

Working Papers

RESEARCH DEPARTMENT

WP 19-52

December 2019

<https://doi.org/10.21799/frbp.wp.2019.52>

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ISSN: 1962-5361

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Financial Constraints of Entrepreneurs and the Self-Employed

Vyacheslav Mikhed, Sahil Raina, and Barry Scholnick*

December 2019

Abstract

Growth-oriented entrepreneurial start-ups generate more economic growth than other self-employed businesses, yet they only constitute a small fraction of start-ups. We examine whether financial constraints impede these types of start-ups by exploiting lottery wins as exogenous wealth shocks. We find that lottery-win magnitude increases winners' subsequent incorporation, implying that entrepreneurs face financial constraints, but not business registration, implying that financial constraints do not bind as much for the self-employed. Our results, that financial constraints bind for incorporations among men, for serial entrepreneurs, during economic booms, and in neighborhoods without local lenders, are important for understanding the financial impediments to entrepreneurial start-ups.

Keywords: entrepreneurship, self-employment, financial constraints

JEL Codes: L26, M13, G21

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1 Introduction

Small business starts have been in decline for the past two decades in the U.S. and Canada.¹ A possible explanation for this trend is that financial constraints serve as a barrier to entrepreneurship. Even though start-ups are believed to be important for economic growth, only a small portion of small businesses are responsible for the growth attributed to them (these are often labeled as entrepreneurial firms).² This fact raises the key question: Are there differences between the financial constraints faced by these entrepreneurial business starts versus other self-employed business starts? We address this question by examining whether potential entrepreneurs and other self-employed individuals respond differently to an exogenous shock that loosens their financial constraints. We also examine under which conditions entrepreneurs and the self-employed are financially constrained.

Following Levine and Rubinstein (2017, 2019), we use incorporation as a proxy for entrepreneurs and unincorporated firm registration as a proxy for other self-employed businesses. Our decision to categorize firms as entrepreneurial based on their legal form is motivated by Levine and Rubinstein’s argument that “conceptually, the corporation’s defining legal characteristics—limited liability and a separate legal identity—are most useful for undertaking large, risky investments that require external financing ... [W]hen they start larger, risky—more “entrepreneurial”—ventures, they will incorporate.” Using this reasoning, we separate firms into entrepreneurial and other self-employed businesses, based on whether they are established as incorporated or unincorporated entities.

To identify the effect of relaxing financial constraints on entrepreneurs and other self-employed, we use plausibly exogenous variation in randomly sized lottery wins. With this approach, we follow a large literature that uses various plausibly exogenous wealth or credit shocks (e.g., house price shocks, unexpected inheritance, lottery win, the removal of bankruptcy flags)³ to study the

¹As reported by the Census Bureau, there were 20% fewer firms started in 2015 than in 2006 (<https://www.census.gov/newsroom/press-releases/2017/business-dynamics.html>). *The New York Times* points out that the “share of younger companies – less than one year old – in the United States has declined by almost half over the last generation” (<https://www.nytimes.com/2017/09/20/business/economy/startup-business.html>). See also Decker et al. (2014); Hathaway and Litan (2014); Decker et al. (2016).

²The Small Business Administration points out that 368,262 entrepreneurial firms were responsible for all the job growth in the economy in 2004-2008 (Tracy, 2011). Of these, 367,420 were small businesses (under 500 employees), which comprises just 7.4% of all small businesses in the U.S. (on average, there were 4.993 million small businesses in the U.S. in 2004-2008, according to BLS Business Employment Dynamics data available at http://www.bls.gov/web/cewbd/table_g.txt).

³Examples of these various plausibly exogenous shocks impacting entrepreneurial activity, include variation in the value of houses (e.g., Adelino, Schoar, and Severino, 2015; Corradin and Popov, 2015; Hurst and Lusardi, 2004;

effect of financial constraints on entrepreneurial activity. A finding that positive exogenous wealth shocks increase subsequent entrepreneurial activity supports the hypothesis that individuals face financial constraints when starting their business because the recipients of the positive shocks would not have been able to start the business without the positive shock. To the best of our knowledge, the literature has not previously examined the impact of lottery wins on incorporated and unincorporated businesses *separately*.

To measure incorporated and unincorporated companies, we exploit a unique new corporate registry database provided by the government of a specific Canadian province (which has to remain anonymous because of a nondisclosure agreement). The corporate registry database contains (1) the *universe* of incorporations and (2) the *universe* of business name registrations in this province. In this province, an individual can either select to *incorporate* a new business, which is a costly process but provides advantages in terms of limited liability and separate legal identity, or *register* a new business. Registration has significantly lower filing fees and lower transactions costs than incorporation, but the only legal advantage of registration is that the trading name of that entity cannot subsequently be used by any other business entity.

We match these corporate registry data with lottery winner data,⁴ which include the *universe* of lottery wins in the same Canadian province as our corporate registry data. Our key identification strategy is to exploit the exact dollar magnitude of the lottery win. The identifying assumption is that, conditional on winning the lottery, the dollar magnitude of the lottery win is plausibly random. Our empirical strategy thus involves restricting the sample to lottery winners in the province and examining whether the dollar magnitude of these lottery wins affects winners' incorporations and registrations and the survival of already operating incorporated and registered businesses. Because we can analyze the combined total of subsequent registrations and incorporations, we provide evidence that examining these two categories of businesses jointly can produce misleading results.

Our baseline set of results uses the full sample of lottery winners to examine the effect of a lottery

Schmalz, Sraer, and Thesmar, 2017); unexpected inheritance (e.g., Andersen and Nielsen, 2012); the removal of bankruptcy filing flags as a credit supply shock (e.g., Herkenhoff, Phillips, and Cohen-Cole, 2016) and lottery wins (e.g., Cesarini, Lindqvist, Notowidigdo, and Östling, 2017; Lindh and Ohlsson, 1996; Taylor, 2001; Holtz-Eakin, Joulfaian, and Rosen, 1994).

⁴Cesarini et al. (2017); Lindh and Ohlsson (1996); Taylor (2001); Holtz-Eakin et al. (1994) also examine lottery wins as an exogenous shock impacting entrepreneurship. Our lottery winner data were also used in Agarwal, Mikhed, and Scholnick (2019).

winning amount on the subsequent registration and incorporation of new firms by the winners. The main finding is that winners' incorporations increase with the lottery-win amount, whereas, unincorporated business name registrations generally do not change with lottery-win amount. We interpret these findings as evidence of entrepreneurs being financially constrained and other self-employed not being financially constrained.

Given that a possible public policy goal is to increase business formation by entrepreneurs (because they generate more economic growth compared with business starts by the other self-employed), it is important to document in which specific contexts potential entrepreneurs face financial constraints when starting a business. We thus provide evidence of financial constraints in various contexts. First, we use winners' first names to infer their gender and examine whether women and men face different financial constraints when starting high-growth entrepreneurial businesses and low-growth self-employment ventures. We find that the lottery magnitude has a positive and statistically significant effect on the probability of incorporation among men, and a similar in size but not statistically significant effect on incorporation among women. On the other hand, the size of lottery prize significantly increases women's chances of registering their business name. These results may suggest that men are constrained in starting corporations, which proxies for high-growth businesses, but women are constrained even when registering their business name, measuring low-risk low-growth enterprises.

Second, we examine the effect of financial constraints in economic boom and bust periods separately. Many previous studies argue that the supply of entrepreneurial financing tends to be greater in economic booms than busts. Yet, during the boom period of 2004-2008, we find that the magnitude of the lottery win increases incorporations but does not affect registrations. This result may imply that the demand for entrepreneurial financing for incorporated businesses must exceed any increased levels of the supply of entrepreneurial financing during the boom. On the other hand, during the bust period of 2009-2014, we find that lottery-win size has a significant effect on registrations and no significant effect on incorporations.

Third, we compare lottery winners who have previous business experience and those who have no previous experience. The venture capital literature (e.g., Gompers, Kovner, Lerner, and Scharfstein, 2010) documents that serial entrepreneurs (compared with first-time business owners) receive an increased supply of venture financing, which they also receive earlier in their firms' lives. Our results,

however, indicate that winners with prior business experience are still financially constrained when starting incorporated businesses, which implies that their demand for entrepreneurial financing exceeds any increase in supply from the financial sector. For winners without previous business experience, we find evidence of financial constraints only to starting registered businesses.

Fourth, following the large literature on the soft information hypothesis (e.g., Petersen and Rajan, 2002), we examine whether the effect of a lottery win is different in neighborhoods with and without access to local lenders. These tests examine whether restrictions to the supply of credit because of the distance to local banks create financial constraints for individuals considering business registrations and incorporations. We find that lottery-win magnitude has a significant effect on incorporations only in neighborhoods far from a bank and no effect on registrations or incorporations in neighborhoods close to a bank. These results imply that incorporated (i.e., entrepreneurial) businesses may be financially constrained because of a lack of access to very local credit.

Finally, we use hazard models to examine the effect of lottery-win size on the survival of incorporated businesses run by the lottery winners. We find that if the lottery winner has an existing incorporated business, then the lottery-win size has a significant positive effect on the survival probability of that business. This finding is consistent with existing incorporated businesses being financially constrained. However, we find no effect of lottery-win amount on the survival probabilities of incorporated businesses established after a lottery win. In addition, incorporated businesses opened by lottery winners have the same probability of survival as businesses opened by non-winners. These findings suggest winners' businesses are not of worse quality than other businesses.

Taken together, these findings suggest that, while only entrepreneurship is financially constrained overall, in various different circumstances, both entrepreneurial businesses (incorporations) and self-employed businesses (registrations) face financial constraints. As such, lumping these two types of business starts together may mask important differences between them. Our findings also suggest that policies to support economic growth during busts through new business formation may not be effective when directed at corporations as these businesses are not constrained in busts. On the other hand, other business starts (registrations) may benefit from cash infusions that reduce unemployment among the self-employed.

2 Contributions to the Literature

Our paper fits into the recent stream of research in entrepreneurship that emphasizes that not all individuals classified as “self-employed” are the same, and that a few entrepreneurial firms generate most economic growth (e.g., Levine and Rubinstein, 2017, 2019; Gendron-Carrier, 2018; Herkenhoff et al., 2016; Schoar, 2010).⁵ The closest empirical study to ours is Levine and Rubinstein (2019), which also examines differences in incorporated and unincorporated firms. However, it uses the NLSY79 panel data to examine who selects into incorporated or unincorporated firms and uses regional variation in house prices as exogenous income shocks. As we describe in detail next, our very different identification strategy and data allow us to address a set of very different questions.

Other papers disaggregate entrepreneurs and other self-employed using various other techniques. Herkenhoff et al. (2016), for example, examines financial constraints in the creation of *employer* firms (defined as having at least one employee), and *self-employed* firms (defined as having no employees) in response to credit supply shocks (resulting from the removal of bankruptcy flags). However, their employee-based distinction captures the ex-post growth of firms, while we capture their ex-ante underlying legal nature. Gendron-Carrier (2018) also exploits the distinction between incorporated and unincorporated firms to distinguish between entrepreneurs and the other self-employed, which they are able to observe using tax filings undertaken by the different types of firms. This paper does not focus on financial constraints, however, but rather examines how issues such as human capital accumulation and non-pecuniary benefits impact selection into incorporation.

As described previously, our use of lottery wins as an exogenous shock in this context follows a number of other studies, including Cesarini et al. (2017); Lindh and Ohlsson (1996); Taylor (2001); Holtz-Eakin et al. (1994). The main advantages of our lottery-winner data is that we can observe the exact name and address of the winner, the exact date of the win, and the exact dollar amount of the win. Additionally, as we discuss later, lottery winnings in Canada are not taxed, which eliminates tax avoidance-related incentives to incorporate for our sample.

While our paper exploits lottery wins as an exogenous shock, a related literature has examined

⁵The literature on entrepreneurship has long reflected that there are multiple ways of measuring who is an entrepreneur. Hurst and Lusardi (2004), for example, argues that “theory provides little guidance on how to classify ‘entrepreneurs’” (p. 322). Schoar (2010) makes essentially the same argument, distinguishing between what it refers to as “subsistence” and “transformational” entrepreneurship. Other authors who also emphasize this point include Evans and Leighton (1989), Hurst and Pugsley (2011), and La Porta and Shleifer (2014).

the effect of exogenous shocks to housing on entrepreneurship (e.g., Adelino et al., 2015; Corradin and Popov, 2015; Hurst and Lusardi, 2004; Schmalz et al., 2017; Levine and Rubinstein, 2019). A key part of this housing wealth literature is the need to provide a persuasive identification strategy, showing that local housing price shocks can indeed be considered plausibly exogenous with respect to entrepreneurial activity.⁶ The wealth shock we use (lottery wins) provides a more tightly defined plausible exogenous shock because we can observe the exact dollar magnitude of the wealth windfall to each individual (the magnitude of the lottery win), rather than more aggregate measures of house price trends in larger geographic regions.

3 Data

We use data on lotteries and entrepreneurial entry in a Canadian province to perform our analyses. In this section, we discuss our data sources (to the extent possible, given the legal restrictions), review the data set we construct using the sources, and provide summaries of key variables.

3.1 Sources

3.1.1 Lotteries

All of the individual provincial governments in Canada have monopolies over official lotteries run in their jurisdictions. Our data include all winners of lottery products with random-win amounts who win more than C\$1,000 in prizes between April 1, 2004, and March 31, 2014, provided by the provincial lottery organization (which, under the terms of our nondisclosure agreement, we are not able to divulge). The provincial lottery corporation does not keep track of lottery wins of less than C\$1,000. Therefore, it was unable to provide data on such wins (which is similar to many other lottery studies in the literature).

As a central element of our identification strategy is that the dollar magnitude of the win should be randomly assigned, we exclude lotteries in which the win amount is fixed rather than random. In the majority of lottery games included in our data, the amount of the win is determined by dividing the size of the pool by the number of winners (i.e., the amount of the win is random).

⁶For example, to identify the causal effects of house prices on entrepreneurship Schmalz et al. (2017) exploit the distinction between homeowners and renters, while Adelino et al. (2015) exploit Saiz (2010) type measures of supply constraints on housing, based on exogenous geographic and regulatory constraints.

In some of the lottery games in our data, the amount won is predetermined. As there is far less uncertainty in win amounts (conditional on winning) for such games, we exclude them from our study. These excluded fixed lottery prizes have no influence on the sample of included random lottery prizes because random lottery prizes are independent of fixed lottery prizes. Agarwal et al. (2019) provide additional details on these lottery data and show that lottery amounts are not correlated with any neighborhood observable characteristics.

The lottery corporation provided data on each winner’s name (first and last names), six-digit postal code, dollar magnitude of the lottery win, date of lottery win, and type of lottery game for each win.⁷ Table 1 provides some summary statistics on the lottery wins. Overall, in the decade for which we have data, over C\$1.06 billion was paid out to 21,625 lottery-winning tickets bought by 22,047 lottery players.⁸ The table also shows that the average win amount for each lottery winner was approximately C\$48,289. As we can see by comparing this mean amount with the median (approximately C\$2,082), the winnings distribution is highly skewed. Figure 1 shows the mean win amount by percentile, in absolute and log amounts, and illustrates the skewness of our lottery data. The mean winnings across the lower 90 percentiles are relatively low. The mean winnings jump dramatically in the top 10 percentiles, with the top-percentile mean winnings at slightly above C\$500,000. In logs, the distribution of winnings is more evenly distributed, although even the log amount of the top 20 percentiles rises faster than the lower 80 percentiles.

Because lottery winnings are not taxed in Canada, lottery winners do not have tax-related reasons for incorporating in our sample. If lottery income is taxed, as is the case in some countries, winning the lottery may have an impact on incorporations because income held within a corporation is often taxed at a lower rate than income paid to an individual. However, this is not a concern for us because lottery winnings in Canada are not taxed (Wong, 2015). Therefore, there is no tax avoidance-related incentive to incorporate for the lottery winners in our sample.

⁷We do not use any personal identifiable information (PII) in our subsequent analyses.

⁸There are 1.01 winners per winning ticket. For multiple-winner wins, we split the win amounts evenly across the winners, exactly as the lottery corporation does.

3.1.2 Business Starts and Closures

We requested business registry data from the provincial government of the province for which we have lottery winners' data and were granted access to the universe of its corporate registry. The registry database captures all events for the two sets of businesses that interest us: unincorporated businesses (registration) and incorporated businesses. Crucially for us, the database records when unincorporated businesses register their names with the province and incorporated businesses incorporate themselves in the province, as well as when both types of businesses close down. For each of these events, we have information on the date of the name registration/incorporation, the name and address of the parties filing the application for the event, and the fee paid for filing the application.

Registering a business name is possible for unincorporated firms in the province. These firms may be sole proprietorships, partnerships, or limited partnerships. Note that all partnerships and limited partnerships have to register their business names. A sole proprietorship may also do so, but it is not required.⁹ As Table 2 reports, we observe 278,639 business name registrations from 2002 to 2016. The province's registry database records the filers of the registration as "declarants." As each registration can have more than one declarant, we observe 322,644 declarants for the registrations (approximately 1.16 declarants per registration). In Figure 2, we observe that registrations per capita are relatively stable in this province in 2002 through 2016 at around 0.0008 registrations per capita per month (or 1 registration per 1,250 people every month). The fees for registering an unincorporated business remain stable throughout the period (C\$10 for sole proprietorships and partnerships and C\$50 for limited partnerships). We should note that, unlike corporations, self-employed businesses are not required to register their names with the provincial government. Thus, while our incorporation data are complete, the registration data do not capture all self-employed individuals. This feature explains why there are fewer registrations than incorporations in our data (for example, see Figure 2). Although we do not capture all the self-employed, we still examine whether financial constraints matter for those self-employed who decided to register their business name with the province.

Incorporating a limited liability corporation in the province is possible for businesses that have

⁹If the sole proprietorship operates in the owner's name, the owner does not have to register the name (but is allowed to do so).

shareholders who are not held responsible for any liability or default of the corporation. Table 2 shows that, in total, we have 538,013 first-time business incorporations in 2002-2016. There are 832,880 directors and shareholders who own and control the firm at incorporation. Each incorporation can have (and usually does have) more than one director/shareholder at incorporation, with the typical incorporating firm having 1.55 directors/shareholders. In Figure 2, we observe that incorporations per capita vary dramatically over the period. There is a clear peak in 2006-2008, with 0.0025 incorporations per capita per month (or 1 incorporation per 400 people every month) and troughs on both sides falling as low as 0.0006 incorporations per capita per month (or 1 incorporation per 1,667 people every month). This is in stark contrast to registrations per capita, which are relatively stable across the sample period.

The price for incorporating a firm stays fixed throughout the period (C\$250), which is between 5 and 25 times greater than the cost of registering an unincorporated firm. Furthermore, incorporated firms have to file an annual return to the corporate registry, which costs an additional C\$50 every year, but registration only requires a one-time fee. Incorporations also usually involve higher transactions costs than registrations. For example, incorporation usually involves the submission of audited annual tax returns, which entails the annual use of certified accountants.

Both registered businesses and corporations may shut down for a number of reasons. Corporations may not file the annual paperwork required to continue operating. Both registered businesses and corporations may choose to dissolve themselves. Table 3 shows that the vast majority (92%) of registered businesses are still active based on the corporate registry, whereas only 56% of corporations are active. This difference arises because of the frequency in which the two types of businesses report their status. Because of the annual filing requirement for corporations, their status is updated regularly, whereas most registered businesses never update their status after registering because there is generally no need to do so.¹⁰

Based on the difference between business starts and closures, we calculate the age of all businesses in the province. If a business is still active, we take the date of data acquisition as our end date to calculate business age. As Table 3 shows, the average corporation is younger than the average registered business (5.6 years old versus 7.6 years old). Closed businesses have shorter

¹⁰A partnership may choose to dissolve in case the partners decide to stop working together. However, for sole proprietorships, there is little incentive to update the province about changes in status after registering.

lifespans, with closed corporations living for 4.0 years and closed registered businesses living for only 2.1 years. Active corporations are about 6.7 years old, and active registered businesses are 8.1 years old. Notice that the relationship between the life span of corporations and the life span of registered businesses reverses among closed businesses. This is more evidence that registered businesses do not update their status regularly: Among registered businesses that report closure, the life span is much shorter than among corporations, suggesting that many of the active registered businesses simply have not reported their closure. Based on this pattern in the closure data, we focus our examination of business survival on corporations but not registered businesses.

3.1.3 Combining Lotteries and Business Registry Data

We perform a two-step operation to combine lottery data with business registry data, which we perform for both the registered businesses data and the corporations data. The first step is relatively straightforward in that we match the six-digit postal code of the lottery winner to the six-digit postal code of each declarant (director/shareholder) in the registrations (incorporations) data. Six-digit postal codes in Canada are extremely small, containing only a median of 13 households. The next step focuses on the last names of the lottery winners and registrants/shareholders. First, we keep all the perfect matches in last names between lottery winners and registrants/shareholders who share a postal code. Next, we calculate the Levenshtein lexical distance between all the remaining pairs of lottery winners and registrants/shareholders. Using a threshold of 0.2 for the Levenshtein distance (normalized by maximum name length within each pair) as our cutoff, we manually search through all winner-registrant/shareholder pairs below the threshold to find any lottery-registrant/shareholder last-name matches.¹¹ We then combine the set of perfect name matches within each postal code and the set of manual matches within each postal code into a common matched data set of winner-registrants/shareholders. At the end of this matching process, we have two data sets: one for lottery winner-business registrant matches and another for lottery winner-incorporating shareholder matches.

¹¹We use the Levenshtein lexical distance algorithm as a way to reduce the manual effort involved in finding imperfect matches.

3.2 Data Summary

We observe that about 0.4% of registrations in 2002-2016 are filed by lottery winners within two years of winning the lottery. The top panel of Table 4 shows that 1,084 registrations are filed by lottery winners within two years (before or after) winning the lottery (approximately 0.8% of the total number of registrations in that period). Of those, 147 occur within 90 days of the win (0.05% of total registrations). As the last column of the panel shows, generally speaking, slightly more registrations occur in the 90 days after a lottery win than before it. The second panel of Table 4 shows that 948 lottery winners are responsible for the 1,084 registrations within two years of their lottery wins. Similarly, 139 lottery winners registered 147 names within 90 days of their lottery wins.

