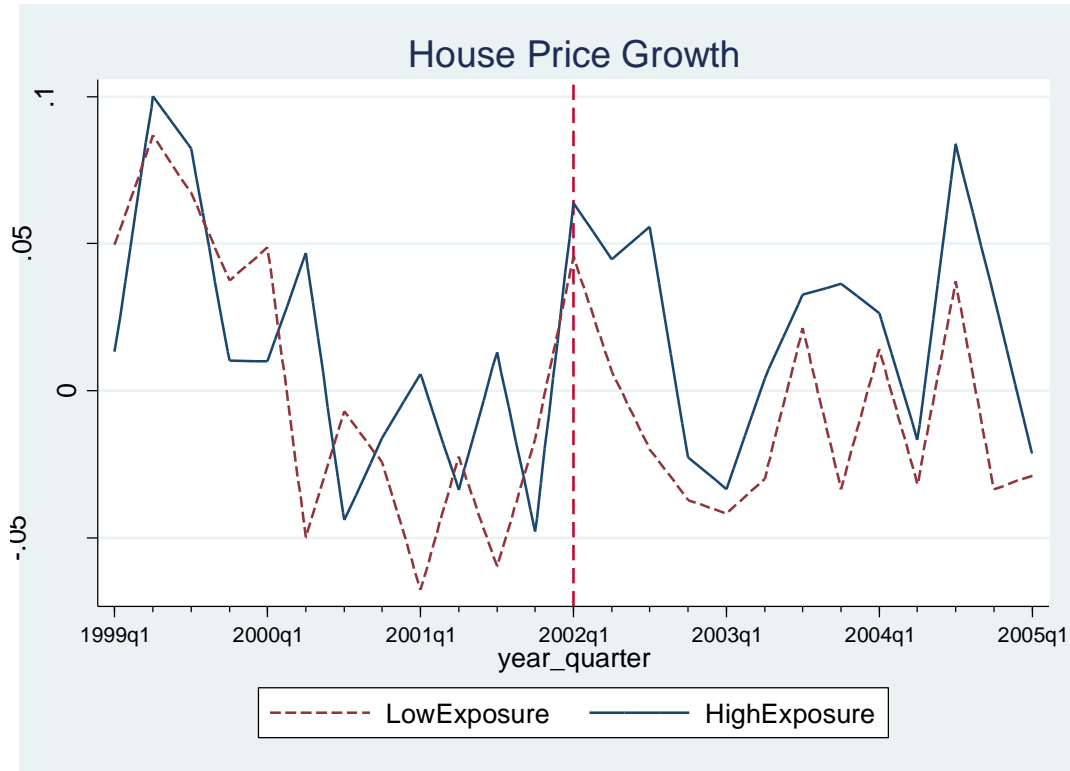
Table 1 Summary Statistics

The table report summary statistics for all new firms created during the sample period. Panel A report the industry-level statistics on business creation while Panel B and C presents the firm-level statistics on business's characteristics and entrepreneur demographics.

	N	mean	sd	p25	p50	p75
Panel A Industry-level						
Number of firms created (monthly)	6075	37.23868	90.12133	1	9	35
Panel B Firm Characteristics: Full Sample						
Employment at creation	124204	3.302	3.762	1	2	4
Survive during the first year	124204	0.954	0.21	1	1	1
Survive during first two years	124204	0.926	0.262	1	1	1
Survive during first three years	124204	0.882	0.322	1	1	1
Survive during first four years	124204	0.833	0.373	1	1	1
Survive during first five years	124204	0.782	0.412	1	1	1
Panel C Entrepreneur Demographics: Singaporean Sample						
Age	85770	39.535	8.714	33	39	45
Ratio of Young/Old	85770	0.224	0.373	0	0	0.5
Male	85770	0.666	0.401	0.5	1	1
Married	85770	0.585	0.439	0	0.667	1
Chinese	85770	0.898	0.289	1	1	1
Malay	85770	0.048	0.204	0	0	0
India	85770	0.039	0.184	0	0	0
Others	85770	0.014	0.106	0	0	0
Non-Chinese	85770	0.102	0.289	0	0	0

