

Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Economic Modelling

journal homepage: www.journals.elsevier.com/economic-modelling

The role of gender and its potential channels to affect self-employment in Taiwan

Kuang-Ta Lo^{a,*}, Jiun-Nan Pan^b, Shi-Shu Peng^a

^a National Chengchi University, Department of Public Finance, No. 64, Sec. 2, Zhi-nan Rd., Wenshan, 11605, Taipei, Taiwan

^b Yuan Ze University, College of Management, No. 135, Yuan-Tung Road, Chung-Li, 32003, Taoyuan, Taiwan

ARTICLE INFO

JEL classification:

J16
J21
C23

Keywords:

Self-employment
Gender
Dynamic panel model
Taiwan

ABSTRACT

This research investigates the gender differences in the self-employment sector by employing a dynamic panel model with county- and city-level data from 1998 to 2016 in Taiwan. Our study is distinct from most others in this issue in that we explore not only the inter-gender difference, but also the intra-gender differences in self-employment. Following this framework, we first find that women are on average less likely to self-employ than men, and further find that older men, married men, men living in lower income regions and women living in higher income regions are more likely to become self-employed compared to their respective reference groups. We thus argue that gender influences self-employment not only directly but also through interactions with other demographic variables. Separate evaluation of different groups based on demographics should therefore result in better targeting of policies.

1. Introduction

Self-employment has been studied in fields as diverse as economics, sociology, psychology, and business management. Economists have long paid attention to self-employment because it can play an important role in development of an economy, and they have so far made some progress in finding the factors behind the choice of being self-employed for an individual. These factors include not only macro variables such as the business cycle and the opportunity in the labor market but also micro ones such as liquidity constraints, family condition, age, education, and so on.

From the macro point of view, according to the recession-push hypothesis, unemployment rates increase during economic recession, resulting in employees facing wage reductions and retrenchment stress. To avoid unemployment, employees will then be pushed into the self-employment sector. In other words, when unemployment rates increase, the self-employment sector absorbs the excess labor released by the paid employment sector and plays a role in regulating the labor market. Conversely, according to the prosperity-pull hypothesis, unemployment rates decrease when the economy improves. At this time, paid employees expect higher returns from the self-employment sector and therefore engage in entrepreneurial activities. Under these circumstances, economic improvement leads to a positive stimulus for the self-

employment sector. Although the relationship between the business cycle and self-employment has been extensively studied, owing to its complexity and multiple aspects, previous research has obtained many different results. For instance, [Benedict and Hakobyan \(2008\)](#) used state-level data in the United States to investigate this issue, and their results supported the prosperity-pull hypothesis. [Thurik et al. \(2008\)](#) used data from 23 OECD countries and found that both recession-push and prosperity-pull effects simultaneously exist, but the prosperity-pull effects seem to be stronger. Based on data from 1976 to 2004 in Spain, [Congregado et al. \(2012\)](#) found that recession-push effects are present, supporting the notion of self-employment serving as a way out of unemployment.

In previous studies, the main trend running throughout this research topic generally concerns the role of self-employment in economic development and growth, but it is certainly worth noting that more recent studies have been paying more attention to micro variables. In particular, among all micro determinants, gender has been identified as an important factor in affecting the decision of self-employment, and more importantly, it is found that other factors of self-employment vary between genders (e.g., [Devine, 1994](#); [Buttner and Moore, 1997](#)). Men are found to enter the self-employment sector based on financial and economic considerations, while women are more likely to choose to do so because of lifestyle limitations and balance between work and family

* Corresponding author.

E-mail addresses: vancelo@nccu.edu.tw (K.-T. Lo), edouard@saturn.yzu.edu.tw (J.-N. Pan), ssp@nccu.edu.tw (S.-S. Peng).