Similarly, about 0.5% (0.07%) of incorporations in 2002-2016 are filed by lottery winners within two years (90 days) of winning the lottery. In the top panel of Table 4, we observe that 2,708 (352) incorporations are filed by a lottery winner within two years (90 days) of their lottery win. There are slightly more incorporations in the 90 days after the win than before, but the difference is small. Looking at the second panel of the table, we find that 2,005 (306) lottery winners incorporate a firm within two years (90 days) of the lottery win. There is almost no difference in incorporations in the 90 days before or after a win.

Using their first names, we identify lottery winners' gender using a web-based service that matches first names to gender and find that the majority of lottery winners are male. Of the 5,541 unique first names we extract from our lottery data set, we have highly dependable gender classification for nearly 80%. For the set of lottery winners, our gender-match rate improves to 85% because of the relative popularity of classified names. Of the winners whose gender we successfully determine, 28% are female and 72% are male. This asymmetry across genders fits with other research on the differences in lottery participation among men and women, which finds that men play the lottery nearly twice as often as women (Barnes et al., 2011).

We use Canada-wide unemployment figures to measure the business cycle, which we use in some of our analyses. Figure 3 shows an extremely large spike in unemployment in Canada at the beginning of 2009, which coincides with the global financial crisis. As is the case with many other countries, it took many years for unemployment in Canada to return to precrisis levels. For

this reason, we consider the precrisis period from 2004-2008 as the boom period, and the postcrisis period from 2009-2014 as the bust period in our analysis. While this unemployment time series is Canada-wide, it is highly correlated with the unemployment time series for the province we are studying (which we cannot identify because of a nondisclosure agreement).

Another dimension of heterogeneity we examine is distance to banks for lottery winners. We base the distance to a bank branch on the centroid of the postal code in which the lottery winner resides.¹² Because postal codes are generally very small (a median of 13 households), this is a fairly reliable proxy for the actual distance from the lottery winner’s location to the nearest bank. As we can see in Table 5, 49% of lottery winners live within 1 km of a bank, 79% live within 2 km of a bank, and 89% live within 5 km of a bank. Focusing on declarants of registrations (directors of incorporations) in the two years before and after a lottery win, we find slightly lower proportions: 45% (45%) live within 1 km of a bank, 71% (72%) live within 2 km of a bank, and 80% (82%) live within 5 km of a bank.

4 Research Design

The purpose of this paper is to examine how relaxing financial constraints via wealth shocks from lottery winnings affects business starts (i.e., incorporations and registrations) and business survival. To study these questions, we partition self-employment into two categories—unincorporated and incorporated—and test the relationship between wealth and these two forms of self-employment separately. For both business starts and survival, we use the random and plausibly exogenous magnitude of lottery winnings as the source of variation in financial constraints. As discussed in Levine and Rubinstein (2017), a firm’s chosen organizational form is a relatively clean way of disentangling “entrepreneurs” from other non-entrepreneurial self-employed people. If there are credit constraints to entrepreneurship (other self-employment), we should find a positive relationship between wealth and incorporation (registration of business name) and a negative relationship between wealth and incorporated (registered) business closures.

¹²We use data from the 2012 Enhanced Points of Interest data available for all Canadian provinces.

4.1 Business Starts

To assess differing financial constraints on entrepreneurial and non-entrepreneurial business starts, we examine whether lottery-winning amounts affect incorporations and registrations differently. This approach follows much of the previous literature on the effect of wealth shocks from lottery prizes on various outcomes (e.g., Imbens, Rubin, and Sacerdote, 2001; Hankins and Hoekstra, 2011; Cesarini et al., 2017). As we discussed in the previous section, the distribution of the lottery-win amount is highly skewed, so we transform it by taking logs.¹³ The precise regression equation for our analyses is:

$$\Pr(\text{event}_i = 1) = F(\alpha_{py} + \gamma \times g(\text{amount}_i) + \epsilon_i), \quad (1)$$

where $\Pr(\text{event}_i)$ is the likelihood of a business start (registration, incorporation, or either) for lottery winner i , $F(\cdot)$ is the logistic function, α_{py} are interactions of all lottery product and year fixed effects, and ϵ_i is an error term. The γ coefficient measures the effect of the size of the lottery-win amount on the likelihood of a business start. To measure event_i , we create quarterly indicators for business starts (registrations, incorporations, and total) for every quarter before and after the winning date. This setup allows us to measure the effect of the lottery win before and after the lottery-winning date so we can explore any pre-trends, as well as examine the duration and timing of the lottery-wealth shock. This specification relies on the random magnitude of the lottery prize and does not use any panel dimensions of the data to allow for easier interpretation of our results.

Finding that lottery win size has a significant effect on the likelihood of subsequent business formation (either registrations or incorporations) is consistent with the hypothesis that the lottery winner has a potentially viable business idea but is financially constrained in her ability to form that business. That is, it indicates that a lottery win enables those winners who have an unfunded business idea to form those kinds of businesses.

On the other hand, finding that the lottery-win size does not affect subsequent business formation is consistent with two hypotheses: The winner did not face financial constraints in forming a business or that the winner did not have a business idea that required funding.

We, of course, cannot observe whether the lottery winner has a business idea immediately prior

¹³For robustness, we perform the same tests using right-winsorized (at the 98th percentile) lottery-win amounts and get similar results.

to the date of the lottery win that would proceed if funded. However, we have relatively fine-grained measures of timing for both the dates of the lottery wins and the dates of the business formations. This feature allows us to test for the effects of lottery win size on business formation at different dates. As we describe in detail next, most of our results indicate significant coefficients consistent with winners starting their new businesses in either the quarter immediately following the win or the quarter thereafter. This relatively fast formation of the new business after the lottery win is consistent with the argument that the winner already had a business idea at the date of the lottery win but lacked funding to implement it.

While our baseline test operates on our whole sample, we conduct additional tests to provide evidence on financial constraints in specific subsamples of interest: gender differences across men and women, boom and bust phases of the business cycle, lottery winners with and without prior business experience, and, areas with and without local banks (proxying for access to credit). The interpretation of our estimated coefficients is the same as that of the baseline test, except that they apply to the subsamples. For example, a significant effect of lottery-win size on the subsequent formation of incorporated businesses during boom periods is consistent with the hypothesis that those lottery winners who subsequently started an incorporated firm during a boom period had a business idea involving incorporation, but they were financially constrained in their ability to start such a business, which was eased by their lottery win.

4.2 Business Survival

We employ a Cox proportional hazards model to examine the quarterly likelihood of incorporated business closure. We exclude registered businesses from survival analyses because the data on registered business closures are unreliably reported, as we explain in Section 3.1.2. There are a number of reasons for this specification choice. First, as the dependent variable (business closure) is a binary measure, a regression model designed for binary outcomes is preferable. Second, as there is right censoring in the data (based on when we stop observing firms), simple logistic regression is also not suitable. Finally, and relatedly, there is heterogeneity in time to failure even among businesses that do close, which makes a logistic regression-based test of the overall likelihood of the closure a coarse test, as it treats all closures, regardless of the proximity to a lottery win, as equal indicators of failure.

The main specification for our business survival Cox proportional hazard regressions is

$$\lambda_i(t) = \lambda_{0i}(t) \exp(\alpha_{py} + \gamma \times g(\text{amount}_i) + \epsilon_i), \quad (2)$$

where $\lambda_i(t)$ is the quarterly likelihood of failure for lottery winner i 's business in quarter t , $\lambda_{0i}(t)$ is the baseline hazard for businesses in year t , α_{py} are interactions of all lottery product and year fixed effects, and ϵ_i is an error term. The γ coefficient measures the effect of the size of lottery-win amount on the quarterly likelihood of closure (i.e., the hazard rate for the business).

We apply this methodology to two sets of incorporated businesses: businesses already operating at the time of the lottery win and businesses formed after the lottery win. A finding that lottery-win size has a negative significant effect on already operating or newly formed businesses' quarterly likelihood of failure (i.e., $\gamma < 1$) is consistent with the hypothesis that the lottery winner's already operating or newly formed business is financially constrained and the additional liquidity provided by the lottery helps ease these financial constraints.

4.3 External Validity

An important element in all lottery-based studies is the issue of external validity. While it is true that lottery players may differ from the general population of developed economies, two things help extend the generalizability of our findings. First, we explicitly avoid comparing lottery players with non-players. By doing this, we avoid empirical issues related to sample selection that might arise since lottery winners self-select themselves into the group of lottery players, whereas the control group is mostly composed of lottery non-players. Second, there is evidence in the literature that lottery players represent a significant portion of the general population. For instance, the Canadian Survey of Household Spending (Marshall, 2011) shows that approximately two-thirds of all Canadian adults purchase a provincial government-run lottery ticket at least once a year. These data show that purchases of government-run lottery tickets are by far the most popular form of gambling undertaken by adult Canadians. Additionally, Imbens et al. (2001) compare their Massachusetts sample of lottery players to the New England subsample of the Current Population Survey and find that, while middle-aged people are overrepresented in the lottery players sample and lottery players have lower earnings than the general population, the returns to education (in

earnings) are similar across the two groups. Finally, Table 6 provides a comparison of demographic characteristics of postal codes with and without lottery winners in our data set. In general, the two sets of postal codes are very similar in their characteristics. Based on this evidence, we argue that the generalizability of our results should not be too problematic, given that we draw our primary conclusions without comparing lottery players with non-players and that lottery players are generally representative of the general population.

5 Results

In this section, we present findings for the analyses outlined in the previous sections. First, we present results for the effect of wealth shocks on business formation for self-employment overall, entrepreneurial self-employment (incorporations) and other self-employment (registrations). Following that, we assess the role of intermediating factors affecting these types of business formations after lottery wealth windfalls. These factors are gender, business-cycle fluctuations, winners' past business experience, and availability of local lending as proxied by distance to bank branches. Finally, we use hazard models to examine the impact of lottery-win size on the survival probabilities of incorporated businesses owned by the lottery winners.

5.1 Wealth's Effects on Business Starts

In Table 7, we present the results of running the primary analysis, as detailed in Equation 1, over a nine-quarter period for overall business starts, registrations, and incorporations. The nine-quarter period we consider covers one year before the lottery-winning date, the quarter of the win (time 0), and one year after this date.¹⁴ Each cell in Table 7 presents the marginal effect of a unit increase in the log of lottery amount on the likelihood of a business start in a specific quarter relative to the lottery-win date, as well as the t -statistic for the marginal effect, in brackets. In columns (1), (2), and (3), we show marginal effects of lottery size on total business formations, registrations and incorporations.¹⁵ Negative event time shows the effect of lottery amount on the probability

¹⁴We also present marginal effects of the lottery amount on these business formation variables for the 16-quarter period covering two years before and two years after the winning date in Figures A1–A3 in the Appendix.

¹⁵We replicate this reporting format (showing total, registrations and incorporations) across all of the following business formation results tables in this paper.

of business formation before lottery wins, and positive event time shows these effects after lottery wins. As we discussed in Section 3, we use the logarithm of lottery amount to decrease the influence of extreme right-tail observations. We also use the winsorized lottery amount at the 98th percentile and obtain similar results (see Table A1).¹⁶

All three columns of Table 7 show that the lottery-shock amount has no effect on the probability of business formation prior to winning the lottery (event time 0). This finding supports our identifying assumption that lottery amounts are essentially random and uncorrelated with business starts prior to the time of the win. In addition, since all significant coefficients (for total and for incorporations) are in quarter 1, this implies that the effects happen reasonably soon after the lottery win.

In the positive event time rows of Table 7, we show very significant positive effects for incorporations and total business starts in quarter 1 but no effect for registrations in any quarter. The significant finding for incorporations is consistent with the hypothesis that lottery winners have business ideas involving incorporation, but they are not able to fund such ideas prior to the lottery win. The lottery win removes these financial constraints, resulting in new incorporations. On the other hand, the insignificant findings for registration are consistent with the hypotheses that lottery winners do not have unfunded business ideas requiring registration. This may be because of sufficient funding for unincorporated businesses or a lack of business ideas. Therefore, our findings are consistent with the implications of Levine and Rubinstein (2019) that entrepreneurs (incorporators) are much more likely to be financially constrained and require more capital to start a firm than other self-employed (registrants). Overall, we find a clear positive effect of an exogenous wealth shock on incorporations, which is consistent with entrepreneurship rates increasing with loosened financial constraints, as documented by some of the prior literature in finance (e.g., Bernanke and Gertler, 1989; Evans and Jovanovic, 1989; Schmalz et al., 2017).

We can rule out a few alternative interpretations of the results in Table 7. First, we can rule out the interpretation that lottery wins give winners ideas that trigger incorporations. As can be seen in this table, the effects on incorporations are almost immediate (one quarter after the

¹⁶While the sign and significance of all marginal effects are very similar across Table 7 and Table A1, the magnitudes of estimated coefficients are different because the log of lottery amount is used in the first table and the winsorized amount (in thousands) is used in the second table.

win), which suggests that winners did not dwell on their business plans for long, but most likely they implemented ideas they already thought about before the win date. Second, we can provide suggestive evidence that lottery-win size is sufficient to start a firm. Hence, our null results are not because of lottery wins being too small to alleviate financial constraints of business registrants. The average lottery win in our sample is C\$48,289 and the median winning amount is C\$2,082. These magnitudes are comparable with the size of starting capital needed for unincorporated businesses, which, according to Levine and Rubinstein (2019), has a mean of \$35,715 and a median of \$2,033 in the U.S. (see Levine and Rubinstein, Table I, p. 45). Even for incorporated businesses, lottery shocks are economically significant; the average starting capital of these businesses is \$90,555, with the median of \$19,633 (Levine and Rubinstein, 2019; Table I, p. 45).

The coefficients in Table 7 are marginal effects of the log of lottery amount on the probability of any business formation, registration, and incorporation. To help with economic interpretation of these effects, we calculated changes in the probability of business formation that they imply for certain sizes of wealth shocks.¹⁷ A lottery win equivalent to median annual income (C\$29,229 in this sample) would increase the probability of any type of business formation in quarter 1 by 0.0008, or by 8.3% relative to the baseline of 0.0096 in our sample. This amount would increase the probability of incorporation in quarter 1 by 0.0007 or 10.5%. A C\$100,000 wealth shock would increase the probability of starting any type of business in quarter 1 by 0.0021, or 21.6%, and the probability of incorporation in quarter 1 by 0.00177, or 26.1%.

Our results for incorporations confirm the findings in the prior literature showing the existence of financial constraints to entrepreneurship. When entrepreneurs have access to additional wealth, they start more entrepreneurial (i.e., incorporated) businesses. On the other hand, our registration results may imply that the prior literature showing no or weak financial constraints to entrepreneurship may be mismeasuring entrepreneurship. Our results indicate that other self-employed (i.e., registered) businesses are not more likely to be started after wealth windfalls (lottery winnings), thus they do not seem to be financially constrained. These results may suggest that the literature, finding no financial constraints on entrepreneurship, may be capturing more of these sorts of small business starts rather than entrepreneurial business starts. In our total business starts, the

¹⁷We calculated total self-employment and incorporations at mean values of all variables. Then, we estimated changes in the two types of business formation from increasing lottery amount by C\$29,229 or C\$100,000.

entrepreneurial business effect dominates, but, for some other data sets, it may be the opposite, which may drive these papers to conclude a lack of financial constraints on entrepreneurship.

5.2 Financial Constraints by Gender

A large literature has documented gender differences among entrepreneurs (see Orser, Riding, and Manley (2006) and Jennings and Brush (2013) for surveys).¹⁸ Robb, Coleman, and Stangler (2014) report that surveyed female entrepreneurs indicate a lack of funding as a major obstacle to their success. Raina (2019) shows that, among entrepreneurs who receive financing from venture capitalists, the female-led start-ups have lower likelihoods of success. Levine and Rubinstein (2017, 2019) document significant underrepresentation of women among individuals who start incorporated businesses. Among the individuals in their NLSY79 sample, women make up 49% of those who are employed, 37% of those who own unincorporated businesses, and 24% of those who own incorporated businesses.

A key question is why women are significantly underrepresented among those who own incorporated businesses. One potential explanation often offered in the literature is that women seeking incorporation face financial constraints (i.e., women are less likely to receive key inputs for incorporation, such as financing), which results in them being less likely to start incorporations. Given the strong public policy motivation to encourage more incorporations (which generate more economic growth), providing evidence on whether financial constraints hinder incorporations among women has important policy implications. Our empirical setup in this paper allows us to provide new empirical evidence on this issue.

To examine if women and men face financial constraints in starting businesses, we split the sample into female and male lottery winners and estimate the effect of lottery-win amount on the probability of starting the three types of businesses for men and women, separately. As explained in detail in the previous section, if we find that the lottery win size has a significant effect on subsequent incorporations or registrations, then this finding is consistent with the lottery winner

¹⁸Orser et al. (2006) conclude that “women-owned firms are on average smaller, less profitable, and less likely to grow. Access to capital is perceived to be a primary barrier to the growth for women-owned firms.” Jennings and Brush (2013) argue that “... research reveals notable differences ... between female and male entrepreneurs ... women tend to launch firms with lower levels of initial financing and they tend to operate with lower levels of both debt and equity beyond the start up stage ... female entrepreneurs are less likely ... to utilize financing provided by formal, external sources during start-up.”

facing financial constraints in starting that new firm (because the winner could not have started the firm without the lottery win). On the other hand, if we find no effect of the lottery magnitude on the probability of a business start, we can argue there is no binding financial constraint for this business start type and group. As we argue in the previous section, lottery amounts in our study are comparable with the starting capital needed for unincorporated and incorporated businesses, so it is unlikely that null results are because of the insufficient size of the lottery wins.

While our lottery data do not specifically record the gender of the individual lottery winner, we exploit the fact that we can observe the first names of winners to make an assessment of their gender. Specifically, we match first names to gender algorithmically, which provides us with both the best prediction of the gender associated with a specific first name, as well as the confidence level of that prediction, based on a very large database of first names and genders.¹⁹ In our study, we restrict the sample to only those first names for which the algorithm provides a 90% or higher confidence level in the gender allocation outcome.

Table 8 reports results for male lottery winners. We also provide marginal effects for longer time horizons for both men and women in Figures A4–A9. The results in Table 8 show that male lottery winners face significant financial constraints in starting new incorporated (but not registered) firms. In particular, lottery amount increases the probability of men starting corporations in quarter 1 after the lottery win.

Table 9 reports results for female lottery winners. In contrast to the results for men, Table 9 shows that women are more likely to start a registered business after lottery wins. In particular, lottery magnitude increases women’s likelihood of starting a registered business in quarter 0. Lottery amount also increases women’s total business formation in quarter 2 after the winning date. This effect arises from slightly less statistically significant impacts of lottery win magnitude on both registration and incorporation business starts. Importantly, the effect of the lottery amount on incorporations for men in quarter 1 (Table 8) and women in quarter 2 (Table 9) is almost identical. Overall, these results for women indicate that they face significant financial constraints in starting new registered firms and some financial constraints in starting incorporated firms.

¹⁹We categorize people’s gender by their first names using a web service (<https://gender-api.com>). Other research that employs this web service include Bonham and Stefan (2017); Caplar, Tacchella, and Birrer (2017). And other papers have used various other, similar services to link first names and gender.

Taken together, our findings indicate that men face financial constraints when starting incorporated businesses and women face financial constraints when starting both registered and (to some extent) incorporated businesses. The incorporation findings for women are somewhat consistent with surveys that report female entrepreneurs have difficulty securing financing for their start-ups (e.g., Robb et al., 2014). The registration findings for women are consistent with two different hypotheses. First, as shown by Levine and Rubinstein (2019), registered businesses often need no or less capital than incorporated firms; thus, the former are less likely to be financially constrained. Given that we find financial constraints affect registered businesses of women, this may imply that women have preferences for starting registered businesses and thus generate excess demand for this type of business and financing for it. Alternatively, even for registered businesses, women may be more likely to face financial constraints compared with men, which is consistent with the prior literature.

5.3 Financial Constraints over the Business Cycle

A very large literature has linked entrepreneurship to business cycles (e.g., Shleifer, 1986; Caballero and Hammour, 1994; Bernanke and Gertler, 1989; Kiyotaki and Moore, 1997; Francois and Lloyd-Ellis, 2003; Barlevy, 2007). The main contribution of this section, relative to the existing literature, is to provide new evidence on financial constraints for both incorporations and registrations during both boom and bust periods.

There are many ways in which business cycle conditions can intermediate the effect of wealth shocks on business formations for entrepreneurs and other self-employed individuals. For example, the previous literature (e.g., Levine and Rubinstein, 2019) has argued that sources of external funding are more readily available during boom than bust periods, which may ease financial constraints during booms compared with busts. While financial constraints may be more relaxed during booms than busts, it's still possible that not all entrepreneurs can obtain sufficient funding because they may have more ideas than funding or be more optimistic during these periods. We test who faces financial constraints during booms and busts.

The issue of who is financially constrained in booms and busts is important for policy reasons if the policy aim is to increase the number of entrepreneurs (as they generate economic growth). The key reason why we are able to examine financial constraints during both booms and busts is that our

measure of the loosening of financial constraints (the magnitude of the lottery win) is orthogonal to our measure of business cycles (defined based on macro variables, such as unemployment). This feature differentiates us from Levine and Rubinstein (2019), who also study incorporations and registrations over the business cycle. Our setup thus enables us to provide actual empirical evidence on whether financial constraints (lottery-win size) are indeed binding in either boom or bust periods, impacting either incorporations and registrations.

As in many other countries, Canada experienced a boom period in the years before the financial crisis of 2008 and a bust period in the years after the financial crisis. We thus split our sample period into a boom period (2004–2008), and a bust period (2009–2014). Figure 3 shows unemployment rates in these periods in Canada, highlighting these boom-and-bust trends. The unemployment series for the province we examine is very similar to Canada’s unemployment series.²⁰

Our findings for boom periods (2004–2008) are reported in Table 10 and bust periods (2009–2014) in Table 11 (Figures A10–A15 present these effects for longer time horizons). Our main findings for incorporations are that the size of a lottery win has a significant positive effect on the likelihood of incorporation during boom periods (both quarters 0 and 1 after the lottery win) but no effect in bust periods. The boom period finding indicates that, despite possible boom-time expansions in the supply of credit, lottery winners have unfunded ideas for new incorporated businesses. The lottery win eases these financial constraints on the unfunded business ideas, resulting in the observed subsequent incorporations.

The results for the bust period, on the other hand, show no significant impact on lottery-win size on incorporation. This is consistent with the hypothesis that, in the bust period, lottery winners do not have unfunded business ideas involving incorporation, either because of sufficient funding or because of a lack of business ideas requiring incorporation during bust periods. It is also possible that in bust periods, even if constraints are relaxed, entrepreneurs may not start new businesses until demand returns.