Table 2 Home Office Scheme and Business Creation

The table investigates the impact of the home-office scheme on firm creation. The sample includes 81 industries, January 1999 - March 2005, monthly. The sample period is selected to avoid the confounding effect of 97-98 Asian financial crisis and Singapore's Limited Liability Partnership Act of 2005 implemented in April 2005. *Pre* is a dummy equal to 1 for the observations during the period from 200001-20011, otherwise 0. *Post* is a dummy equal to 1 for the observations after the reform (200112-200503), otherwise 0. *Post_1_Stage* is a dummy equal to 1 for the observations in first stage of reform period (200112-200306), otherwise 0. *Post_2_Stage* is a dummy equal to 1 for the observations in second stage of reform period (200307-200503), otherwise 0. *Treated* is a dummy equal to 1 if the industry does not belong to the forbidden industry in the Home Office Scheme. *Industry productivity* is the change in value added per work in each industry. *GDP Growth* is the annual GDP growth in Singapore. *, **, *** denotes significance at the 10%, 5%, and 1% levels, respectively.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Log (1+number of new firms created in an industry at a month)						
Treated*Pre	-0.018						
	(-0.35)						
Treated*Post	0.230***	0.236***	0.237***	0.220***			
	(2.76)	(3.21)	(3.26)	(3.04)			
Treated*Post_1_Stage					0.117**	0.117**	0.118**
					(1.96)	(2.01)	(2.05)
Treated*Post_2_Stage					0.344***	0.344***	0.343***
					(3.69)	(3.72)	(3.45)
Constant	2.203***	2.203***	2.204***	1.148***	2.203***	2.204***	2.202***
	(44.35)	(44.40)	(43.43)	(3.51)	(44.40)	(43.33)	(40.99)
Control for industry productivity	No	No	Yes	Yes	No	Yes	Yes
Treated*GDP Growth	No	No	No	Yes	No	No	Yes
Month FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	6,075	6,075	6,075	6,075	6,075	6,075	6,075
R-squared	0.94	0.94	0.94	0.94	0.94	0.94	0.94

Table 3 Business Creation: Heterogeneity Test

The table explores the heterogeneity of the impact of the home-office scheme on firm creation. The sample includes 81 industries, January 1999 - March 2005, monthly. *, **, *** denotes significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
Dependent Var. = Log (1+number of new firms created in an industry at a month)				
Panel A By number of employees at creation				
	>3 employees at creation		<=3 employees at creation	
Treated*Post	0.013	-0.002	0.247***	0.230***
	(0.40)	(-0.06)	(3.37)	(3.20)
Constant	0.235***	-0.377	2.182***	1.271***
	(5.25)	(-1.15)	(44.79)	(3.93)
Control for industry productivity	No	Yes	No	Yes
Treated*GDP Growth	No	Yes	No	Yes
Month FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	6,075	6,075	6,075	6,075
R-squared	0.67	0.67	0.94	0.94
Panel B Rich vs Poor Community				
	Rich Community		Poor Community	
Treated*Post	0.175***	0.151**	0.242***	0.233***
	(2.90)	(2.61)	(3.52)	(3.37)
Constant	0.657***	-0.837**	1.308***	0.240
	(13.79)	(-2.28)	(31.52)	(0.74)
Control for industry productivity	No	Yes	No	Yes
Treated*GDP Growth	No	Yes	No	Yes
Month FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Observations	6,075	6,075	6,075	6,075
R-squared	0.86	0.86	0.91	0.91