<https://doi.org/10.1016/j.econmod.2020.02.030>

Received 6 August 2018; Received in revised form 9 January 2020; Accepted 16 February 2020

Available online xxx

0264-9993/© 2020 Elsevier B.V. All rights reserved.

responsibilities (Brush, 1992; Green and Cohen, 1995). Besides, women are found to be more averse to the risks of running small businesses (e.g., Minniti et al., 2005; Wagner, 2007; Poggesi et al., 2016). Female entrepreneurs also have less peer emotional or material support (Chell and Baines, 1998; Jurik, 1998), and encounter more challenges such as personal and psychological risks other than financial ones when starting a business (Green and Cohen, 1995). In summary, previous studies have found that self-employed women and men have different characteristics (Cowling and Taylor, 2001; Georgellis and Wall, 2005; Rico and Cabrer-Borrás, 2018).¹

In addition, the form and gender composition of the self-employment sector seem to vary across eras and regions. Vosko and Zukewich (2006) pointed out that in the 1980s, the growth in self-employment in the United States was mainly driven by self-employed employers or employers who hire paid services. In the 1990s, growth mainly originated from independent self-employed workers or people who worked on their own. Also in the 1990s, men were more likely than women to become self-employed, whereas the growth in self-employment among women was faster than that among men. However, after the 2000s, the self-employment rate in the United States decreased from 7.42% in 2000 to 6.26% in 2017, and female (male) self-employment also decreased from 6.1% to 5.3% (8.6%–7.1%) in the same period. In contrast, the self-employment rate in the United Kingdom increased from 12.3% in 2000 to 15.4% in 2017, and female (male) self-employment also increased from 7.8% to 11.0% (16.1%–19.2%).² In general, females (9.9%) were about half as likely as males in the European Union to be self-employed (17.8%) in 2015. This ratio holds in most EU Member States. The gender gap in the proportion of men and women who were self-employed was the smallest in Luxembourg, and the greatest in Ireland, where men were approximately three times more likely than women to be self-employed.³

The labor market in Taiwan can be classified, according to employment status, into four categories: paid employees, employers, the self-employment sector, and unpaid family workers. The 1998–2017 labor data collected by the Directorate General of Budget, Accounting and Statistics (DGBAS) of Taiwan show that the total self-employment rate decreased from 15.94% to 11.68%, in which the rate of females fell from 3.14% to 2.98%, while that of males fell by even more, from 12.81% to 8.7%. This pushed up the percentage of female self-employed from 19.68% to 25.53%, a change in gender composition in the self-employment sector in Taiwan.

Gender seems to play some role in the aforementioned structural change. That is, males are more likely to leave the self-employment sector than females when the overall self-employment falls. In addition, the economic environment may affect the rate of self-employment. This can be roughly observed when we look at the relationship between the gender ratio, unemployment rate, and self-employment rate in Taiwan at the county and city levels in the period of 1998–2016, as shown in Fig. 1. As seen in this figure, the positive fitted relationship between gender ratio and self-employment rate suggests a higher tendency of male workers to become self-employed than female ones, implying a greater decrease in the male self-employment rate when the overall rate falls. Similarly, the positive fitted relationship between unemployment rate and self-employment rate suggests that an individual will be pushed towards self-employment when the economy is in recession.

We pay attention to Taiwan's self-employment sector since it has considerable influence in Taiwan's labor market. Self-employment has unique types and forms of work and usually involves possession of production tools and small capital, so the self-employed are not easily

exploited by employers. Also, self-employment has the characteristics of both employers and employees and allows flexible working time, which is an option when employees change employment status or lose their job. We are specifically interested in gender's role, since gender may have various influences on the decision of self-employment via different channels such as income, age, and marriage, among others.

This study uses Taiwanese long-term panel data at the county and city level over 1998–2016 to examine the growth in the self-employment sector in Taiwan. More interestingly, although it is well documented that gender is an important factor in choosing self-employment, we also wonder whether the gender differential has different effects on self-employment through other variables. Thus, this paper not only investigates the role of gender by itself in choosing whether to be self-employed, but also looks at its influence through the possible channels of other factors. We first find that regions with a higher rate of males, higher unemployment rate, lower average age, lower marriage rate, and higher income level tend to have a higher ratio of self-employment. With a further analysis by including the interaction terms of the gender variable with other factors, we find that older men (compared to younger men), married men (compared to unmarried men) are more likely to be self-employed. In addition, men living in lower income regions tend to become self-employed compared to those living in higher income regions; however, women in regions with a higher income level have a higher tendency to be self-employed compared to females living in lower income regions. We believe that these findings may be universal or only specific to Taiwan, depending on whether it is the universal or regional characteristics which dominate the decision-making mechanism. We also believe that these findings will provide valuable insights for policy-makers when they design labor policies for the self-employment sector.