For registrations, shown in Tables 10 and 11, we find a significant effect (in quarter 0) in the bust period but no significant effect in the boom period. The significant coefficient for the bust period is consistent with the hypothesis that, during busts, lottery winners have unfunded

²⁰We display Canada’s unemployment series to avoid disclosing the identity of the province as stipulated in the nondisclosure agreement for the lottery data.

business ideas requiring registration, which they start using lottery winnings. An explanation for this finding (following the discussion in Levine and Rubinstein, 2019) is that reduced labor demand in the salaried sector during bust periods increases newly unemployed workers’ small scale (i.e., registered) business starts. Even though the setup costs to register are generally smaller than to incorporate, our findings imply that financial constraints to register a company may still be binding, especially for unemployed workers during a recession.

Our finding of no significant coefficient for registrations during boom periods is consistent with lottery winners lacking unfunded registered business ideas during boom periods, either because of the adequate availability of funding during booms or because of the lack of such business ideas.

5.4 Serial Entrepreneurs

While a variety of authors in both the finance and management literatures (e.g., Lazear, 2005; Agarwal, Echambadi, Franco, and Sarkar, 2004; Gompers, Lerner, and Scharfstein, 2005; Franco and Filson, 2006; Chatterji, 2009; Chatterji and Seamans, 2012) have emphasized the possible importance of previous business experience for success as an entrepreneur, Gendron-Carrier (2018) highlights the fact that “datasets that link business owners to their previous career histories are exceedingly rare” (p. 1). Our paper is able to provide evidence on this issue because our data have the universe of corporate registry activity over a very long time period, allowing us to observe all previous corporate registry activity by individuals.

In this section, we use the baseline model examined in the previous sections, but we split the data based on whether the lottery winner had any business experience (either registrations or incorporations) prior to the lottery win. Prior business experience can affect financial constraints in several ways. On the one hand, it is possible that prior business experience will loosen financial constraints, if more external funding is available to individuals with a business track record.²¹ On the other hand, not all ideas of serial entrepreneurs may receive external funding, and some of them may be financially constrained.

The distinction between people with and without prior business experience can also affect the choice between incorporation and registration. It can be argued that, all else equal, individuals

²¹Gompers et al. (2010) report that serial entrepreneurs financed by venture capitalists raise more money and raise it earlier than first-time, inexperienced entrepreneurs.

with prior business experience are more likely to select into incorporation because they are more able to manage the legal and business complexities involved in incorporation. A similar argument can be made that individuals without prior business experience will be, all else equal, more likely to select into registration because of the relative simplicity, lower cost, and lower risk of this kind of business formation. Our empirical setup allows us to provide evidence on these predictions.

Our results for lottery winners with prior business experience are reported in Table 12A and Figures A16–A18. Our results for winners with prior business experience indicate that the lottery-win size increases the likelihood of incorporation (in quarter 1). This result is consistent with the previous discussion that serial entrepreneurs are indeed financially constrained in starting incorporated businesses. Under such circumstances, the lottery win is used to start these incorporated businesses.

Table 12A also reports a negative effect of lottery-win size for serial entrepreneurs on business registration. This coefficient implies that winning a larger lottery actually reduces the likelihood of starting a registered businesses for serial entrepreneurs. Taken together, these findings are consistent with our argument that (financially constrained) serial entrepreneurs are more likely, all else equal, to start incorporated rather than registered businesses.

Table 12B and Figures A19–A21 report results for winners without any business experience. The main result from this table is that the lottery-win size has a significant positive effect (in quarter 0) on registrations, but it does not have a significant effect on incorporations in any quarter. This finding is consistent with the argument that lottery winners without business experience faced financial constraints when starting a registered business prior to winning the lottery.

5.5 Proximity to Traditional Lenders and Availability of Credit

Our very detailed location-based data on the universe of incorporations and registrations in the province allow us to add to the large literature in finance arguing that close proximity to lenders may affect the availability and terms of small business credit (e.g., Petersen and Rajan, 2002; Degryse and Ongena, 2005; Nguyen, 2019; Agarwal and Hauswald, 2010). This section of our paper examines the role of bank proximity in the specific context of lottery wins and subsequent corporate registry activity.

This literature argues that soft information is used by banks to assess very local and uncertain

business projects, which local lenders can acquire via their branches (e.g., Agarwal and Hauswald, 2010). The conclusion in this literature — that new businesses may face tighter credit constraints in areas without nearby lenders — leads directly to a test of the main mechanism proposed in our paper. We argue that wealth shocks from lottery winnings can alleviate financial constraints of potential new small business owners. Given the conclusion in the literature that areas without nearby lenders may face tighter financial and credit constraints than areas served by traditional lenders, we split our sample into these two types of areas and estimate our main specification for these two samples.

We propose and test the following hypotheses. In areas without nearby lenders, financial constraints should be stricter, and loosening them by lottery wealth shocks should lead to larger increases for constrained businesses. On the other hand, areas with bank branches may face less binding financial and credit constraints; thus, lottery wealth shocks would have smaller effects in these areas.

To test these hypotheses, we use data on exact locations (longitude and latitude) of all branches of major lenders in the province. We use data from the 2012 Enhanced Points of Interest database on locations of bank branches and data from Statistics Canada on coordinates of all postal codes. Based on these two sets of coordinates, we compute distances from every lottery win postal code to every major bank branch in the province. We use these distances to find the closest bank branch for every lottery winner in the data.²²

We use the median distance to bank branches in our data to split the sample into lottery winners with and without bank branches nearby. We use the median distance to the closest bank branch in our data (1 km) as our cutoff for having a nearby bank branch. We run the same model as in the previous sections on these two samples of the data to test if credit constraints as proxied by distance to financial institutions play a role in business formation after lottery wealth shocks.

Table 13A and Figures A22–A24 report results for the effect of lottery-win size on the probability of starting a business, conditional on there not being a local bank within 1 km of the postal code (i.e., where financial constraints may be more binding). We find that the lottery amount increases the

²²Postal codes in Canada are extremely small geographic units with the median postal code containing 13 households. Most of them are smaller than city blocks. Thus, by using coordinates of winners' postal codes, we can compute precise distances from all lottery winners to the closest bank branch.

probability of incorporation (in quarter 1) but has no significant effect on registration. This finding supports our hypothesis that wealth shocks from lottery winnings are effective in easing financial constraints in areas without nearby banks for incorporations but not necessarily for registrations.

The results for lottery winners with nearby bank branches are summarized in Table 13B and Figures A25–A27. This table shows no statistically significant effects of lottery winnings for any type of business formation. Thus, we can conclude that, in areas well served by financial institutions, relaxing financial constraints by lottery windfalls does not induce more business formation of any kind. Because we use distance to financial institutions to proxy for local financial constraints of potential entrepreneurs and other self-employed, we argue that these findings of no effect of the lottery amount on business formation for the sample with local lenders support our main mechanism that lottery-wealth shocks can induce business formation by relaxing financial constraints.

Jointly, these results reflect the interaction of two different reasons for financial constraints on business formation: (1) incorporations are more likely than registrations to face financial constraints, and (2) businesses in areas far from local banks are more likely to face financial constraints than businesses in areas close to local banks.

5.6 Business Survival

In this section, we test the effect of lottery winnings on the survival of incorporated (i.e., entrepreneurial) businesses. As detailed in Section 4.2, we perform these tests using Cox proportional hazards model regressions based on Equation 2 specifications.²³ We perform these survival tests on two sets of incorporated businesses: those already operating when the lottery winners win the lottery and those formed after the lottery wins.

5.6.1 Already Incorporated Businesses

We present our findings for incorporated businesses already in operation when an individual wins the lottery in Table 14A. We run hazard regressions using the natural log of win amount and the square of the logged win amount. In the linear specifications, we do not find any impact of lottery winnings on quarterly closure likelihoods. In the quadratic specifications, however, we find that

²³In Appendix B, we present evidence that a proportional hazards model is an appropriate choice for this survival analysis.

there are statistically significant effects of lottery amount on the likelihood of closure.

The linear and quadratic terms have opposing signs, however, so we consider marginal effects at different win amounts to interpret the net impact of additional winnings. In Table 14B, we present the marginal effect on quarterly likelihood of closure of a 10% increase in lottery-win size at the 50th, 90th, 93rd, 95th, 97th, 98th, and 99th percentiles of lottery-win amounts. We find that the quarterly likelihood of closure decreases significantly with an increase in lottery-win size at lower win levels. For instance, for a 50th percentile lottery winner with an already operating corporation, a 10% increase in lottery winnings, on average, results in a 0.178 percentage point decrease in the likelihood of closure in each subsequent quarter. Given that, on average, 1.72% of incorporated businesses fail in each quarter in the first five years after a lottery win (this proportion decreases with time), the impact of 10% more lottery winnings at the 50th percentile is just over 10%.²⁴ For greater win amounts, additional winnings do not affect closure rates of incorporated businesses

These results on the closure rates of already operating incorporated businesses suggest that additional capital may have two countervailing effects on business survival. First, additional capital may ease financial constraints and improve the survival rates of already operating businesses. Second, for sufficiently large win amounts, additional capital may decrease the business owner's supply of labor, which, in this setting, translates into reduced likelihood of survival for the owner's business. As this second effect is unlikely to be present at smaller lottery amounts, we find improved survival rates at lower lottery win amounts because of eased financing constraints. However, at larger lottery amounts, the two effects seem to cancel each other out. Thus, these findings are consistent with the aforementioned literature showing that small businesses are operating under financial constraints and the literature that implies labor supply diminishes at higher levels of income (Friedman, 1963; Hanoch, 1965).

5.6.2 Newly Formed Corporations

For incorporated businesses formed after an individual wins the lottery, based on two sets of analyses, we show that lottery winnings do not affect survival. In the first two columns of Table 15A, we show that lottery-winning amount does not change the quarterly likelihood of closure using both

²⁴We measure quarterly likelihood of closure as the percent of businesses that fail in quarter t having survived until quarter $t - 1$.

linear and quadratic specifications. We confirm that there are no marginal effects of win amount changes at any level of lottery win amount in Table 15B. In addition to comparing within lottery winners across win amounts, we also test for differences between lottery winners' post-win incorporated businesses and non-lottery winners' incorporated businesses. As reported in the third column of Table 15A, we find no differences in the closure likelihoods of these two sets of incorporated businesses.

There are at least two opposing hypotheses for the survival (i.e., performance) of newly formed businesses. First, assuming small business financing is efficient, all ex-ante profitable businesses should receive funding. This leaves only ex-ante unprofitable businesses to be financed from sources outside of capital markets such as lotteries (Leland and Pyle, 1977). Another factor affecting business survival can be a stronger incentive of winners who started their business with their own capital (from lottery winnings) to expend greater effort to make the business perform well (Holmstrom, 1979). Because we find no difference between survival rates of businesses financed by capital markets and lottery winners, it is possible that these two factors cancel each other out in the aggregate.

6 Conclusions

The recent small business literature has emphasized that entrepreneurs are more likely to generate positive economic returns, relative to individuals who are simply self-employed. In addition, one particularly important issue for all small business owners is the issue of financial constraints impeding their ability to start and grow their businesses. These points raise the important policy issue of whether entrepreneurs face different financial constraints than other self-employed individuals.

In this paper, we provide new empirical evidence on this question by linking a novel corporate registry database to data on individual lottery winners. We are able to test whether financial constraints affect potential business starts by examining whether the size of a plausibly exogenous lottery win increases subsequent business incorporation (reflecting entrepreneurs) or business registration (reflecting other self-employed) by the lottery winner. This is because the lottery win serves to reduce the financial constraint upon the business owner.

Our baseline finding is that individuals who want to start incorporated businesses (entrepreneurs)

are financially constrained, while individuals who want to start registered businesses (other self-employed) are not financially constrained. From a policy perspective, we also find that individuals wanting to start new incorporated businesses face financial constraints during economic boom periods. This finding is in contrast to the idea in the existing literature that more external funding is readily available during boom periods compared with bust periods. In bust periods, there are differing implications, depending on policy objectives. As other self-employed businesses are financially constrained during busts, providing additional capital to these businesses may lessen the impact of a bust period on unemployment by encouraging self-employment. On the other hand, as we find no evidence that entrepreneurship is financially constrained during busts, providing capital to entrepreneurial businesses to jumpstart flagging economic growth may be a waste of resources.

References

- Manuel Adelino, Antoinette Schoar, and Felipe Severino. House prices, collateral, and self-employment. *Journal of Financial Economics*, 117(2):288–306, 2015.
- Rajshree Agarwal, Raj Echambadi, April M. Franco, and Mitrabarun B. Sarkar. Knowledge transfer through inheritance: Spin-out generation, development, and survival. *Academy of Management Journal*, 47(4):501–522, 2004.
- Sumit Agarwal and Robert Hauswald. Distance and private information in lending. *Review of Financial Studies*, 23(7):2757–2788, 2010.
- Sumit Agarwal, Vyacheslav Mikhed, and Barry Scholnick. Peers’ income and financial distress: Evidence from lottery winners and neighboring bankruptcies. *Review of Financial Studies*, Forthcoming, 2019.
- Steffen Andersen and Kasper Meisner Nielsen. Ability or finances as constraints on entrepreneurship? Evidence from survival rates in a natural experiment. *Review of Financial Studies*, 25(12):3684–3710, 2012.
- Gadi Barlevy. On the cyclicalities of research and development. *American Economic Review*, 97(4):1131–1164, 2007.
- Grace M. Barnes, John W. Welte, Marie-Cecile O. Tidwell, and Joseph H. Hoffman. Gambling on the lottery: Sociodemographic correlates across the lifespan. *Journal of Gambling Studies*, 27(4):575–586, 2011.
- Ben Bernanke and Mark Gertler. Agency costs, net worth, and business fluctuations. *American Economic Review*, 79(1):14–31, 1989.
- Kevin S. Bonham and Melanie I. Stefan. Women are underrepresented in computational biology: An analysis of the scholarly literature in biology, computer science and computational biology. *PLoS computational biology*, 13(10):e1005134, 2017.
- Ricardo J. Caballero and Mohamad L. Hammour. The cleansing effect of recessions. *American Economic Review*, 84(5):1350–1368, 1994.
- Neven Caplar, Sandro Tacchella, and Simon Birrer. Quantitative evaluation of gender bias in astronomical publications from citation counts. *Nature Astronomy*, 1(6):0141, 2017.
- David Cesarini, Erik Lindqvist, Matthew J. Notowidigdo, and Robert Östling. The effect of wealth on individual and household labor supply: Evidence from Swedish lotteries. *American Economic Review*, 107(12):3917–3946, 2017.
- Aaron K. Chatterji. Spawned with a silver spoon? Entrepreneurial performance and innovation in the medical device industry. *Strategic Management Journal*, 30(2):185–206, 2009.
- Aaron K. Chatterji and Robert C. Seamans. Entrepreneurial finance, credit cards, and race. *Journal of Financial Economics*, 106(1):182–195, 2012.
- Stefano Corradin and Alexander Popov. House prices, home equity borrowing, and entrepreneurship. *Review of Financial Studies*, 28(8):2399–2428, 2015.

- Ryan Decker, John Haltiwanger, Ron Jarmin, and Javier Miranda. The role of entrepreneurship in US job creation and economic dynamism. *Journal of Economic Perspectives*, 28(3):3–24, 2014.
- Ryan Decker, John Haltiwanger, Ron S. Jarmin, and Javier Miranda. Where has all the skewness gone? The decline in high-growth (young) firms in the US. *European Economic Review*, 86:4–23, 2016.
- Hans Degryse and Steven Ongena. Distance, lending relationships, and competition. *Journal of Finance*, 60(1):231–266, 2005.
- David S. Evans and Boyan Jovanovic. An estimated model of entrepreneurial choice under liquidity constraints. *Journal of Political Economy*, 97(4):808–827, 1989.
- David S. Evans and Linda S. Leighton. Some empirical aspects of entrepreneurship. *American Economic Review*, 79(3):519–535, 1989.
- April Mitchell Franco and Darren Filson. Spin-outs: Knowledge diffusion through employee mobility. *RAND Journal of Economics*, 37(4):841–860, 2006.
- Patrick Francois and Huw Lloyd-Ellis. Animal spirits through creative destruction. *American Economic Review*, 93(3):530–550, 2003.
- Milton Friedman. *Price Theory*. Routledge, New York, 1963.
- Nicolas Gendron-Carrier. Understanding the careers of young entrepreneurs. Working paper, 2018. URL https://www.nicolasgendroncarrier.com/_pdf/Gendron-Carrier_JMP.pdf.
- Paul Gompers, Josh Lerner, and David Scharfstein. Entrepreneurial spawning: Public corporations and the genesis of new ventures, 1986 to 1999. *Journal of Finance*, 60(2):577–614, 2005.
- Paul Gompers, Anna Kovner, Josh Lerner, and David Scharfstein. Performance persistence in entrepreneurship. *Journal of Financial Economics*, 96(1):18–32, 2010.
- Patricia M. Grambsch and Terry M. Therneau. Proportional hazards tests and diagnostics based on weighted residuals. *Biometrika*, 81(3):515–526, 1994.
- Scott Hankins and Mark Hoekstra. Lucky in life, unlucky in love? The effect of random income shocks on marriage and divorce. *Journal of Human Resources*, 46(2):403–426, 2011.
- Giora Hanoch. The ‘backward-bending’ supply of labor. *Journal of Political Economy*, 73(6):636–642, 1965.
- Ian Hathaway and Robert E. Litan. What’s driving the decline in the firm formation rate? A partial explanation. *The Brookings Institution*, 2014.
- Kyle Herkenhoff, Gordon Phillips, and Ethan Cohen-Cole. The impact of consumer credit access on employment, earnings and entrepreneurship. Technical report, National Bureau of Economic Research, 2016.
- Bengt Holmstrom. Moral hazard and observability. *Bell Journal of Economics*, 10(1):74–91, 1979.
- Douglas Holtz-Eakin, David Joulfaian, and Harvey S. Rosen. Sticking it out: Entrepreneurial survival and liquidity constraints. *Journal of Political Economy*, 102(1):53–75, 1994.

- David W. Hosmer, Stanley Lemeshow, and Susanne May. *Applied survival analysis: regression modeling of time-to-event data*, volume 618. Wiley-Interscience, 2008.
- Erik Hurst and Annamaria Lusardi. Liquidity constraints, household wealth, and entrepreneurship. *Journal of Political Economy*, 112(2):319–347, 2004.
- Erik Hurst and Benjamin Wild Pugsley. What do small businesses do? Working Paper 17041, National Bureau of Economic Research, May 2011. URL <http://www.nber.org/papers/w17041>.
- Guido W. Imbens, Donald B. Rubin, and Bruce I. Sacerdote. Estimating the effect of unearned income on labor earnings, savings, and consumption: Evidence from a survey of lottery players. *American Economic Review*, 91(4):778–794, 2001.
- J. E. Jennings and C. G. Brush. Research on women entrepreneurs: Challenges to (and from) the broader entrepreneurship literature? *The Academy of Management Annals*, 7(1):663–715, 2013.
- Nobuhiro Kiyotaki and John Moore. Credit cycles. *Journal of Political Economy*, 105(2):211–248, 1997.
- Rafael La Porta and Andrei Shleifer. Informality and development. *Journal of Economic Perspectives*, 28(3):109–26, 2014.
- Edward P. Lazear. Entrepreneurship. *Journal of Labor Economics*, 23(4):649–680, 2005. doi: 10.1086/491605.
- Hayne E. Leland and David H. Pyle. Informational asymmetries, financial structure, and financial intermediation. *Journal of Finance*, 32(2):371–387, 1977.
- Ross Levine and Yona Rubinstein. Smart and illicit: Who becomes an entrepreneur and do they earn more? *Quarterly Journal of Economics*, 132(2):963–1018, 2017.
- Ross Levine and Yona Rubinstein. Selection into entrepreneurship and self-employment. Working Paper 25350, April 2019. URL <http://www.nber.org/papers/w25350>.
- Thomas Lindh and Henry Ohlsson. Self-employment and windfall gains: Evidence from the Swedish lottery. *Economic Journal*, 106(439):1515–1526, 1996.
- Katherine Marshall. Perspectives on labour and income - gambling 2011. In *Statistics Canada Catalogue 75-001-X*. Statistics Canada, 2011.
- Hoai-Luu Q. Nguyen. Are credit markets still local? evidence from bank branch closings. *American Economic Journal: Applied Economics*, 11(1):1–32, 2019.
- B. J. Orser, A. L. Riding, and K. Manley. Women entrepreneurs and financial capital. *Entrepreneurship Theory and Practice*, 30(5):643–665, 2006.
- Mitchell A. Petersen and Raghuram G. Rajan. Does distance still matter? The information revolution in small business lending. *Journal of Finance*, 57(6):2533–2570, 2002.
- Sahil Raina. VCs, founders, and the performance gender gap. Technical report, <https://papers.ssrn.com/abstract=2846047>, 2019.
- Alicia Robb, Susan Coleman, and Dane Stangler. Sources of economic hope: Women’s entrepreneurship. Available at SSRN 2529094, 2014.

- Albert Saiz. The geographic determinants of housing supply. *Quarterly Journal of Economics*, 125(3):1253–1296, 2010.
- Martin C. Schmalz, David A. Sraer, and David Thesmar. Housing collateral and entrepreneurship. *Journal of Finance*, 72(1):99–132, 2017.
- Antoinette Schoar. The divide between subsistence and transformational entrepreneurship. *Innovation Policy and the Economy*, 10:57–81, 2010. doi: 10.1086/605853.
- Andrei Shleifer. Implementation cycles. *Journal of Political Economy*, 94(6):1163–1190, 1986.
- Mark P. Taylor. Self-employment and windfall gains in Britain: Evidence from panel data. *Economica*, 68(272):539–565, 2001.
- Spencer L. Tracy. Accelerating job creation in America: The promise of high-impact companies. *US Small Business Administration, Office of Advocacy*, 2011.
- Craig Wong. Winning the lottery: How to plan your financial future. *CBC News*, June 2015.

Tables and Figures

Table 1. Summary statistics for lotteries, 2004-2014.

This table provides summary statistics for lottery wins in a Canadian province from April 1, 2004, to March 31, 2014, for lotteries without predetermined win amounts.