Table 4 Quality of Business Created: Survival Analysis

Panel A of the table reports the estimated hazard ratios from Cox-proportional hazard models of firm exit. Estimates on discrete variables represents the effect from moving from zero to one. Panel B presents the OLS estimate of firm's survival. *D(Survival)* is a dummy equal to 1 if the business survives during the first /two/three/four/five years. The sample includes all firms in the 81 industries created in the period of January 1999 - March 2005. *, **, *** denotes significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
Panel A Hazard regression					
		Full Sample		Pre-reform	Post-reform
Treated				1.088***	0.769***
				(3.27)	(-15.51)
Treated*Post	0.704***	0.713***	0.710***		
	(-11.72)	(-11.30)	(-11.23)		
Control for industry productivity	No	No	Yes	Yes	Yes
Treated*GDP Growth	No	No	Yes	Yes	Yes
Region FE	No	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Observations	124,204	124,204	124,204	46,526	77,678
Panel B OLS regression					
			D(Survival)		
	1 year	2 years	3 years	4 years	5 years
Treated*Post	-0.004	0.007	0.032***	0.049***	0.054***
	(-1.06)	(1.16)	(3.08)	(3.03)	(2.95)
Constant	0.923***	1.041***	1.430***	1.512***	1.539***
	(12.89)	(11.83)	(13.03)	(8.34)	(7.31)
Control for industry productivity	Yes	Yes	Yes	Yes	Yes
Treated*GDP Growth	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Observations	124,204	124,204	124,204	124,204	124,204
R-squared	0.01	0.02	0.04	0.04	0.05

Table 5 Business Creation and Entrepreneur Characteristics

The table examines the impact of home office scheme on the ex-ante measures of entrepreneur Characteristics of new business created. Column 1 includes all firms in the 81 industries created in the period of January 1999 - March 2005 and Column 2-5 focus on the sample of firms created by Singaporean when we can merge with the demographics data. *, **, *** denotes significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
	Full Sample	Singaporean Sample			
	Ratio of Singaporean	Ratio of Young/old	Ratio of Non-Chinese	Ratio of Male	Ratio of Married
Treated*Post	0.009**	0.021**	0.008*	0.019	-0.008
	(2.25)	(2.24)	(1.81)	(1.62)	(-1.23)
Constant	1.135***	0.115	0.246	0.670***	1.247***
	(24.83)	(0.83)	(1.64)	(4.27)	(7.58)
Control for industry productivity	Yes	Yes	Yes	Yes	Yes
Treated*GDP Growth	Yes	Yes	Yes	Yes	Yes
Region FE	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes
Observations	124,204	85,770	85,770	85,770	85,770
R-squared	0.13	0.02	0.04	0.05	0.02

Table 6 Falsification Test – Randomizing the treated industries

The table presents the falsification test for the impact of the home-office scheme on firm creation. The sample includes 81 industries, January 1999 - March 2005, monthly. The treated industries is randomly selected. *Treated* is a dummy equal to 1 if the industry does not belong to the forbidden industry in the Home Office Scheme. *, **, *** denotes significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)
Dependent Var. = Log (1+number of new firms created in an industry at a month)			
Treated*Post	-0.070	-0.070	-0.067
	(-0.98)	(-0.99)	(-0.95)
Constant	2.203***	2.194***	0.667*
	(43.14)	(41.21)	(1.77)
Control for industry productivity	N	Y	Y
Treated*GDP Growth	N	N	Y
Month of the year FE	Y	Y	Y
Month FE	N	N	N
Industry FE	Y	Y	Y
Observations	6,075	6,075	6,075
R-squared	0.94	0.94	0.94

Table 7 Aggregate Effect on House Price Growth

This table presents coefficients of the impact of program exposure, measured by the residential land density, on house price growth (Equation 5). Regional controls in Column (2) and (4) include the regional median income and unemployment rate. Robust t-statistics are reported in parentheses. *, **, *** denotes significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
	Dependent Variable = House Price Growth			
Residential Land Density	0.433**	0.493*		
	(2.12)	(1.95)		
D(High Residential Land Density)			0.132**	0.141**
			(2.03)	(2.36)
Constant	-0.274***	-0.796*	-0.169***	-0.655
	(-4.64)	(-1.96)	(-15.32)	(-1.72)
Regional Controls	N	Y	N	Y
Observations	23	23	23	23
R-squared	0.06	0.23	0.15	0.32