The rest of this paper is organized as follows. Section 2 discusses relevant issues in the literature. Section 3 describes our estimation design and the data. The empirical results are illustrated in Section 4, and Section 5 concludes this study and provides policy implications.

2. Literature review

The expanding trend of the self-employment sector has attracted research attention for the last three decades. Early studies on this issue focused more on the determinants of the rising rate of the self-employment sector which started in the U.S. in the mid-1970s (Blau, 1987; Evans and Leighton, 1989), with a pioneering study on the gender issue by Devine (1994). Researchers soon shifted their interest to a more fundamental issue, i.e., what factors drive an individual to choose to be self-employed, and many socio-economic determinants have thus far been found. In what follows, we will list nine micro and four macro determinants that are most relevant in our view, and specifically highlight those that are related to gender found in the literature.

The first micro determinant is the (expected) earnings and income differential between self-employment and salaried employment. Although generic assumptions suggest that compared to men, who are more affected by financial or economic considerations, women are more likely influenced by non-economic factors such as family concerns or esteem when making a self-employment choice, Saridakis et al. (2014) have found strong evidence to show that women, similar to men, are also strongly influenced by economic variables such as the state of the economy when considering being self-employed. However, some studies have demonstrated that there still exist gender differentials in this aspect. For example, Fujii and Hawley (1991) and Taylor (1996) argued that the higher the differential, the more likely men are to choose to be self-employed, if they are assumed to maximize their expected utility, with the expected earnings used as its proxy. Lombard (2001) used female data and found that higher potential earnings in self-employment than in the salaried-employment sector can explain the significant increase in self-employed women.

The second micro determinant is the liquidity constraint, which is usually related to one's social capital, i.e. participation in social and

¹ A more detailed literature review about this issue will be offered in the next section.

² Source: OECD (2019), Self-employment rate (indicator). <https://doi.org/10.1787/fb58715e-en>.

³ Source: Eurostat (2016), Labour Force Survey.

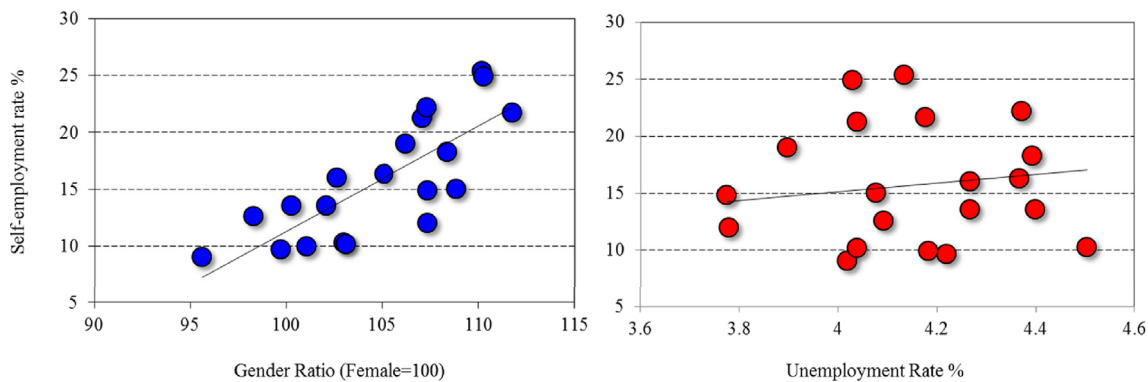


Fig. 1. Relationships between gender ratio, unemployment rate, and self-employment rate in Taiwan (1998–2016).

business networks. Intuitively, lack of sufficient start-up capital and access to credit markets prevents one from entering the self-employment sector. Evans and Jovanovic (1989) and Evans and Leighton (1989) are among the early studies that verify this channel using US data, followed by later studies, such as Holtz-Eakin et al. (1994) and Blanchflower and Oswald (1998), among others.