	Amount
Total winnings (C\$)	\$1,064,623,929
Wins	21,625
Winners	22,047
Winnings per winner (mean, C\$)	\$48,288.83
Winnings per winner (median, C\$)	\$2,081.70
Winners per win	1.010

Table 2. Summary statistics for business starts, 2002-2016.

This table provides summary statistics for registrations and incorporations in a Canadian province from January 1, 2002, to December 31, 2016.

	Amount
Registrations	278,639
Declarants	322,644
Declarants per firm	1.158
Incorporations	538,013
Directors	832,880
Directors per corporation	1.548

Table 3. Summary statistics for business status and age, 2002-2016.

This table provides summary statistics for business status and age for registered and incorporated businesses started in a Canadian province from January 1, 2002, to December 31, 2016.

	Mean	SD	Median	25th %ile	75th %ile	N
<i>Registered Businesses</i>						
Active	0.915	0.279	1.000	1.000	1.000	399,467
Duration (yrs)	7.554	4.529	7.389	3.526	11.359	399,467
active	8.060	4.332	7.975	4.252	11.688	365,535
closed	2.108	2.623	1.090	0.203	3.042	33,932
<i>Corporations</i>						
Active	0.562	0.496	1.000	0.000	1.000	572,814
Duration (yrs)	5.558	3.809	4.438	2.475	7.970	572,814
active	6.748	4.163	5.916	3.124	10.207	322,180
closed	4.028	2.592	2.726	2.450	5.437	250,634

Table 4. Summary statistics for lottery winners who start businesses, 2002-2016.

This table provides summary statistics for firms registered and incorporated by lottery winners 2 years or 90 days before/after winning a lottery.

	Overall	Before	After	Difference
Registrations by winners				
within 2 yrs of win	1,084	552	532	-20
within 90 days of win	147	61	86	25
Incorporations by winners				
within 2 yrs of win	2,708	1,389	1,319	-70
within 90 days of win	352	183	169	-14
Winner declarants				
within 2 yrs of win	948	482	466	-16
within 90 days of win	139	59	80	21
Winner directors				
within 2 yrs of win	2,005	1,031	974	-57
within 90 days of win	306	152	154	2

Table 5. Summary statistics for bank distances.

This table presents the percentages of three samples of lottery winners who are less than 1, 2, and 5 km away from a bank. The three lottery winner samples are: all lottery winners, lottery winners who were declarants for a name registration within 2 years before or after their lottery win, and lottery winners who were directors for an incorporation within 2 years before or after their lottery win.

	All Winners	Declarants	Directors
% with bank within:			
1 km	49.47%	45.44%	44.87%
2 km	79.38%	71.20%	71.74%
5 km	89.19%	79.87%	81.66%

Table 6. Characteristics of winning and non-winning postal codes.

This table presents mean values of Census variables for winning and non-winning postal codes in the province of interest. These variables are derived from the 2006 Canadian census data on Census Dissemination Areas (DAs), which are matched to postal codes. DAs are the smallest Census geographies for which demographic and other data are available. On average, DAs have 200 households and cover 0.2 square km. Comparing Census characteristics of winning and non-winning postal codes, we can conclude that these two groups of postal codes are similar in their demographic characteristics. This finding suggests that our estimated effects may be applicable and generalizable to the overall population, not just lottery winners.

Variable Name	Winners Postal Codes	Non-Winners Postal Codes
Male (proportion of DA population)	0.499	0.500
DA unemployment rate	4.151	4.224
DA median individual income	30,819.3	30,269.2
DA average individual income	41,272.8	43,350.6
Median family income	79,509.1	76,768.5
Average family size	2.938	2.862
Homeownership (proportion of DA population)	0.768	0.727
Divorced (proportion of DA population)	0.079	0.086
High school (proportion of DA population)	0.235	0.229
College (proportion of DA population)	0.206	0.197
University (proportion of DA population)	0.184	0.196
Graduate (proportion of DA population)	0.059	0.071
Proportion of age between 20 and 39 years	0.304	0.303
Proportion of age between 40 and 64 years	0.333	0.337
Proportion of age over 65 years	0.108	0.124
Indicator for living in an MSA	0.743	0.750

Table 7. Effects of lottery-win size on registrations and incorporations.

This table presents the results of regression analyses studying the impact of lottery winnings on business starts by all lottery winners. Each cell presents the marginal effect for the log of lottery-winning amount on the probability of the business start in the quarter relative to the lottery-winning date. The numbers of observations reported are for quarter 0. The numbers of observations for other quarters may vary. The first column shows marginal effects of lottery-winning amount (in logs) on either registrations or incorporations, the second column shows marginal effects for registrations only, and the third column shows marginal effects for incorporations only. All regressions are estimated using logit models with lottery-year fixed effects. We display *t*-stats in brackets. ***, **, * indicate significance at 1, 5, and 10% level, respectively.

Quarter	Total	Registration	Incorporation
-4	-0.000956 [1.178]	-0.001053 [1.573]	-0.000355 [0.539]
-3	-0.000214 [0.302]	0.000028 [0.060]	-0.000104 [0.174]
-2	-0.000411 [0.594]	-0.000645 [1.112]	-0.000002 [0.004]
-1	0.000177 [0.285]	0.000192 [0.519]	-0.000005 [0.010]
0	0.000786 [1.331]	0.000444 [1.172]	0.000323 [0.620]
1	0.001336** [2.522]	0.000142 [0.335]	0.001122*** [2.585]
2	0.000356 [0.607]	0.000422 [1.288]	0.000044 [0.086]
3	-0.000628 [0.909]	-0.000242 [0.587]	-0.000342 [0.584]
4	0.000504 [0.879]	-0.000064 [0.146]	0.000514 [1.104]
Observations	21,617	18,591	21,425

Table 8. Effects of lottery-win size on registrations and incorporations among men.

This table presents the results of regression analyses studying the impact of lottery winnings on business starts by male lottery winners. Each cell presents the marginal effect for the log of lottery-winning amount on the probability of the business start in the quarter relative to the lottery-winning date. The numbers of observations reported are for quarter 0. The number of observations for other quarters may vary. The first column shows marginal effects of lottery-winning amount (in logs) on either registrations or incorporations, the second column shows marginal effects for registrations only, and the third column shows marginal effects for incorporations only. All regressions are estimated using logit models with lottery-year fixed effects. We display t -stats in brackets. ***, **, * indicate significance at 1, 5, and 10% level, respectively.

Quarter	Total	Registration	Incorporation
-4	-0.001177 [1.055]	-0.001320 [1.376]	-0.000502 [0.544]
-3	-0.000109 [0.113]	-0.000110 [0.155]	-0.000068 [0.083]
-2	0.000045 [0.054]	-0.000811 [1.043]	0.000454 [0.675]
-1	0.000242 [0.293]	-0.000012 [0.021]	0.000250 [0.340]
0	0.000599 [0.705]	-0.000402 [0.497]	0.000742 [1.054]
1	0.001662** [2.306]	0.000247 [0.381]	0.001318** [2.301]
2	-0.000286 [0.324]	-0.000036 [0.059]	-0.000283 [0.369]
3	-0.000912 [0.904]	-0.000774 [0.911]	-0.000465 [0.558]
4	0.000585 [0.834]	-0.000721 [0.764]	0.000785 [1.364]
Observations	12,664	9,497	12,170

Table 9. Effects of lottery-win size on registrations and incorporations among women.

This table presents the results of regression analyses studying the impact of lottery winnings on business starts by female lottery winners. Each cell presents the marginal effect for the log of lottery-winning amount on the probability of the business start in the quarter relative to the lottery-winning date. The numbers of observations reported are for quarter 0. The number of observations for other quarters may vary. The first column shows marginal effects of lottery-winning amount (in logs) on either registrations or incorporations, the second column shows marginal effects for registrations only, and the third column shows marginal effects for incorporations only. All regressions are estimated using logit models with lottery-year fixed effects. We display t -stats in brackets. ***, **, * indicate significance at 1, 5, and 10% level, respectively.

Quarter	Total	Registration	Incorporation
-4	-0.000993 [0.571]	-0.000951 [0.472]	-0.000563 [0.402]
-3	-0.000177 [0.127]	0.000007 [0.005]	-0.000212 [0.161]
-2	-0.002361 [1.034]	-0.003694 [0.976]	-0.001212 [0.614]
-1	0.000667 [0.531]	0.001092 [1.495]	-0.000410 [0.287]
0	0.001689* [1.789]	0.001636** [2.409]	-0.000216 [0.170]
1	-0.000640 [0.412]	-0.001559 [0.439]	-0.000394 [0.248]
2	0.001742** [2.081]	0.001258* [1.672]	0.001373* [1.758]
3	-0.000501 [0.386]	0.000177 [0.157]	-0.000280 [0.234]
4	-0.000084 [0.058]	-0.000129 [0.117]	0.000016 [0.011]
Observations	4,930	3,704	4,208

Table 10. Effects of lottery-win size on registrations and incorporations in 2004-2008.

This table presents the results of regression analyses studying the impact of lottery winnings on business starts by lottery winners in the boom period. Each cell presents the marginal effect for the log of lottery-winning amount on the probability of the business start in the quarter relative to the lottery-winning date. The numbers of observations reported are for quarter 0. The number of observations for other quarters may vary. The first column shows marginal effects of lottery-winning amount (in logs) on either registrations or incorporations, the second column shows marginal effects for registrations only, and the third column shows marginal effects for incorporations only. All regressions are estimated using logit models with lottery-year fixed effects. We display t -stats in brackets. ***, **, * indicate significance at 1, 5, and 10% level, respectively.

Quarter	Total	Registration	Incorporation
-4	-0.000003 [0.003]	-0.000284 [0.339]	0.000197 [0.175]
-3	-0.000972 [0.692]	-0.002707 [1.379]	0.000093 [0.090]
-2	-0.001178 [0.808]	-0.000127 [0.154]	-0.001095 [0.836]
-1	-0.001198 [0.851]	-0.004201 [1.358]	-0.000187 [0.178]
0	0.001476 [1.597]	-0.001166 [0.821]	0.001491** [2.481]
1	0.001803** [2.151]	0.000279 [0.474]	0.001479** [2.047]
2	-0.000096 [0.089]	-0.000539 [0.539]	0.000191 [0.228]
3	-0.000969 [0.832]	-0.000153 [0.233]	-0.000490 [0.525]
4	0.000934 [0.970]	-0.000224 [0.269]	0.000953 [1.233]
Observations	7,168	6,483	6,976

Table 11. Effects of lottery-win size on registrations and incorporations in 2009-2014.

This table presents the results of regression analyses studying the impact of lottery winnings on business starts by lottery winners in the bust period. Each cell presents the marginal effect for the log of lottery-winning amount on the probability of the business start in the quarter relative to the lottery-winning date. The numbers of observations reported are for quarter 0. The number of observations for other quarters may vary. The first column shows marginal effects of lottery-winning amount (in logs) on either registrations or incorporations, the second column shows marginal effects for registrations only, and the third column shows marginal effects for incorporations only. All regressions are estimated using logit models with lottery-year fixed effects. We display t -stats in brackets. ***, **, * indicate significance at 1, 5, and 10% level, respectively.

Quarter	Total	Registration	Incorporation
-4	-0.001548 [1.476]	-0.001629* [1.764]	-0.000649 [0.809]
-3	0.000133 [0.161]	0.000500 [1.060]	-0.000222 [0.299]
-2	-0.000098 [0.126]	-0.000937 [1.267]	0.000385 [0.650]
-1	0.000699 [1.016]	0.000513 [1.566]	0.000088 [0.130]
0	0.000337 [0.436]	0.000787** [2.243]	-0.000944 [1.097]
1	0.001016 [1.447]	-0.000003 [0.004]	0.000908 [1.635]
2	0.000560 [0.787]	0.000702* [1.879]	-0.000032 [0.050]
3	-0.000435 [0.503]	-0.000300 [0.567]	-0.000250 [0.334]
4	0.000232 [0.319]	0.000016 [0.030]	0.000221 [0.365]
Observations	14,449	12,108	14,449

Table 12. Impact of lottery winnings on business starts intermediated by prior business experience.

(A) Impact of lottery winnings on business starts by winners with prior business starts. This table presents the results of regression analyses studying the impact of lottery winnings on business starts by lottery winners who have filed a business registration or incorporation with the province at least once in the past. The numbers of observations reported are for quarter 0. The number of observations for other quarters may vary. Each cell presents the marginal effect for the log of lottery-winning amount on the probability of the business start in the quarter relative to the lottery-winning date. The first column shows marginal effects of lottery winnings (in logs) on either registrations or incorporations, the second column shows marginal effects for registrations only, and the third column shows marginal effects for incorporations only. All regressions are estimated using logit models with lottery-year fixed effects. We display *t*-stats in brackets. ***, **, * indicate significance at 1, 5, and 10% level, respectively.

Quarter	Total	Registration	Incorporation
-4	-0.003519 [0.966]	-0.004122 [1.396]	-0.001226 [0.408]
-3	0.000200 [0.062]	0.000814 [0.395]	0.000069 [0.025]
-2	-0.001040 [0.331]	-0.002919 [1.090]	0.000723 [0.290]
-1	0.002013 [0.705]	0.001783 [1.039]	0.000463 [0.177]
0	-0.003252 [1.100]	-0.009076** [2.063]	-0.000741 [0.315]
1	0.005103*** [2.630]	0.000685 [0.433]	0.004613*** [2.583]
2	0.001126 [0.531]	0.002272* [1.936]	-0.001007 [0.453]
3	-0.001923 [0.715]	-0.003048 [1.127]	0.000139 [0.067]
4	0.002251 [1.011]	-0.001478 [0.578]	0.002597 [1.433]
Observations	4,507	3,029	4,388

(B) Impact of lottery winnings on business starts by winners without prior business starts. This table presents the results of regression analyses studying the impact of lottery winnings on business starts by lottery winners who have never filed a business registration or incorporation with the province in the past. Each cell presents the marginal effect for the log of lottery-winning amount on the probability of the business start in the quarter relative to the lottery-winning date. The numbers of observations reported are for quarter 0. The number of observations for other quarters may vary. The first column shows marginal effects of lottery winnings (in logs) on either registrations or incorporations, the second column shows marginal effects for registrations only, and the third column shows marginal effects for incorporations only. All regressions are estimated using logit models with lottery-year fixed effects. By definition these individuals have no business activity prior to the lottery win, thus their pre-lottery business entry is always 0 and not shown in the table. We display *t*-stats in brackets. ***, **, * indicate significance at 1, 5, and 10% level, respectively.

Quarter	Total	Registration	Incorporation
0	0.001324*** [3.147]	0.000890*** [2.690]	0.000693* [1.689]
1	0.000521 [1.035]	0.000025 [0.040]	0.000494 [1.168]
2	0.000261 [0.512]	-0.000164 [0.323]	0.000352 [0.849]
3	-0.000077 [0.142]	0.000167 [0.489]	-0.000329 [0.606]
4	0.000353 [0.731]	0.000157 [0.407]	0.000243 [0.606]
5	-0.000451 [0.671]	0.000168 [0.351]	-0.000777 [1.104]
6	-0.000374 [0.659]	-0.000043 [0.127]	-0.000432 [0.764]
7	-0.000240 [0.405]	-0.000414 [0.714]	-0.000012 [0.024]
Observations	16,356	12,921	13,705

Table 13. Impact of lottery winnings on business starts as intermediated by local lending.

(A) Impact of lottery winnings on business starts in areas without bank branches within 1 km.

This table presents the results of regression analyses studying the impact of lottery winnings on business starts in postal codes without bank branches within 1 km (median distance to a bank). Each cell presents the marginal effect for the log of lottery-winning amount on the probability of the business start in the quarter relative to the lottery-winning date. The numbers of observations reported are for quarter 0. The number of observations for other quarters may vary. The first column shows marginal effects of lottery winnings (in logs) on either registrations or incorporations, the second column shows marginal effects for registrations only, and the third column shows marginal effects for incorporations only. All regressions are estimated using logit models with lottery-year fixed effects. We display t -stats in brackets. ***, **, * indicate significance at 1, 5, and 10% level, respectively.

Quarter	Total	Registration	Incorporation
-4	-0.001135 [0.878]	-0.001142 [1.091]	-0.000384 [0.357]
-3	-0.000930 [0.769]	0.000570 [0.836]	-0.001454 [1.216]
-2	-0.001490 [1.178]	-0.000288 [0.374]	-0.001343 [1.092]
-1	0.000103 [0.105]	0.000546 [1.041]	-0.000510 [0.499]
0	0.000555 [0.604]	0.000774 [1.432]	-0.000512 [0.493]
1	0.002041** [2.442]	-0.000093 [0.113]	0.001916*** [2.808]
2	0.000835 [1.008]	0.000384 [0.643]	0.000735 [1.114]
3	-0.000175 [0.171]	-0.000123 [0.177]	0.000074 [0.082]
4	0.000461 [0.527]	-0.000666 [0.643]	0.000668 [0.928]
Observations	10,629	8,216	9,615

(B) Impact of lottery winnings on business starts in areas with bank branches within 1 km. This table presents the results of regression analyses studying the impact of lottery winnings on business starts in postal codes with bank branches within 1 km (median distance to a bank). Each cell presents the marginal effect for the log of lottery-winning amount on the probability of the business start in the quarter relative to the lottery-winning date. The numbers of observations reported are for quarter 0. The number of observations for other quarters may vary. The first column shows marginal effects of lottery winnings (in logs) on either registrations or incorporations, the second column shows marginal effects for registrations only, and the third column shows marginal effects for incorporations only. All regressions are estimated using logit models with lottery-year fixed effects. We display *t*-stats in brackets. ***, **, * indicate significance at 1, 5, and 10% level, respectively.

Quarter	Total	Registration	Incorporation
-4	-0.000880 [0.717]	-0.001602 [1.087]	-0.000338 [0.345]
-3	0.000517 [0.530]	-0.000813 [0.796]	0.000848 [1.140]
-2	0.000424 [0.482]	-0.001751 [1.133]	0.000790 [1.249]
-1	0.000286 [0.331]	-0.000198 [0.268]	0.000456 [0.607]
0	0.001116 [1.344]	0.000038 [0.052]	0.001060 [1.618]
1	0.001181 [1.494]	0.000553 [0.754]	0.000844 [1.212]
2	-0.000151 [0.157]	0.000626 [1.130]	-0.000888 [0.916]
3	-0.001569 [1.290]	-0.001276 [1.040]	-0.000890 [0.894]
4	0.000634 [0.732]	0.000310 [0.458]	0.000417 [0.571]
Observations	9,910	8,486	9,286

Table 14. Lottery wins and the survival of already operating incorporated businesses.

(A) Impact of lottery winnings on the survival of already operating incorporated businesses. This table presents the results of Cox proportional hazards model regressions studying the impact of lottery winnings on closures of lottery winners' incorporated businesses in operation at the time of their lottery wins, as detailed in Equation 2. We report odds ratios for each explanatory variable, with absolute t -stats in brackets. The first column presents results of a regression using the linear term of lottery winnings (in logs) and the second column presents results using both linear and quadratic terms of lottery winnings (in logs). Both regressions include interacted lottery-win year and lottery product fixed effects and controls for business age at the time of lottery win using age and the square of age. ***, **, * indicate significance at 1, 5, and 10% level, respectively.

	Linear	Quadratic
$\ln(Amt)$	0.975 [1.03]	0.709** [2.15]
$\ln(Amt)^2$		1.016** [2.04]
FEs	LotYrXProd	LotYrXProd
Controls	f(Age)	f(Age)
N	4,665	4,665

(B) Marginal effect of lottery winnings on survival of already operating incorporated businesses at different winning amounts. This table presents the effect of a 10% increase in the lottery-winning amount on quarterly closure rates of lottery winners' incorporated businesses in operation at the time of their lottery wins based on the regression results in the second column of Table 14A. The effects are estimated at the 50th, 90th, 93rd, 95th, 97th, 98th, and 99th percentiles of lottery-win amounts. We display absolute t -stats in brackets. ***, **, * indicate significance at 1, 5, and 10% level, respectively.

	10% Increase in Winnings
Effect @ \$2,082	-0.00178** [2.41]
Effect @ \$6,677	-0.00102* [1.89]
Effect @ \$7,641	-0.000937* [1.81]
Effect @ \$17,798	-0.000481 [1.16]
Effect @ \$53,400	0.0000671 [0.17]
Effect @ \$103,712	0.000398 [0.84]
Effect @ \$500,000	0.00128 [1.56]
N	4,665

Table 15. Lottery wins and the survival of newly formed incorporated businesses.

(A) Impact of lottery winnings on survival of newly formed incorporated businesses. This table presents the results of Cox proportional hazards model regressions studying the impact of lottery winnings on closures of lottery winners' incorporated businesses started after their lottery wins. We report odds ratios for each explanatory variable, with absolute t -stats in brackets. The first column presents results of a regression using the linear term of lottery winnings (in logs) and the second column presents results using both linear and quadratic terms of lottery winnings (in logs). Both regressions include interacted lottery-win year and lottery product fixed effects. The third column presents results of a regression comparing lottery winners' newly formed incorporated businesses to non-lottery winners' incorporated businesses. It includes interacted incorporation year and lottery product fixed effects. ***, **, * indicate significance at 1, 5, and 10% level, respectively.

	Winners	Winners	Everyone
$\ln(Amt)$	1.001 [0.02]	0.921 [0.42]	
$\ln(Amt)^2$		1.004 [0.42]	
Lott winner			1.879 [0.63]
FEs	LotYrXProd	LotYrXProd	IncYrXProd
N	3,628	3,628	433,300

(B) Marginal effect of lottery winnings on survival of newly formed incorporated businesses at different winning amounts. This table presents the effect of a 10% increase in the lottery-winning amount on quarterly closure rates of lottery winners' incorporated businesses started after their lottery wins based on the regression results in the second column of Table 15A. The effects are estimated at the 50th, 90th, 93rd, 95th, 97th, 98th, and 99th percentiles of lottery-win amounts. We display absolute t -stats in brackets. ***, **, * indicate significance at 1, 5, and 10% level, respectively.

	10% Increase in Winnings
Effect @ \$2,082	-0.00143 [0.52]
Effect @ \$6,677	-0.000770 [0.37]
Effect @ \$7,641	-0.000695 [0.34]
Effect @ \$17,798	-0.000232 [0.12]
Effect @ \$53,400	0.000366 [0.18]
Effect @ \$103,712	0.000731 [0.32]
Effect @ \$500,000	0.00164 [0.48]
N	3,628

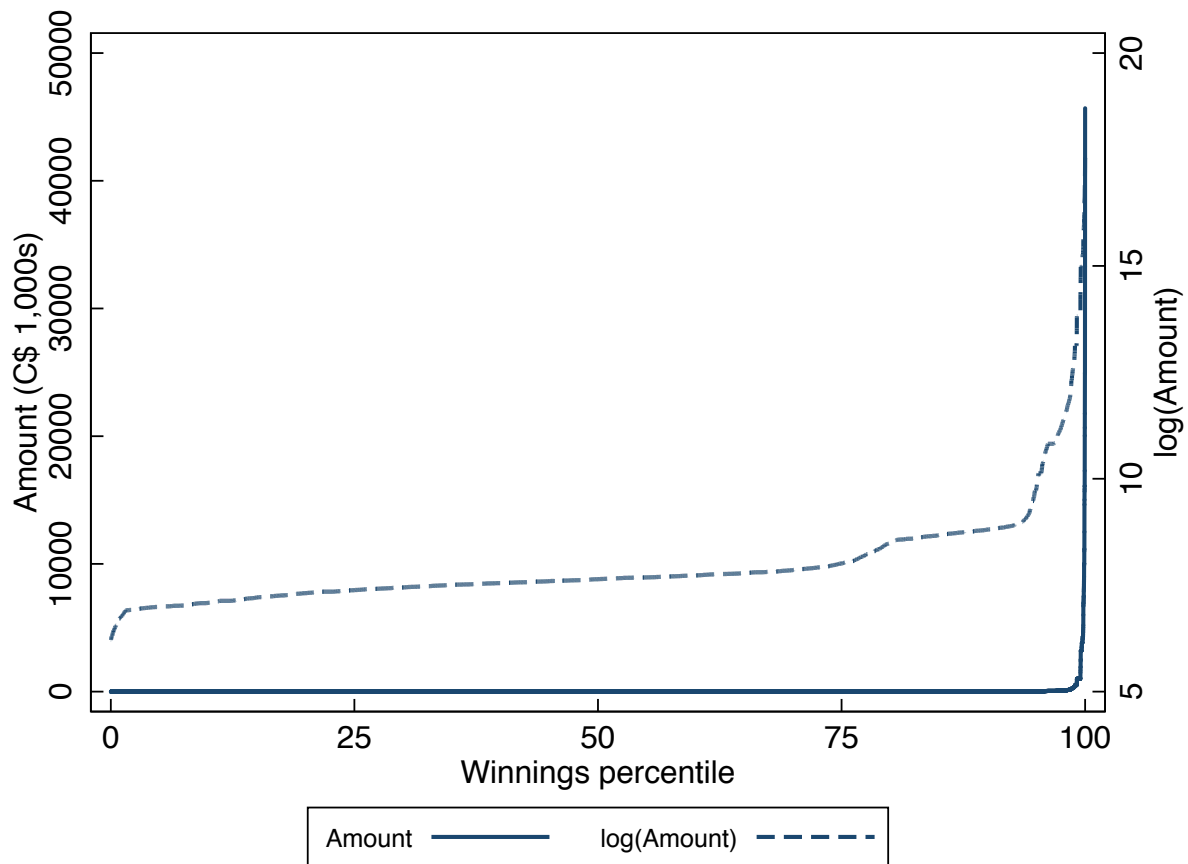


Figure 1. Distribution of lottery-win amounts.

This figure presents lottery-win amounts and log of those amounts for winners of lotteries without predetermined win amounts, sorted by the amount of the lottery win.

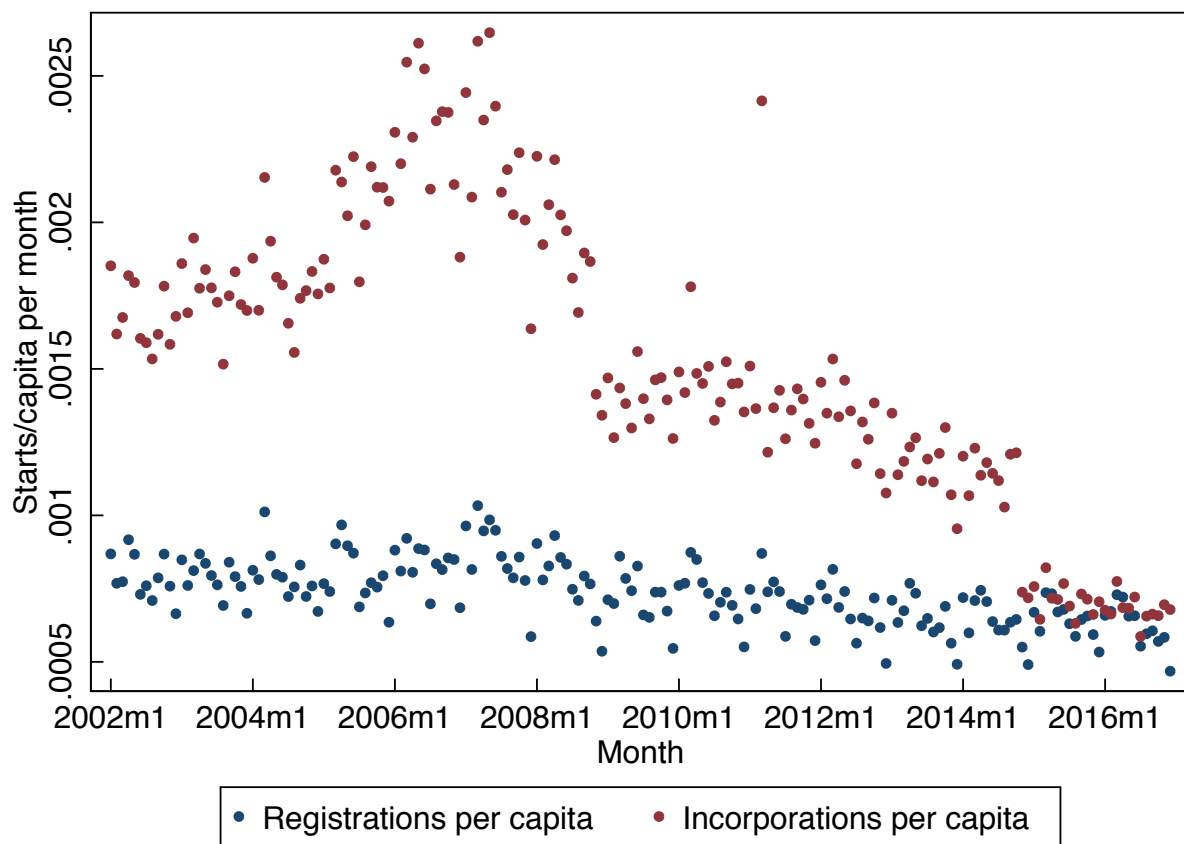


Figure 2. Business starts per capita, 2002-2016.

This figure presents the monthly per capita rate of name registrations and incorporations in a Canadian province.

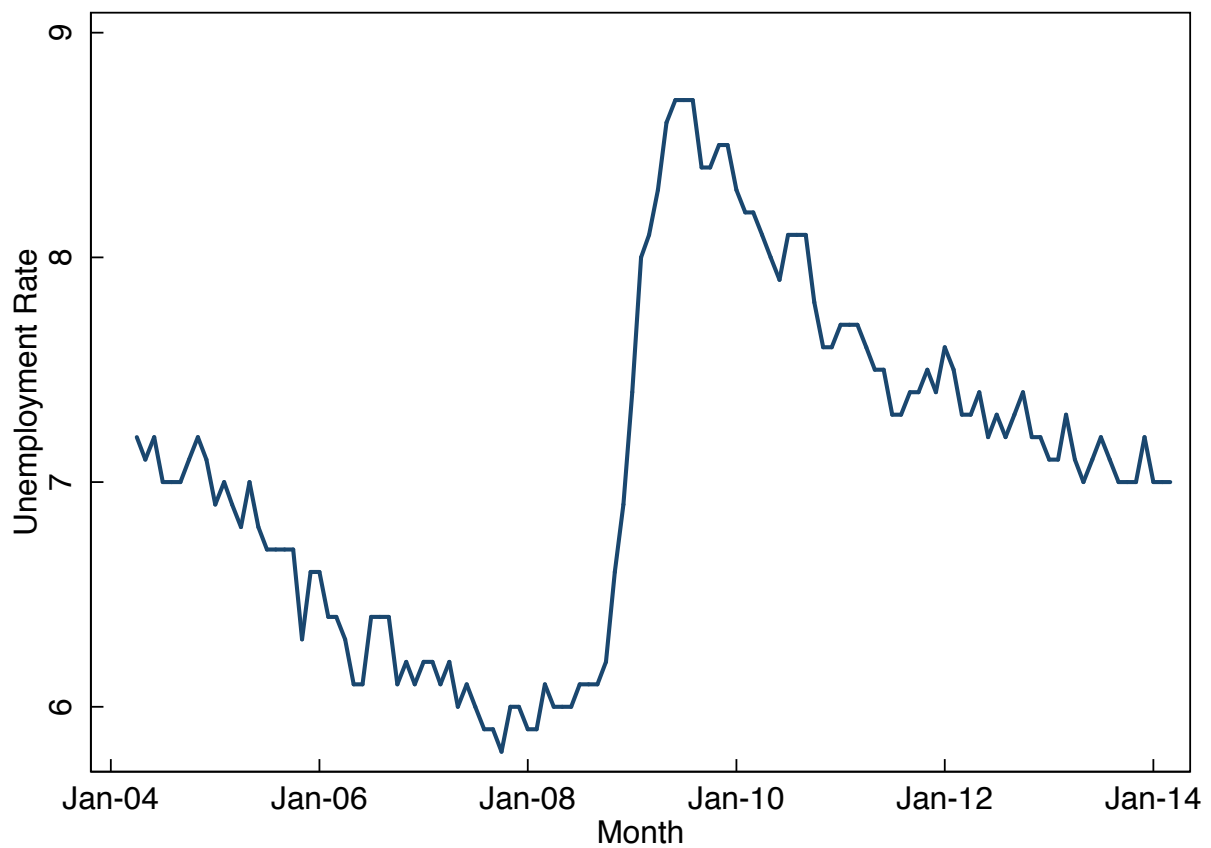


Figure 3. Unemployment rate, Canada-wide, April 2004 - March 2014.

This figure presents the unemployment rate for all of Canada, from April 2004 to March 2014.

Appendices

A Additional Empirical Analyses

Table A1. Effects of lottery-win size on registrations and incorporations with lottery amount winsorized at 98th percentile.

This table presents the results of regression analyses studying the impact of lottery winnings on business starts by all lottery winners. Each cell presents the marginal effect for the lottery-winning amount (in thousands) on the probability of the business start in the quarter relative to the lottery-winning date. The lottery amount is winsorized at the 98th percentile. The number of observations reported are for quarter 0. The number of observations for other quarters may vary. The first column shows marginal effects of lottery-winning amount (in thousands) on either registrations or incorporations, the second column shows marginal effects for registrations only, and the third column shows marginal effects for incorporations only. All regressions are estimated using logit models with lottery-year fixed effects. We display *t*-stats in brackets. ***, **, * indicate significance at 1, 5, and 10% level, respectively.

Quarter	Total	Registration	Incorporation
-4	-0.000040 [0.799]	-0.000108 [1.306]	-0.000003 [0.077]
-3	-0.000013 [0.274]	0.000024 [0.969]	-0.000028 [0.655]
-2	-0.000045 [0.915]	-0.000150 [1.008]	-0.000009 [0.241]
-1	0.000016 [0.423]	0.000009 [0.368]	0.000008 [0.229]
0	0.000053 [1.444]	0.000023 [0.981]	0.000030 [0.962]
1	0.000083** [2.564]	0.000011 [0.402]	0.000069*** [2.616]
2	0.000039 [1.130]	0.000032* [1.660]	0.000018 [0.612]
3	-0.000019 [0.447]	-0.000009 [0.357]	-0.000007 [0.188]
4	0.000040 [1.148]	0.000008 [0.349]	0.000031 [1.069]
Observations	21,617	18,591	21,425

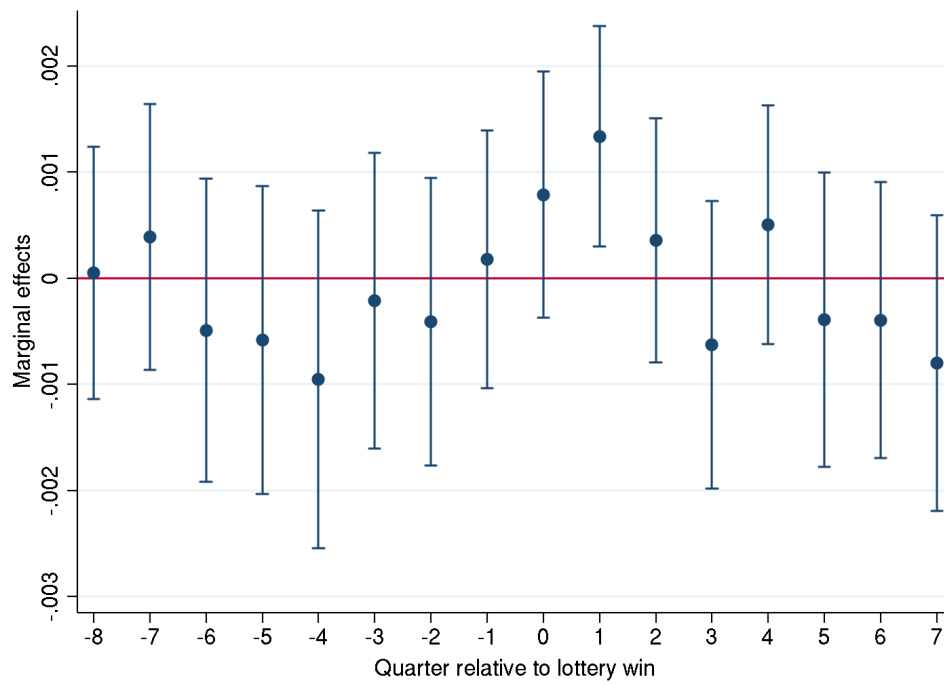


Figure A1. The effect of lottery wins on total business formation.

This figure presents the effect of the log of the lottery-win amount on total business formations. Dots represent marginal effect estimates, and bands show 95% confidence intervals. For more details, see Section 5.1.

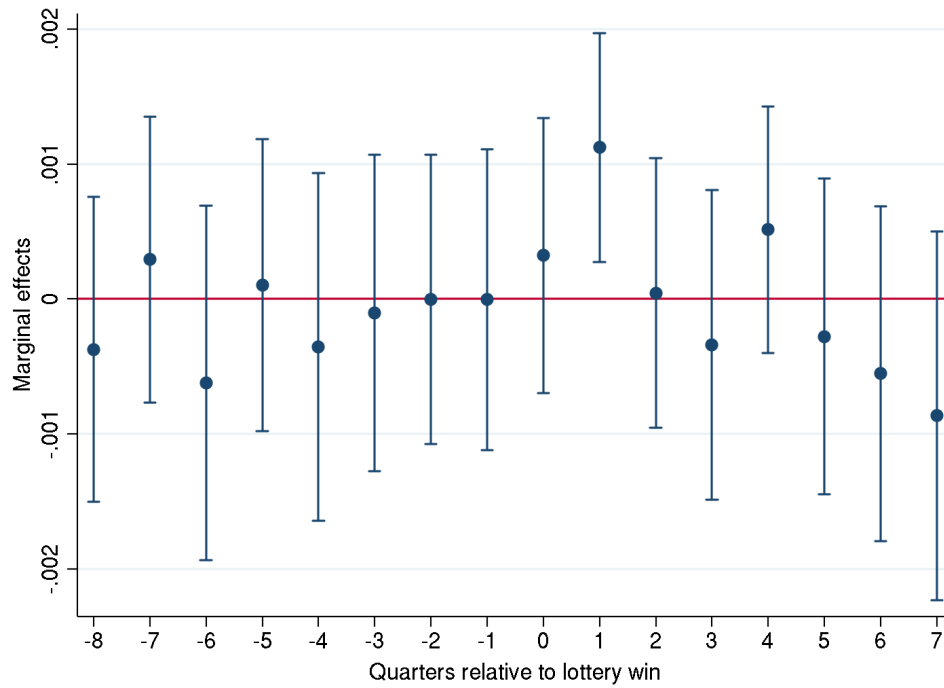


Figure A2. The effect of lottery wins on incorporations.

This figure presents the effect of the log of the lottery-win amount on incorporations. Dots represent marginal effect estimates, and bands show 95% confidence intervals. For more details, see Section 5.1.

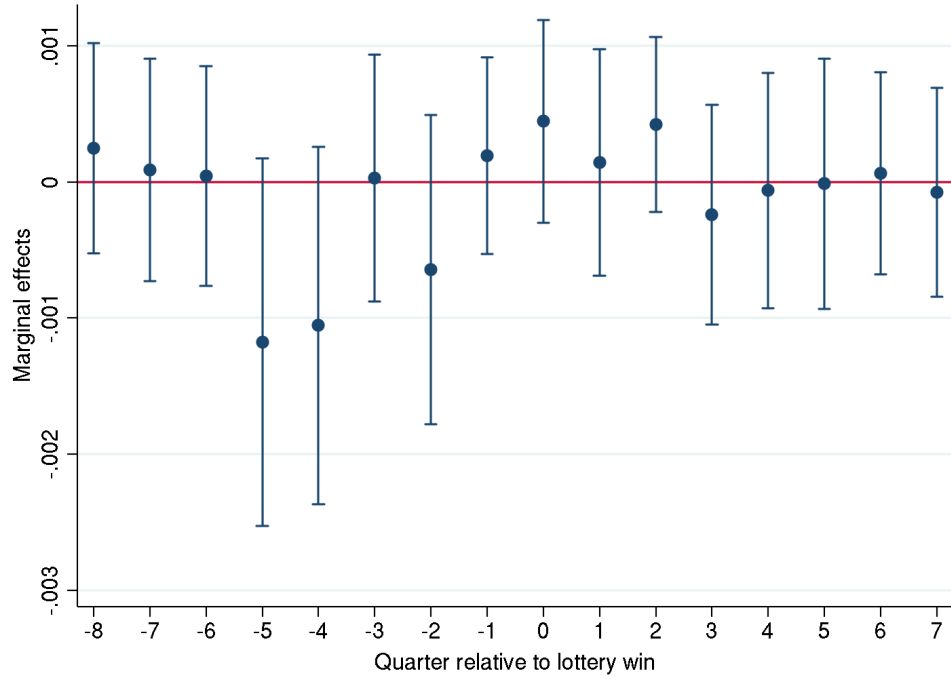


Figure A3. The effect of lottery wins on registrations.

This figure presents the effect of the log of the lottery-win amount on registrations. Dots represent marginal effect estimates, and bands show 95% confidence intervals. For more details, see Section 5.1.

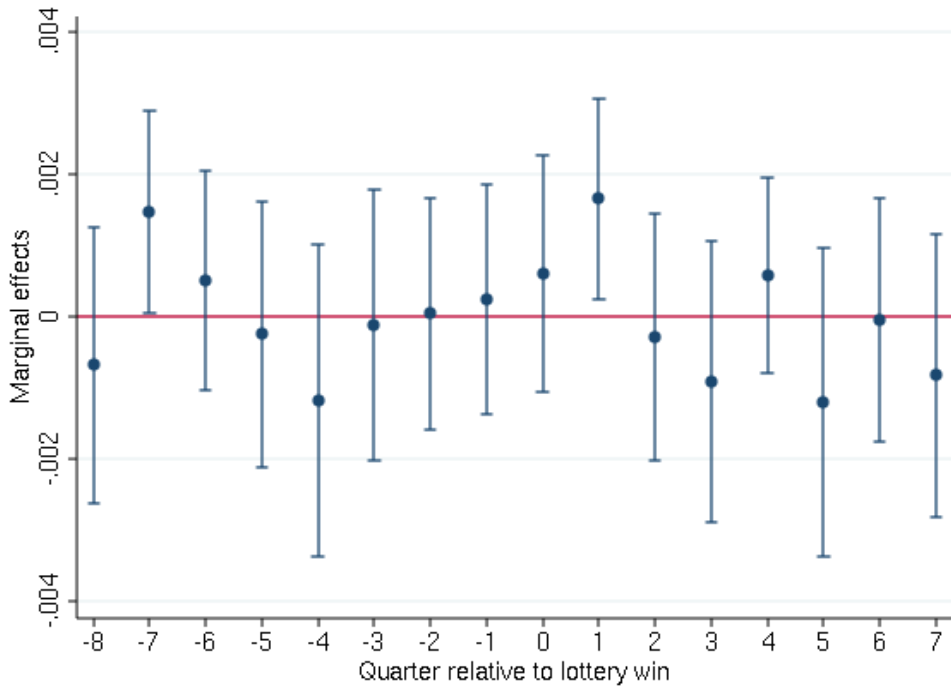


Figure A4. The effect of lottery wins on total business formation among male winners.

This figure presents the effect of the log of the lottery-win amount on total business formation for male lottery winners. Dots represent marginal effect estimates, and bands show 95% confidence intervals. For more details, see Section 5.2.

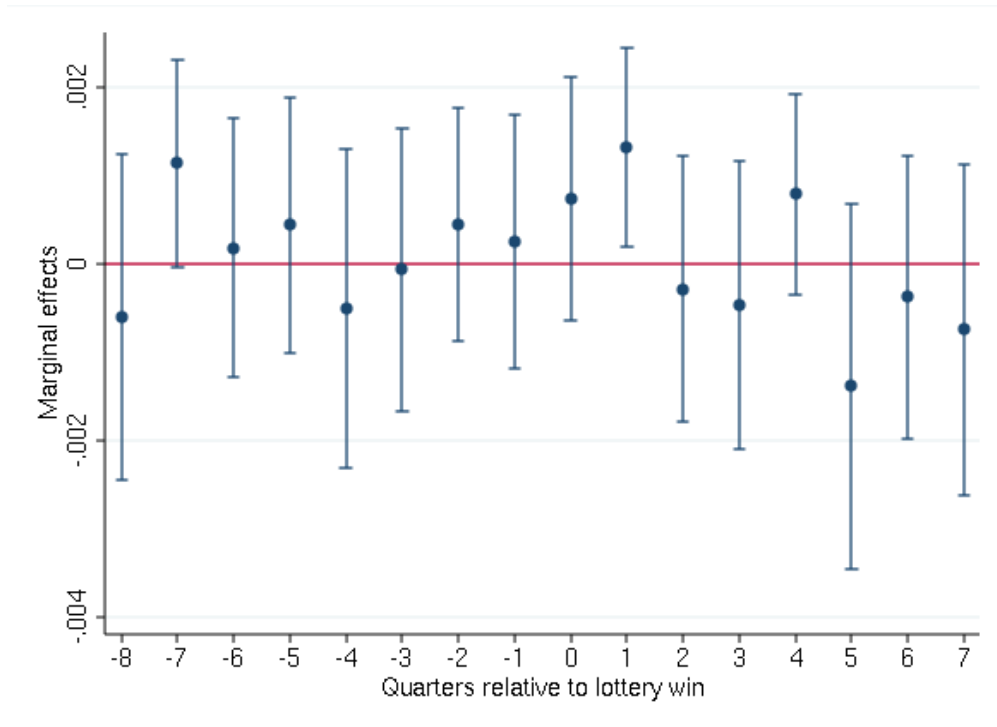


Figure A5. The effect of lottery wins on incorporations among male winners.