The third micro determinant is the family condition, such as parental labor status, marriage status, family size, and fertility rates. Parental labor status is likely to affect children's probability of being self-employed, because of the potential intergenerational transfers of parental wealth and human capital that may relax capital constraints and enhance entrepreneurial ability of children, respectively (Dunn and Holtz-Eakin, 2000; Taylor, 1996; and Hout and Rosen, 2000). Married individuals are more likely to be self-employed because they may be offered more capital and assistance from the spouse, and may be more flexible in allocating time (Taniguchi, 2002; Parker, 2008). However, even though the influence of marriage status on being self-employed is well proven, its effects are quite different between males and females. Saridakis et al. (2014) illustrated that for women, the negative effects of divorce appear to be even more severe, because divorce will lower the asset base of both men and women, but it appears to have particularly significant damaging socio-economic implications for women. In addition, it is believed that a greater family size may cause more economic stress, thus forcing the individual who is the main economic source of a family to be less likely to take higher risks and self-employ, but the opposite result is also found (Wellington, 2006). Dutta and Mallick (2018) recently find that higher rates of fertility will negatively affect female entrepreneurship, pointing out another factor related to family condition. Patrick et al. (2016) argued that even among women, unmarried and married women consider different factors in the decision of whether to be self-employed. Their results in general show that the factors influencing unmarried women's choice of self-employment more closely resemble those that affect men's employment choices, while family burdens and gender-role attitudes significantly influence married women.

However, for women the effects of divorce appear to be even more damaging. The loss of a male earner from the household is unlikely to be compensated by a female wage, given that, on average, women have lower incomes and, in addition, are far more likely to have custody and care of children. Thus, whilst divorce may lower the asset base of both men and women generally, it appears to have particularly damaging socio-economic implications for women.

The fourth micro determinant is age, which is considered to have opposite effects on the propensity of self-employment. An older individual may accumulate greater financial capital that supports him/her to self-employ; while his/her shorter expected remaining lifespan may lower his/her willingness to take risks, suggesting that a younger individual is more likely to self-employ. In the literature, the effect of age on

self-employment is usually assumed to be quadratic. Leoni and Falk (2010) find that in general, age has a positive effect on the selection of self-employment. Storey (1994) finds that compared with other age groups, people in the 25–45 age group are more likely to be self-employed.

Education, the fifth micro determinant, also plays a significant role in self-employment. Robinson and Sexton (1994) find that a general education strongly and positively affects the choice of self-employment. The empirical results obtained in Millán et al. (2012), Wilkins (2014), and Svaleryd (2015) suggest that a higher education level has positive effects on the probability of becoming self-employed. Nevertheless, Blanchflower (2000) finds that the populations with the highest and lowest education levels have a higher tendency to be self-employed. The choice of the field of study is found to be another factor related to education as well. Agriculture, commerce, hospitality and professional activities are found to have the highest rates of self-employment (Wit and Van Winden, 1989; Le, 1999). Recently, the issue of female education has been noticed (e.g. Cooray et al., 2016), indicating another direction of empirical study on the gender issue in self-employment.

Pre-entrepreneurial work experience is the sixth micro determinant. Lazear (2005) finds that if an individual has more diverse working experience, he/she is more likely to be an entrepreneur. Brüderl, Preisdörfer and Ziegler (1992), on the gender issue, find that female entrepreneurs have less working experience before starting up than male ones, suggesting that pre-entrepreneurial work experience may be one of the factors for self-employment.

The seventh micro determinant directly related to gender is perception, such as women's risk aversion and fear of failure or perceived difficulties towards being self-employed (Minniti et al., 2005; Wagner, 2007). Minniti and Nardone (2007), for instance, find that women's perception significantly lowers their propensity to be self-employed. Discrimination, or structural barriers of society, is the eighth gender-related determinant. Poggesi et al. (2016) indicates that social differences between women and men are developed during their socialization process when growing up, and form each gender's self-identity that affects their behavior and choices, which usually negatively influence women's self-employment choice.