This figure presents the effect of the log of the lottery-win amount on incorporations for male lottery winners. Dots represent marginal effect estimates, and bands show 95% confidence intervals. For more details, see Section 5.2.

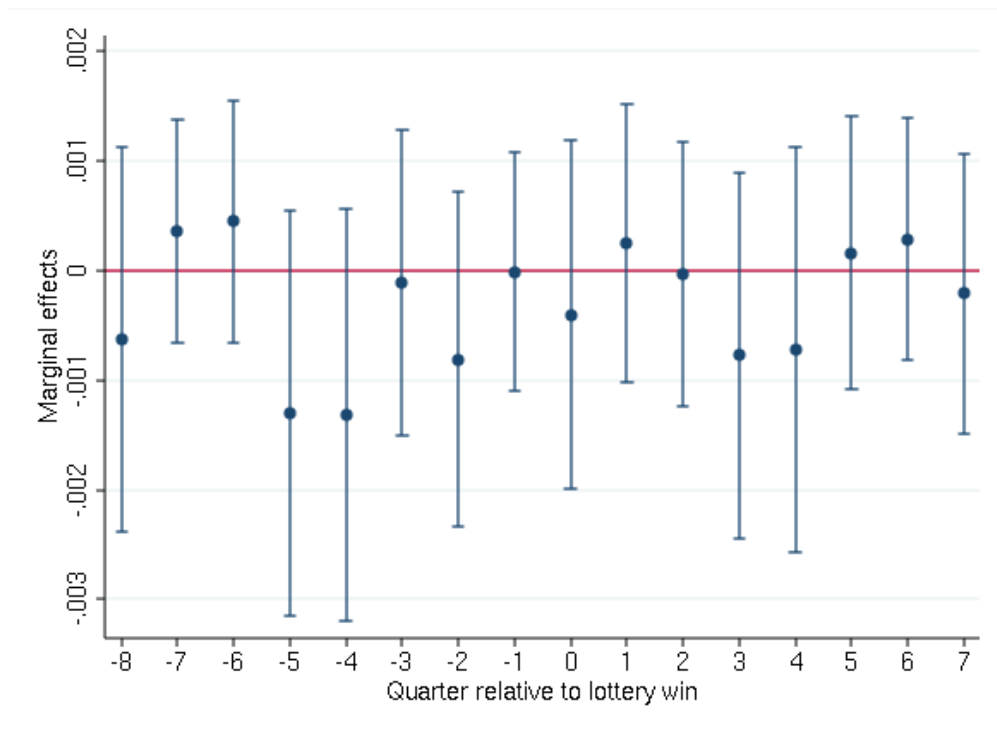


Figure A6. The effect of lottery wins on on registrations among male winners.

This figure presents the effect of the log of the lottery-win amount on registrations for male lottery winners. Dots represent marginal effect estimates, and bands show 95% confidence intervals. For more details, see Section 5.2.

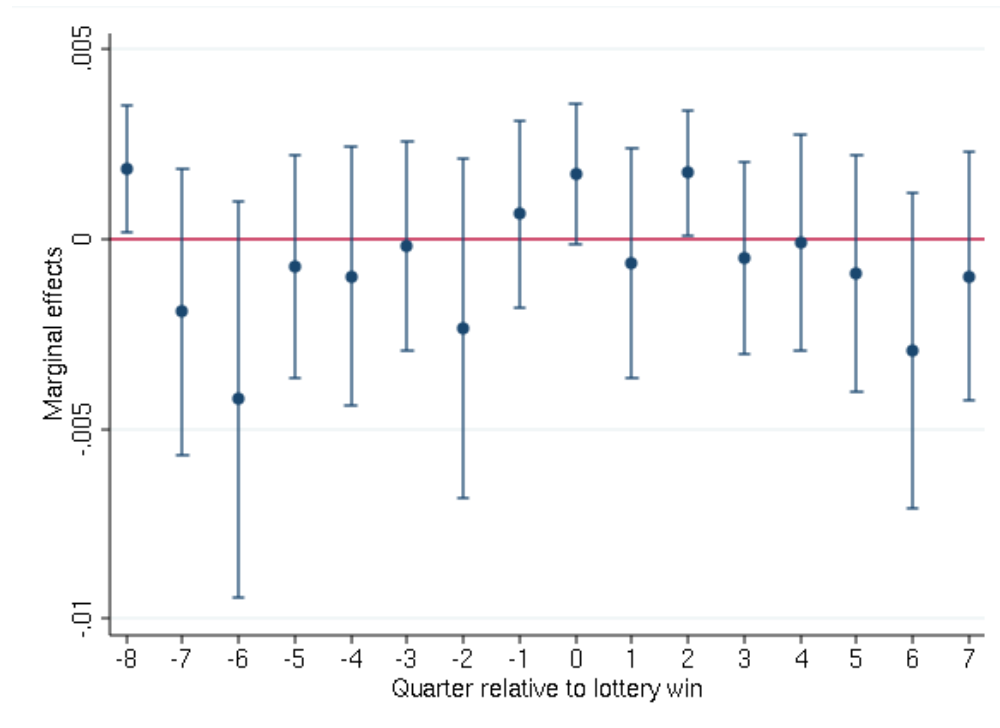


Figure A7. The effect of lottery wins on total business formation among female winners.

This figure presents the effect of the log of the lottery-win amount on total business formation for female lottery winners. Dots represent marginal effect estimates, and bands show 95% confidence intervals. For more details, see Section 5.2.

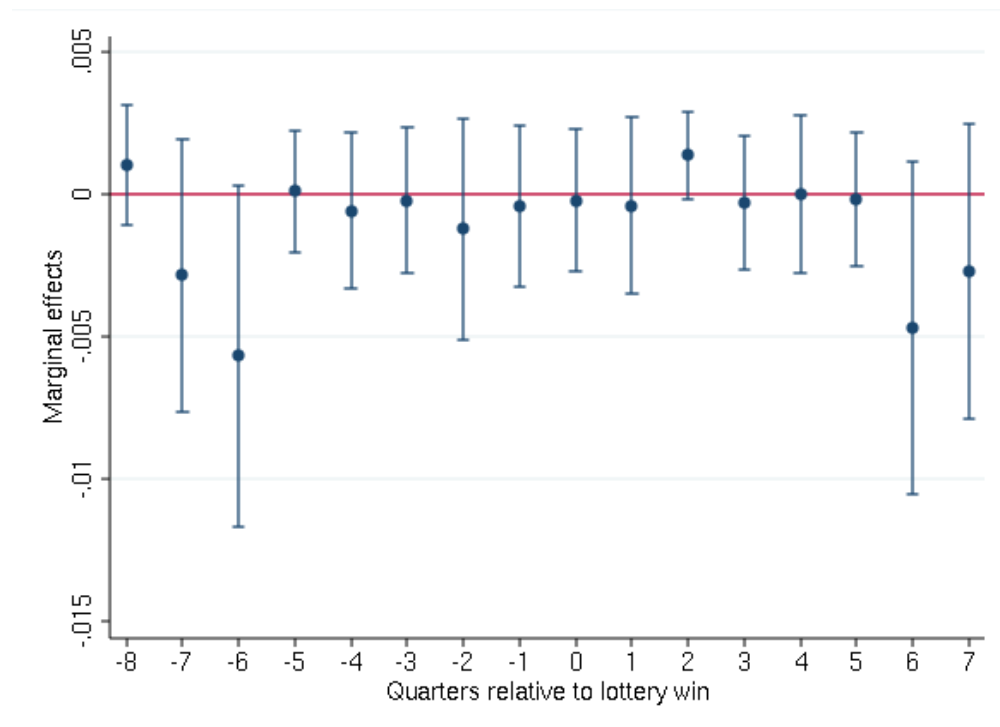


Figure A8. The effect of lottery wins on incorporations among female winners.

This figure presents the effect of the log of the lottery-win amount on incorporations for female lottery winners. Dots represent marginal effect estimates, and bands show 95% confidence intervals. For more details, see Section 5.2.

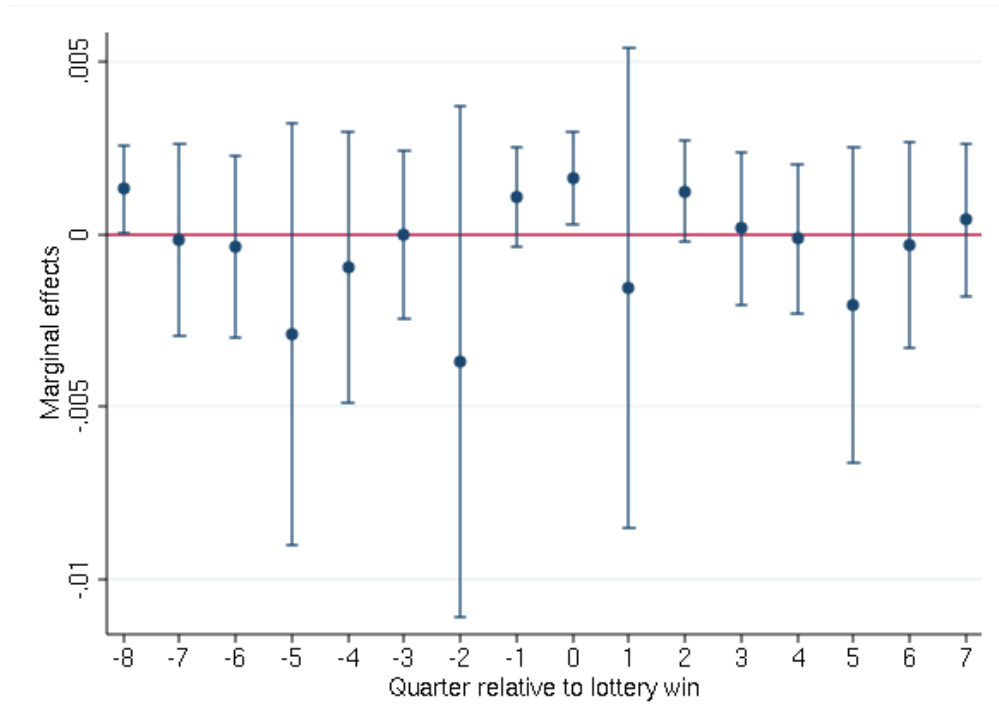


Figure A9. The effect of lottery wins on registrations among female winners.

This figure presents the effect of the log of the lottery-win amount on registrations for female lottery winners. Dots represent marginal effect estimates, and bands show 95% confidence intervals. For more details, see Section 5.2.

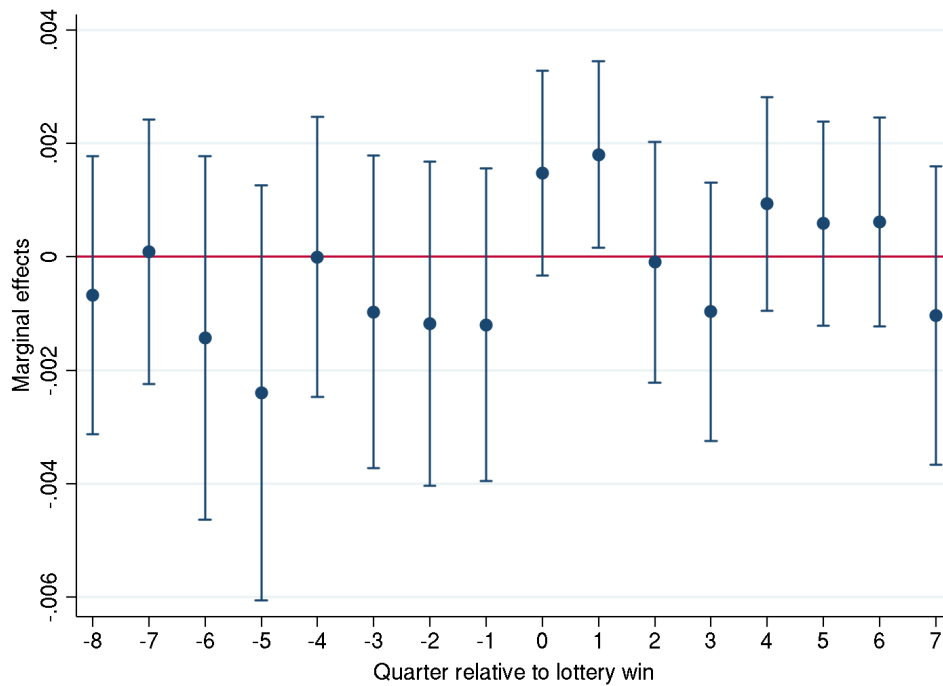


Figure A10. The effect of lottery wins on total business formation, 2004-2008.

This figure presents the effect of the log of the lottery-win amount on total business formation in 2004-2008. Dots represent marginal effect estimates, and bands show 95% confidence intervals. For more details, see Section 5.3.

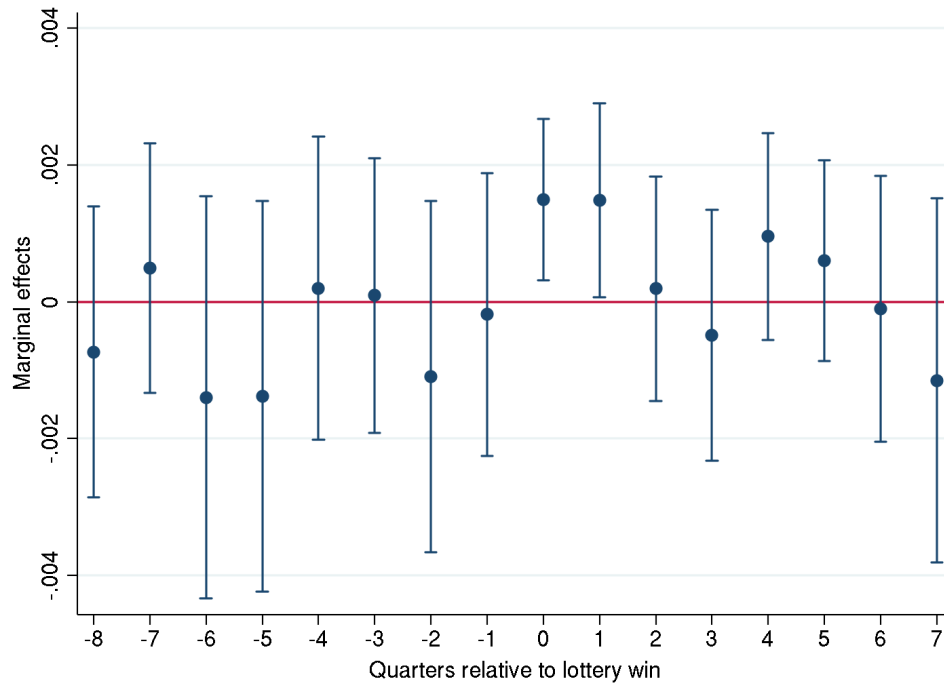


Figure A11. The effect of lottery wins on incorporations, 2004-2008.

This figure presents the effect of the log of the lottery-win amount on incorporations in 2004-2008. Dots represent marginal effect estimates, and bands show 95% confidence intervals. For more details, see Section 5.3.

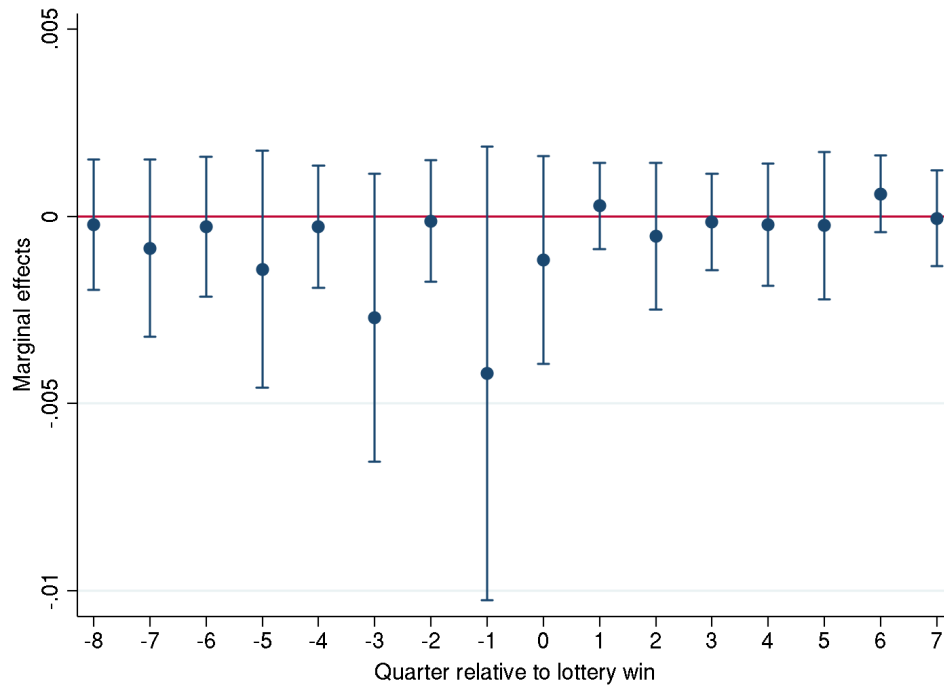


Figure A12. The effect of lottery wins on registrations, 2004-2008.

This figure presents the effect of the log of the lottery-win amount on registrations in 2004-2008. Dots represent marginal effect estimates, and bands show 95% confidence intervals. For more details, see Section 5.3.

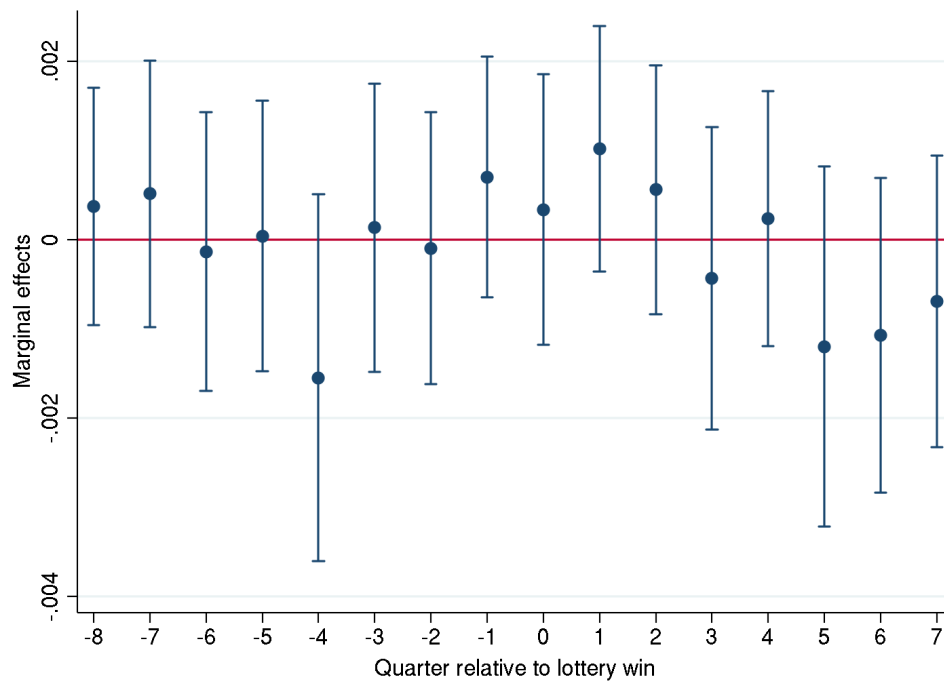


Figure A13. The effect of lottery wins on total business formation, 2009-2014.

This figure presents the effect of the log of the lottery-win amount on total business formation in 2009-2014. Dots represent marginal effect estimates, and bands show 95% confidence intervals. For more details, see Section 5.3.

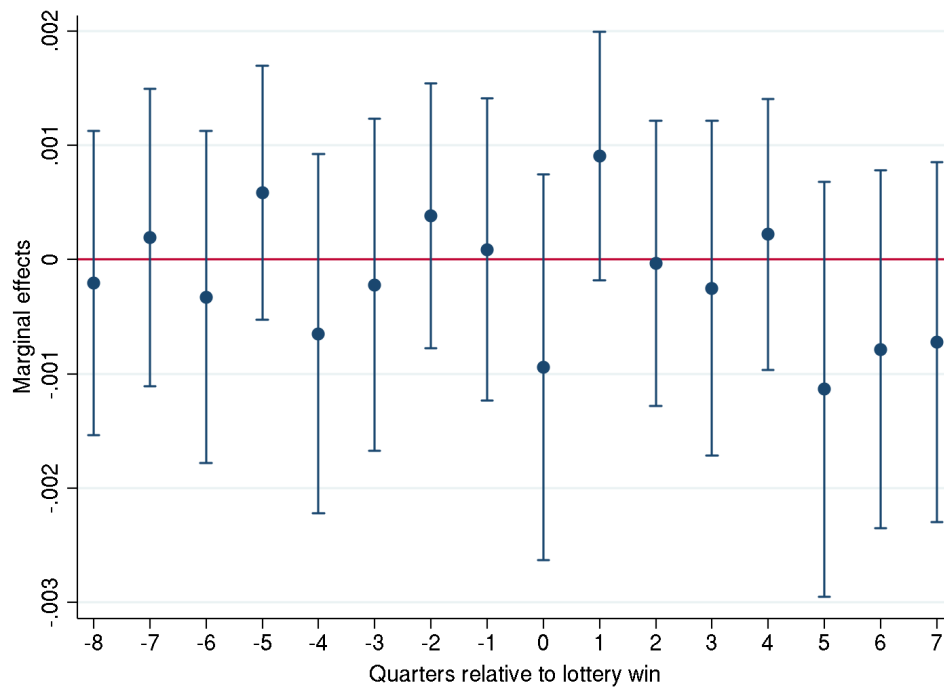


Figure A14. The effect of lottery wins on incorporations, 2009-2014.

This figure presents the effect of the log of the lottery-win amount on incorporations in 2009-2014. Dots represent marginal effect estimates, and bands show 95% confidence intervals. For more details, see Section 5.3.

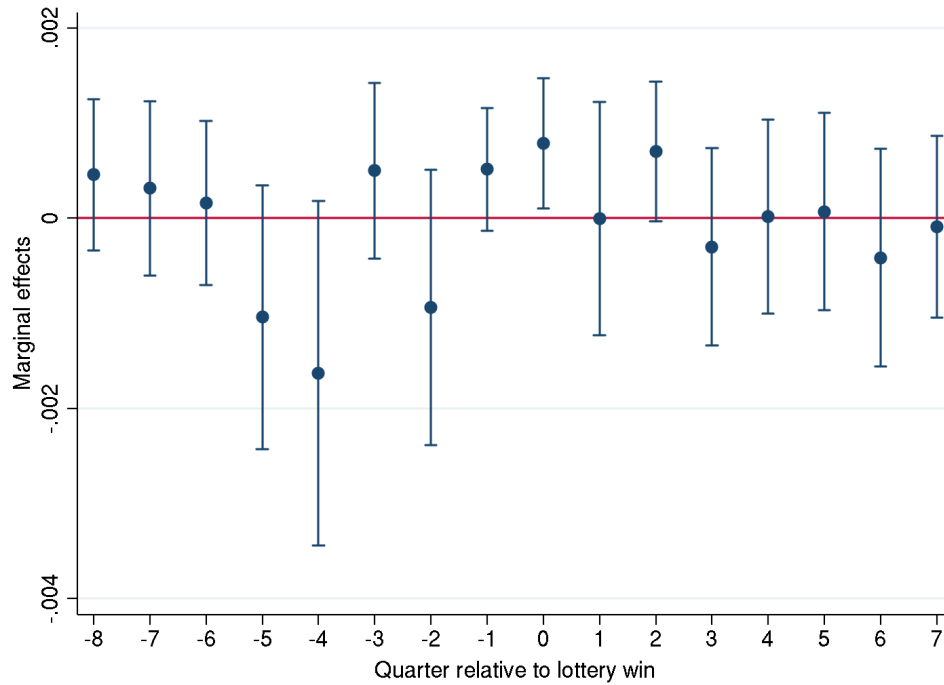


Figure A15. The effect of lottery wins on registrations, 2009-2014.

This figure presents the effect of the log of the lottery-win amount on registrations in 2009-2014. Dots represent marginal effect estimates, and bands show 95% confidence intervals. For more details, see Section 5.3.

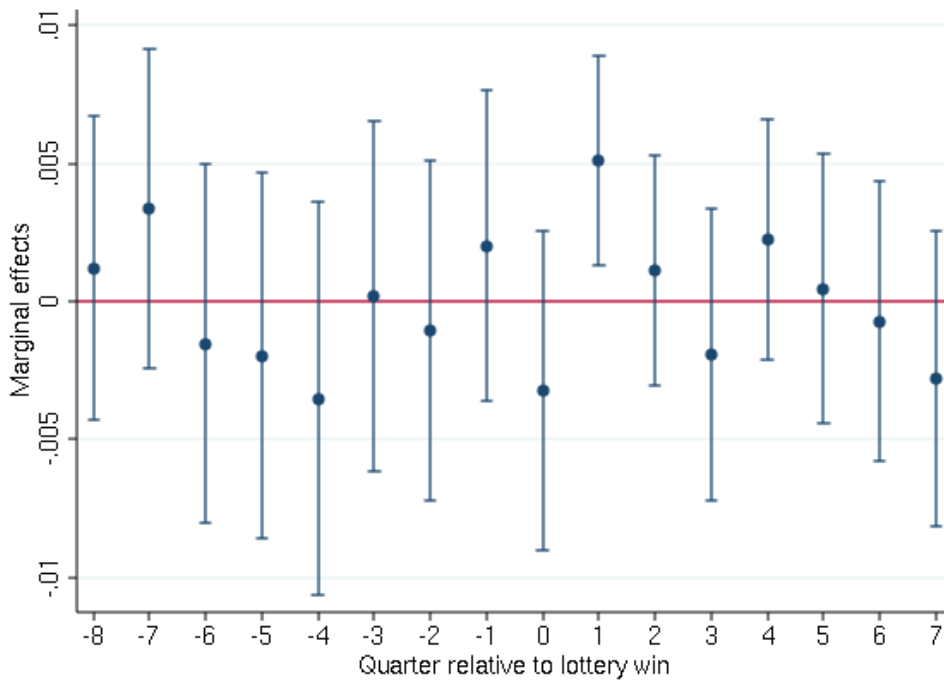


Figure A16. The effect of lottery wins on total business formation for winners with prior business experience. This figure presents the effect of the log of the lottery-win amount on total business formation. Dots represent marginal effect estimates, and bands show 95% confidence intervals. For more details, see Section 5.4.

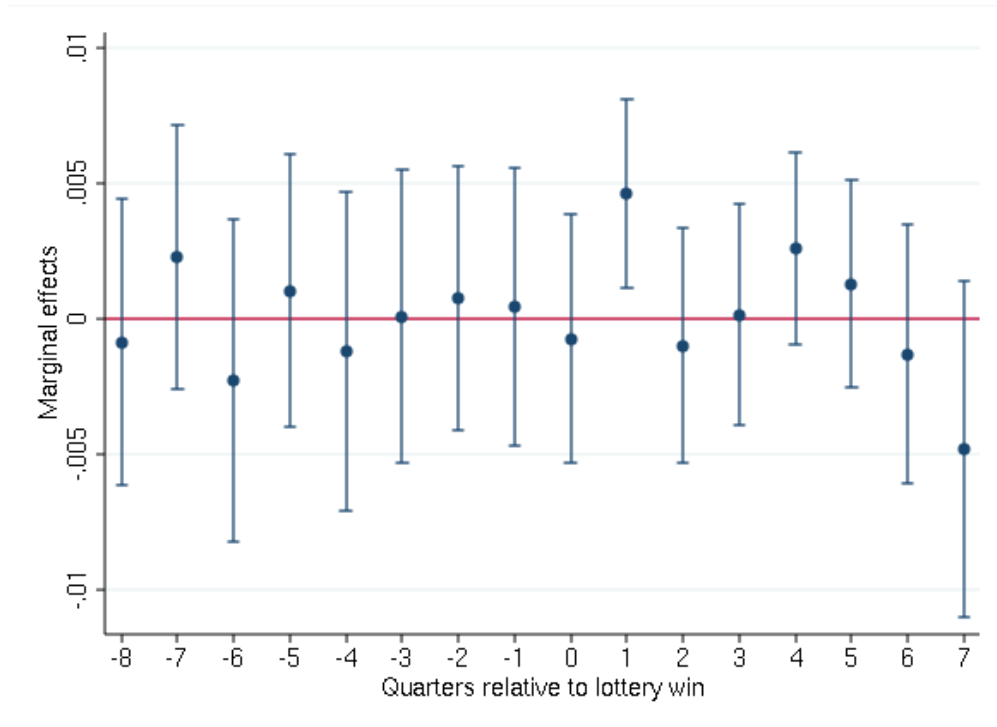


Figure A17. The effect of lottery wins on incorporations for winners with prior business experience. This figure presents the effect of the log of the lottery-win amount on incorporations. Dots represent marginal effect estimates, and bands show 95% confidence intervals. For more details, see Section 5.4.

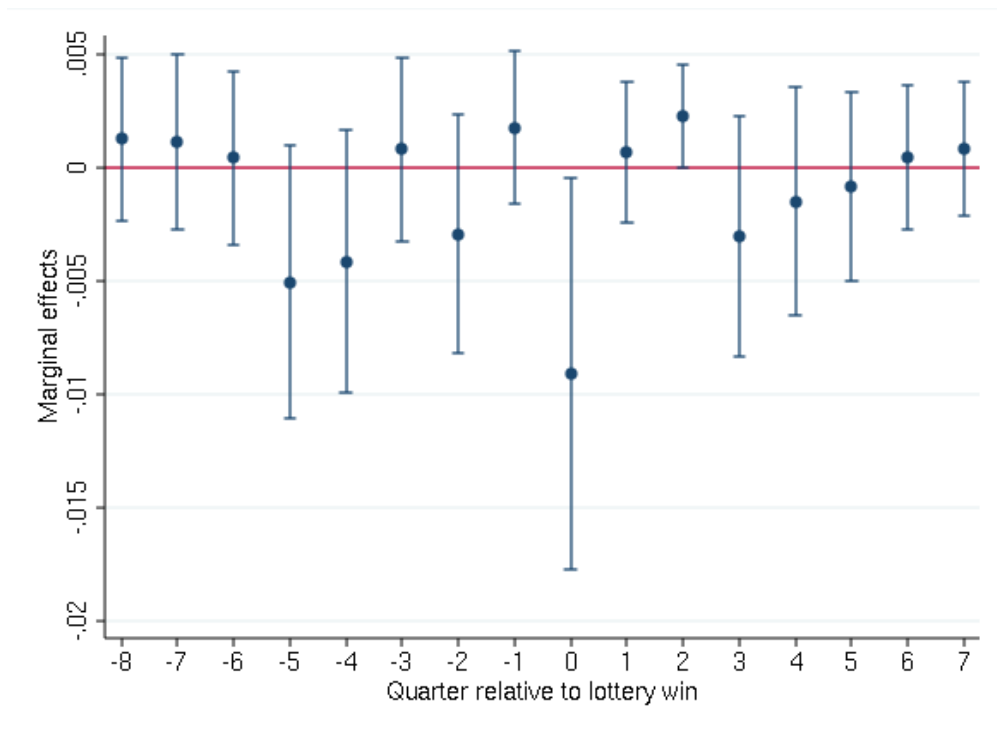


Figure A18. The effect of lottery wins on registrations for winners with prior business experience. This figure presents the effect of the log of the lottery-win amount on registrations. Dots represent marginal effect estimates, and bands show 95% confidence intervals. For more details, see Section 5.4.

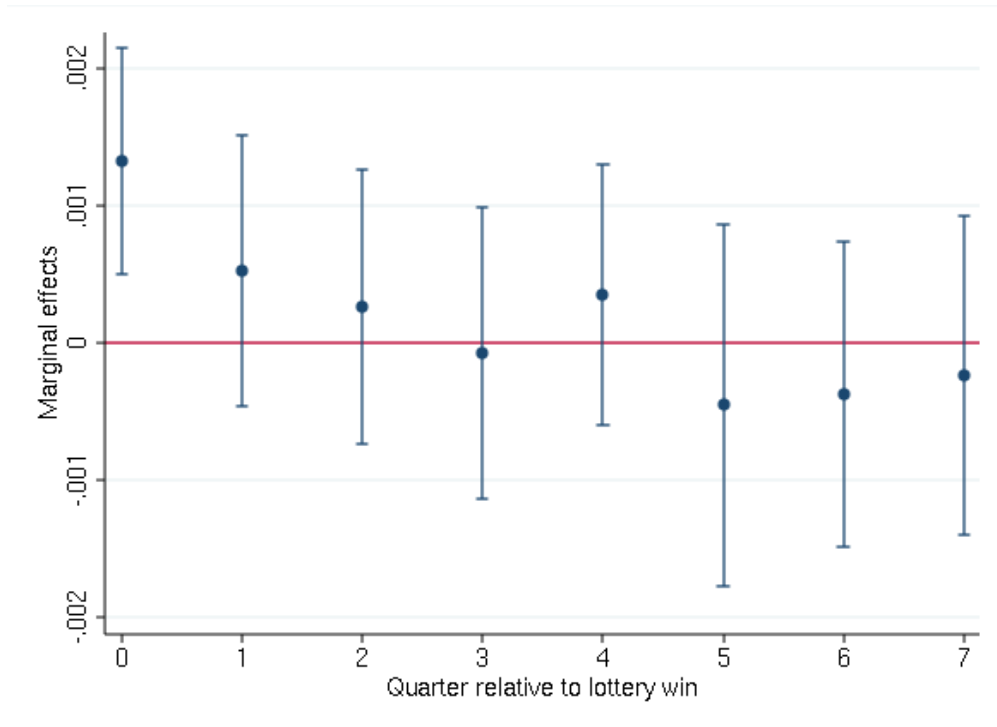


Figure A19. The effect of lottery wins on total business formation for winners without prior business experience. This figure presents the effect of the log of the lottery-win amount on total business formation. Dots represent marginal effect estimates, and bands show 95% confidence intervals. For more details, see Section 5.4.

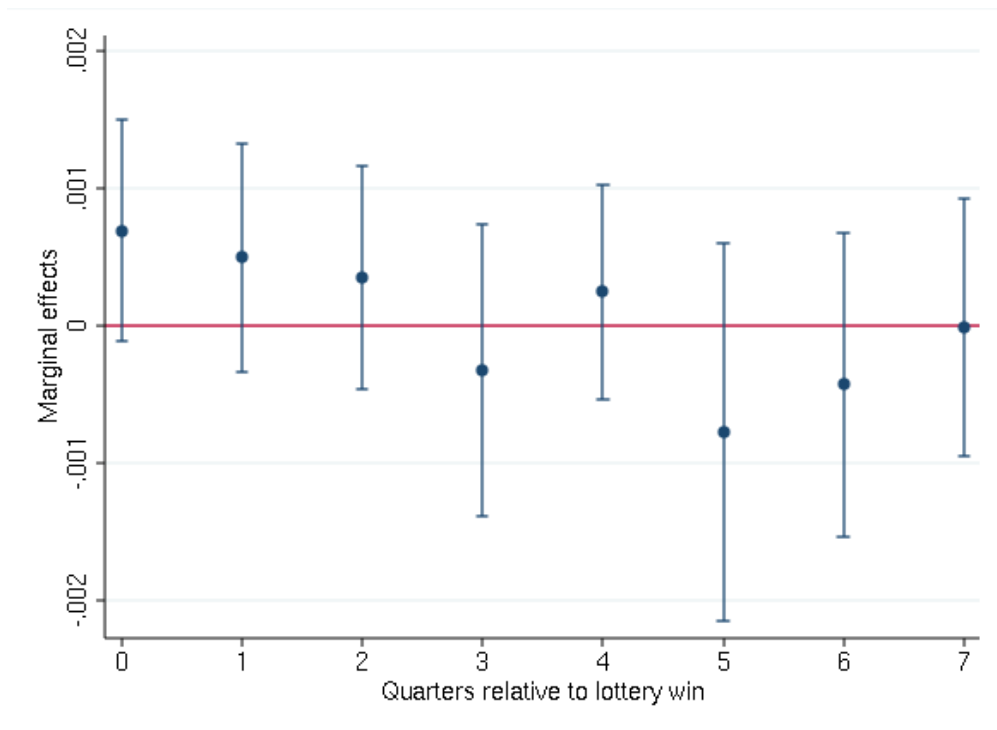


Figure A20. The effect of lottery wins on incorporations for winners without prior business experience. This figure presents the effect of the log of the lottery-win amount on incorporations. Dots represent marginal effect estimates, and bands show 95% confidence intervals. For more details, see Section 5.4.

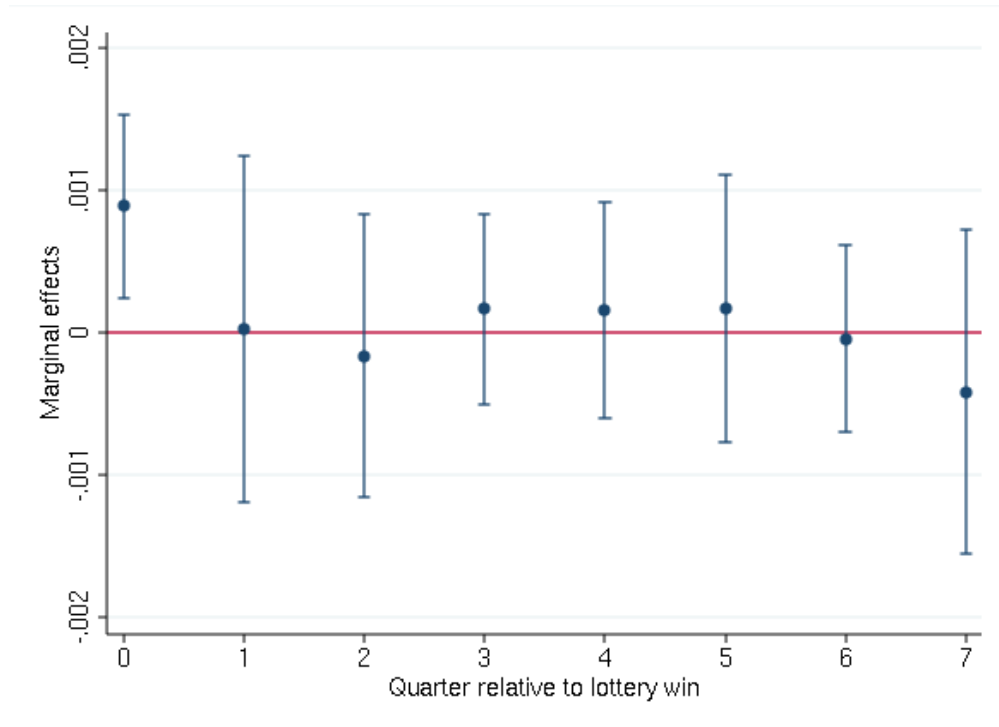


Figure A21. The effect of lottery wins on registrations for winners without prior business experience. This figure presents the effect of the log of the lottery-win amount on registrations. Dots represent marginal effect estimates, and bands show 95% confidence intervals. For more details, see Section 5.4.

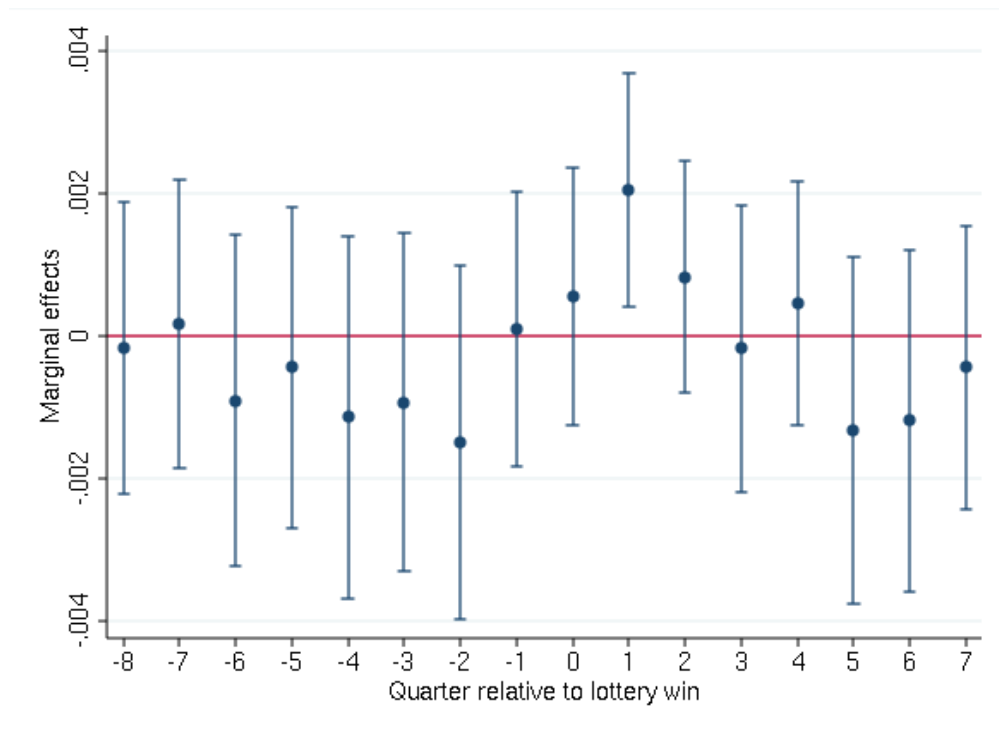


Figure A22. The effect of lottery wins on total business formation for winners without bank branches within 1 km. This figure presents the effect of the log of the lottery-win amount on total business formation. Dots represent marginal effect estimates, and bands show 95% confidence intervals. For more details, see Section 5.5.

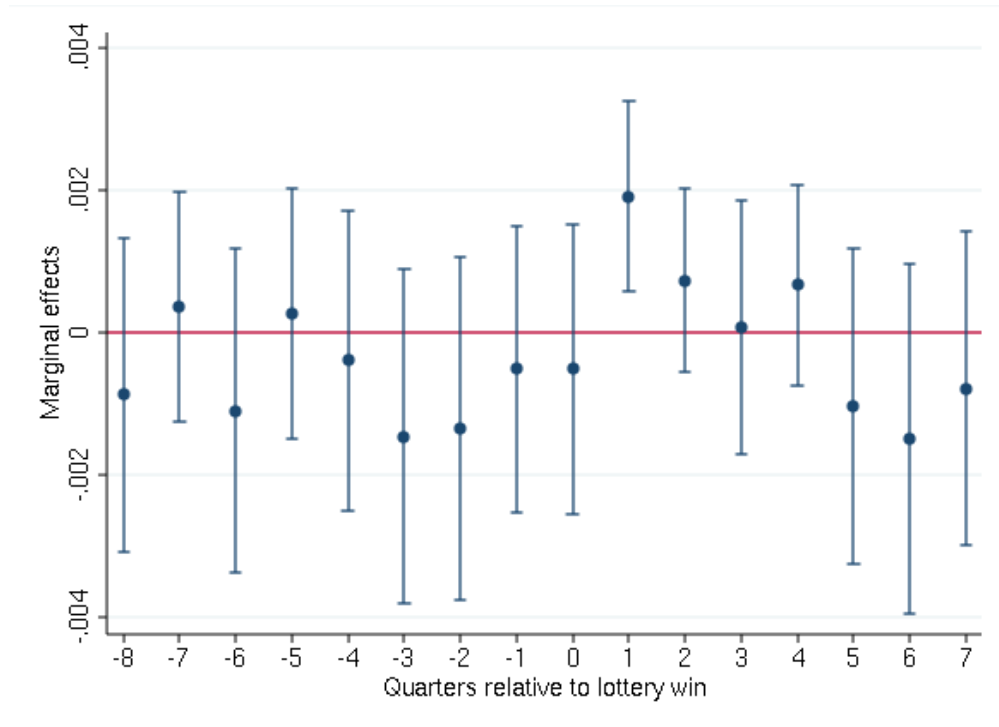


Figure A23. The effect of lottery wins on incorporations for winners without bank branches within 1 km. This figure presents the effect of the log of the lottery-win amount on incorporations. Dots represent marginal effect estimates, and bands show 95% confidence intervals. For more details, see Section 5.5.

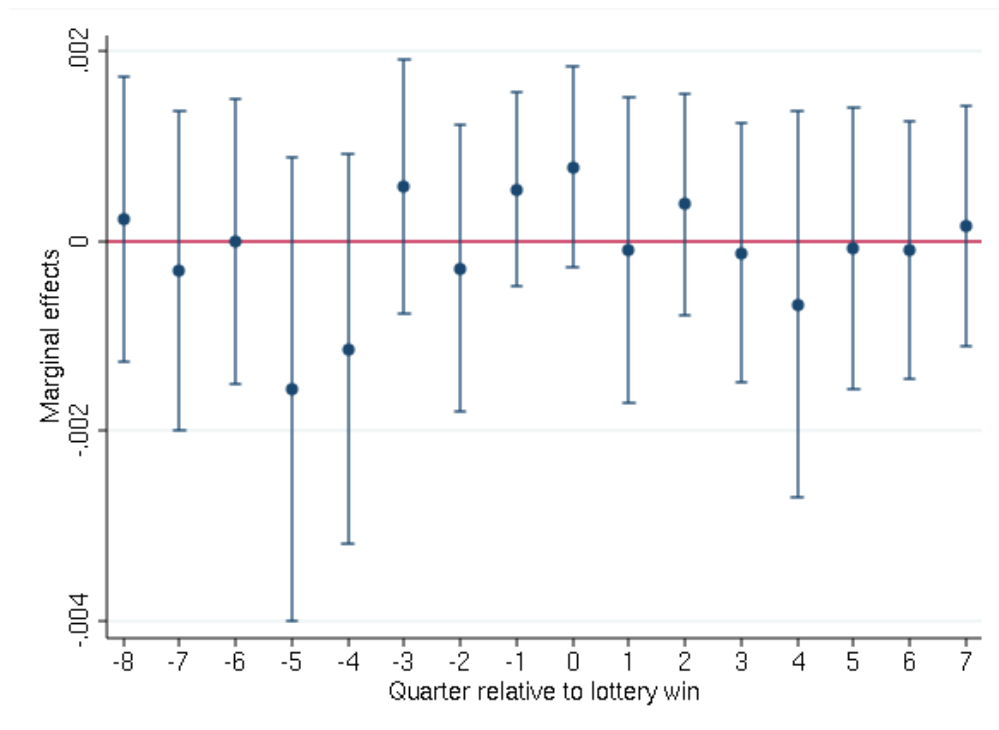


Figure A24. The effect of lottery wins on registrations for winners without bank branches within 1 km. This figure presents the effect of the log of the lottery-win amount on registrations. Dots represent marginal effect estimates, and bands show 95% confidence intervals. For more details, see Section 5.5.

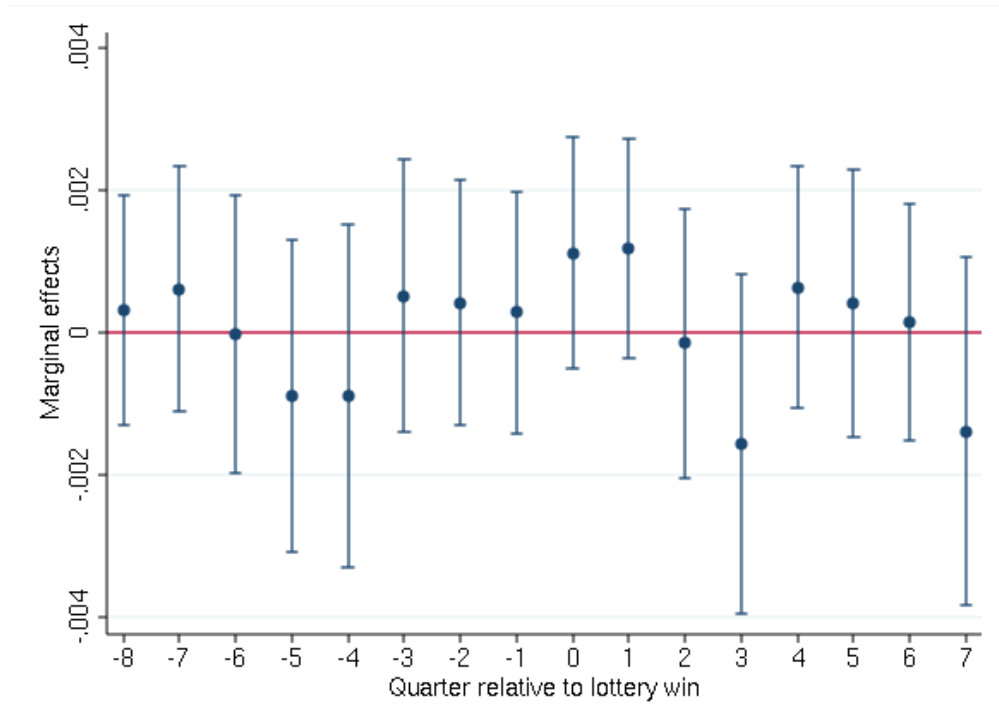


Figure A25. The effect of lottery wins on total business formation for winners with bank branches within 1 km. This figure presents the effect of the log of the lottery-win amount on total business formation. Dots represent marginal effect estimates, and bands show 95% confidence intervals. For more details, see Section 5.5.

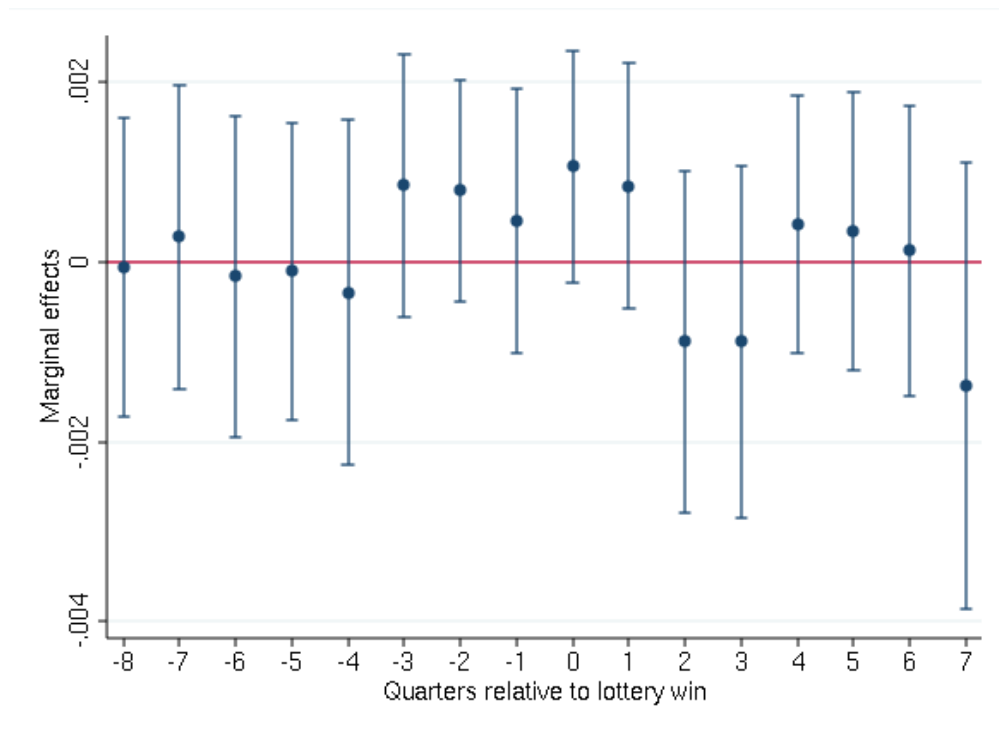


Figure A26. The effect of lottery wins on incorporations for winners with bank branches within 1 km. This figure presents the effect of the log of the lottery-win amount on incorporations. Dots represent marginal effect estimates, and bands show 95% confidence intervals. For more details, see Section 5.5.

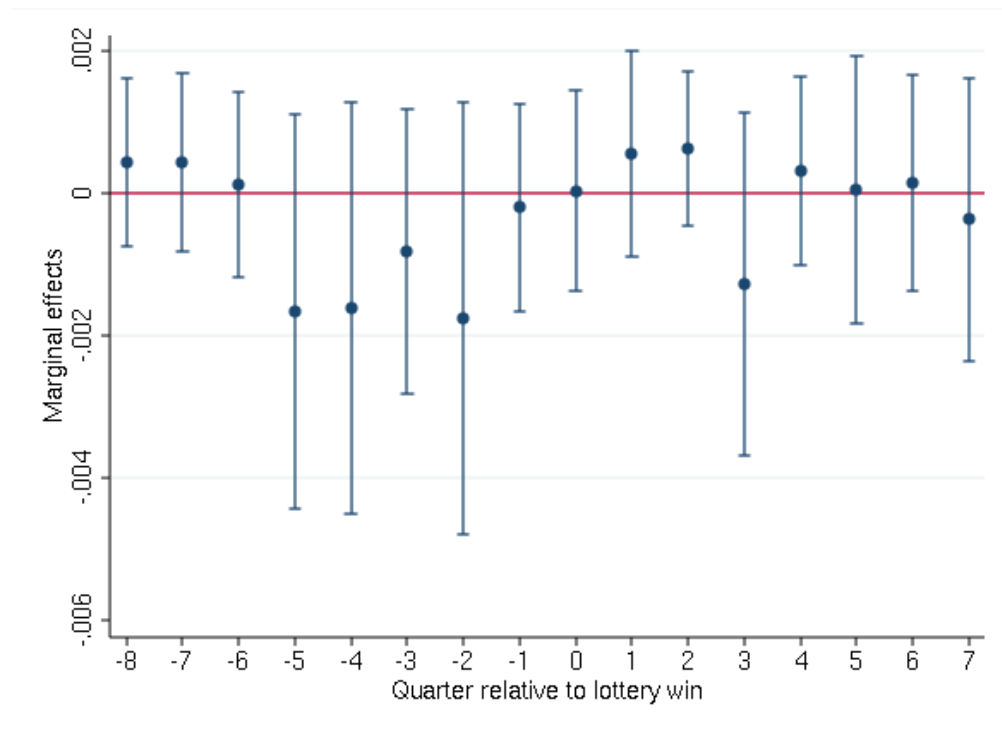
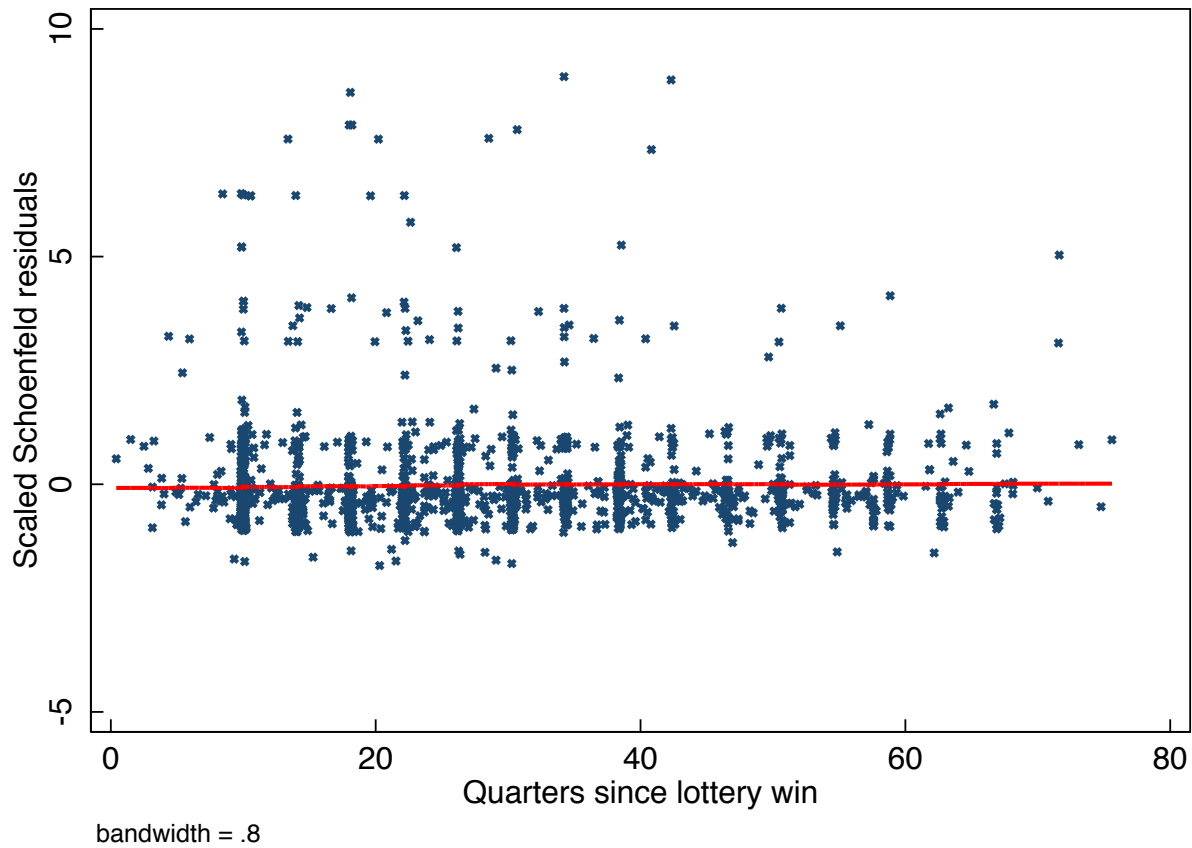


Figure A27. The effect of lottery wins on registrations for winners with bank branches within 1 km. This figure presents the effect of the log of the lottery-win amount on registrations. Dots represent marginal effect estimates, and bands show 95% confidence intervals. For more details, see Section 5.5.

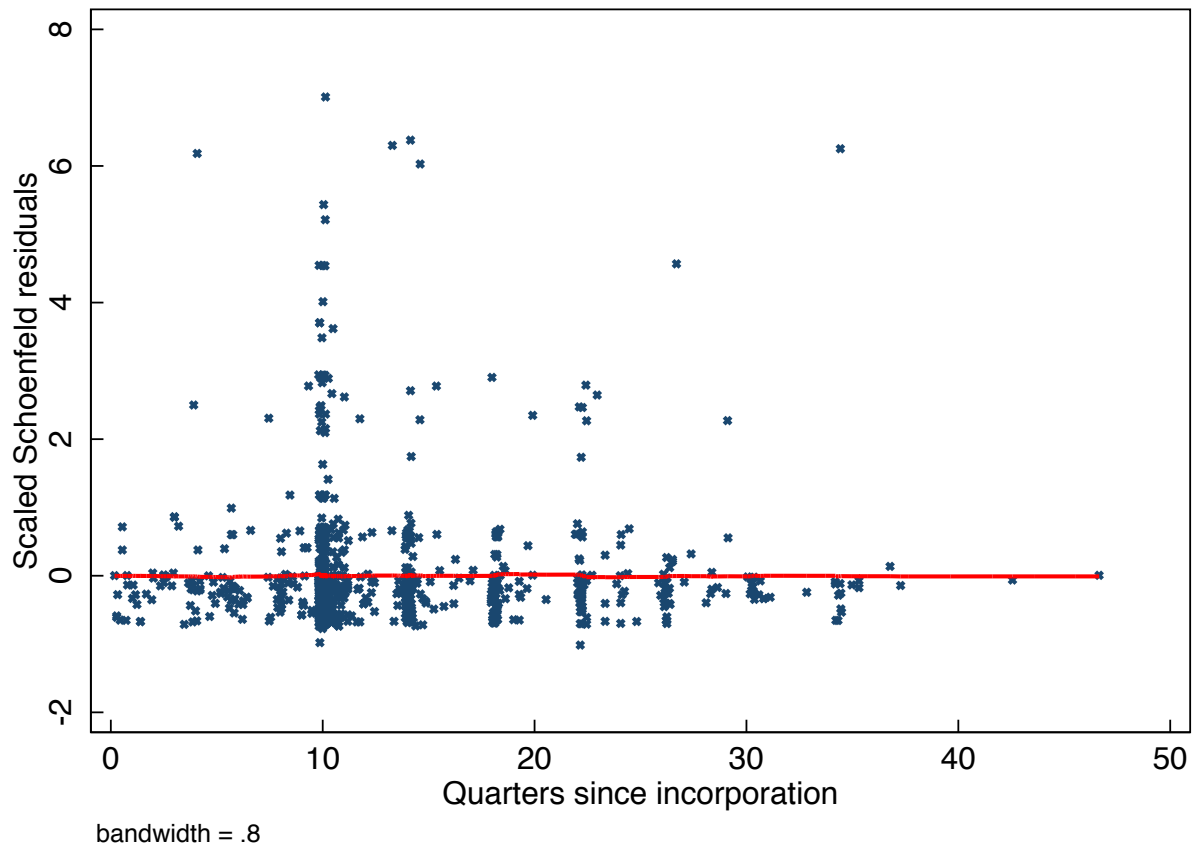
B Tests of Proportional Hazard Assumptions

We perform survival analysis on three samples in this paper: lottery winners' businesses already incorporated at time of win; lottery winners' businesses incorporated after win; and non-lottery winners' incorporated businesses and lottery winners' businesses incorporated after win. In the first two samples, our variable of interest is lottery-win amount (in logs), and in the third sample, it is an indicator for being a lottery winner's business. Following Hosmer, Lemeshow, and May (2008), we test whether the slope of the scaled Schoenfeld residuals for a regression with a univariate Cox model regression with the variable of interest as the explanatory variable is zero when plotted against time. The null hypothesis in these tests, created by Grambsch and Therneau (1994), is that the slope is zero. For all three of these tests, we fail to reject the null hypothesis even at the 10% level, which establishes that a proportional hazards model is a reasonable choice for survival analysis for these cases. In the following three graphs, we plot the residuals against time for all three samples, to visually confirm these tests of the proportional hazard assumption.

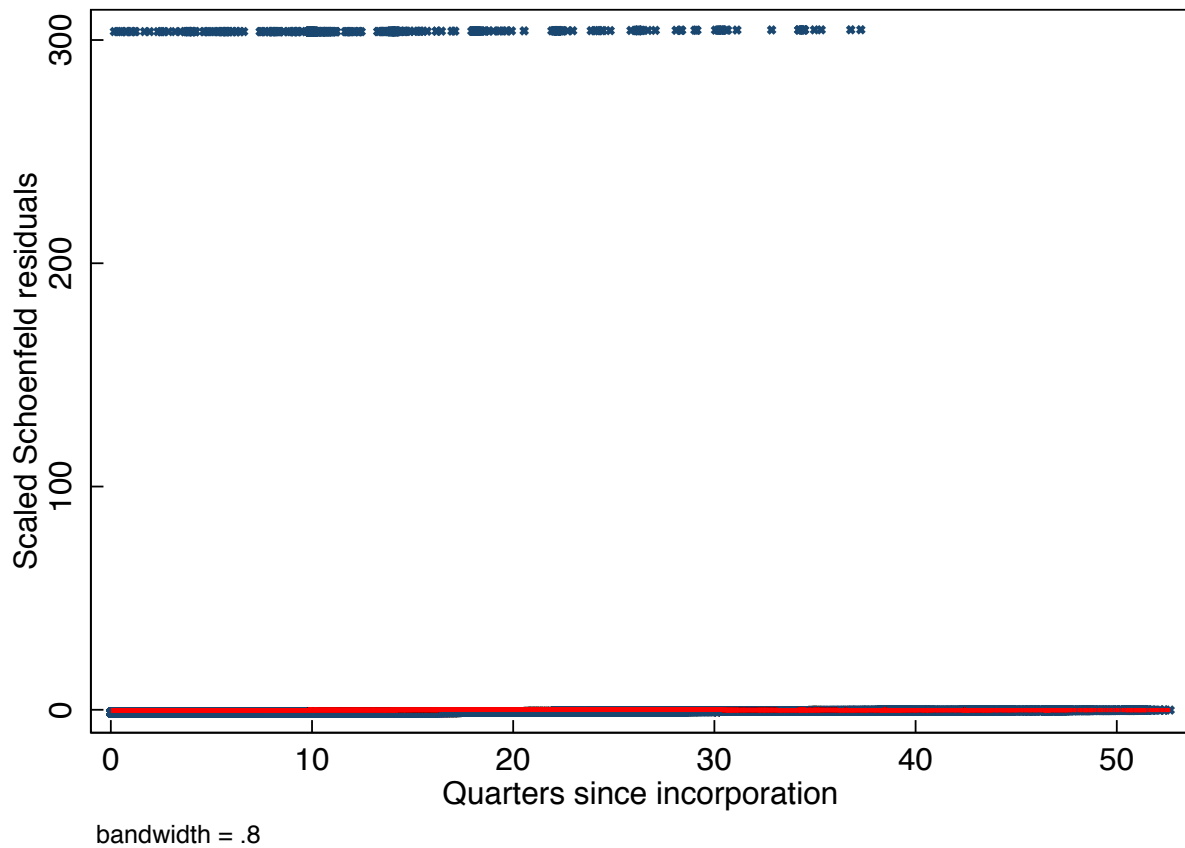
Figure B1. Tests of proportional hazard assumption.



(A) **Lottery winners' already incorporated businesses.** This figure plots the scaled Schoenfeld residuals for lottery-win amounts (in logs) against time for lottery winners' already incorporated businesses at the time of the win and a line representing a linear fit of those residuals against time since lottery win.



(B) Lottery winners' newly incorporated businesses. This figure plots the scaled Schoenfeld residuals for lottery-win amounts (in logs) against time for lottery winners' businesses incorporated after the win and a line representing a linear fit of those residuals against time since incorporation.



(C) **Non-lottery winners' and lottery winners' newly incorporated businesses.** This figure plots the scaled Schoenfeld residuals for an indicator of being a lottery winner's business against time for non-lottery winners' incorporated businesses and lottery winners' businesses incorporated after the win and a line representing a linear fit of those residuals against time since incorporation.