The last micro determinant that is related to gender is the sector in which an individual chooses to be self-employed (Langowitz and Morgan, 2003; Mayer, 2008). Leoni and Falk (2010) find that women tend to be self-employed in the sectors of health and education. Rietz and Henrikson (2000), Watson (2003) and Goldin (2006) find that women's self-employment is more concentrated in traditionally female sectors, such as service and retail, probably because the starting capital required is lower. Humbert and Drew (2010) study Irish data and find that women are more likely to be self-employed in professional services, tourism, hospitality, and education.

Let us now turn our attention to the four macro determinants. The

first macro determinant, the business cycle, is theoretically assumed to place effects of opposite directions on self-employment, and hence the ultimate effect depends on which effect dominates. The push hypothesis states that an individual will be pushed towards self-employment when the economy is in recession (i.e., a rising unemployment rate), making it more difficult to find paid jobs. The pull hypothesis, to the contrary, suggests that an individual will be pulled towards self-employment when the economy is prosperous and offers more business opportunity. There is thus far no consensus on which hypothesis dominates. Some researchers find results supporting the push hypothesis (Parker, 1996; Le, 1999; Schuetze, 2000; Congregado et al., 2012; Yu et al., 2014); others find evidence supporting the pull hypothesis (Blanchflower, 2000; Benedict and Hakobyan, 2008; Brunjes and Diez, 2012); still others find results that support both hypotheses (Thurik et al., 2008). With respect to the gender issue, Buttner and Moore (1997) find that women are motivated by push factors, such as rising unemployment.

Policy is the second macro determinant. Bruce (2000) investigates the effect of differential tax treatment of salaried- and self-employment, and finds that self-employment is more attractive since its taxation depends on voluntary compliance, and many of its expenses are tax deductible. Fan and White (2003) find that the states in the US with higher personal bankruptcy exemptions tend to have higher self-employment rates, probably because the exemption can play a role of partial wealth insurance if a business fails.

Region, the third macro determinant, also affects self-employment. Global Entrepreneurship Monitor (2015) reports that different regions are observed to have heterogeneous entrepreneurial profiles, which can probably be explained by region-specific policies on promoting self-employment and sectorial specialization.

The opportunity in the labor market is the last macro determinant. Evans and Leighton (1989) find that individuals with lower wages, higher job-changing rates, and longer and more frequent spells of unemployment have higher propensity to be self-employed. Taylor (1996) finds, using British data, that in a region with a lower unemployment-to-vacancy ratio, an individual is more likely to enter the self-employment sector.

3. Empirical design and data

3.1. Data and variables

In order to capture the effects of gender on self-employment, we established a 16-year panel dataset on 20 counties and cities in Taiwan for the 1998–2016 period, and variables drawn from the various years of *National Statistics* published by the Directorate General of Budget, Accounting and Statistics (DGBAS), Executive Yuan. In order to solve the problem of the causal relationship between the explanatory variables and dependent variables more accurately, this study further adopts a dynamic panel model to examine the reasons for the growth and decline in the self-employment sector in Taiwan.

There are three reasons why this study adopts a dynamic panel model. First, when the self-employment rate is higher, individuals will imitate and become self-employed. Thus, the self-employment rate may be affected by its previous value, and adopting a dynamic panel data model that includes the one-year lagged explained variable in the explanatory variables is necessary. Second, for the self-employment rate, its explanatory variables may be endogenous. For example, an increase in the unemployment rate may lead to an increase in the self-employment rate; but when the self-employment rate becomes higher, the unemployment rate may decrease. Finally, in order to avoid the bias of estimation caused by ignored variables, the one-year lagged explained variable is added to the explanatory variables to solve the problem of the general fixed-effect model producing biased estimation.

3.1.1. Dependent variable

This study examines the effects of the direction and extent of gender

differences and business fluctuations on the self-employment sector. Therefore, we use the self-employment rate (share of total employment) in various counties and cities as the primary dependent variable.

3.1.2. Independent variables

This study mainly examines the differences between men and women in selecting self-employment. At the same time, we also investigate whether there are recession-push or prosperity-pull effects in the relationship between the self-employment sector and business fluctuations in Taiwan, since the debate of these two hypotheses is a highly discussed topic in the literature. Therefore, the gender ratios of the various counties and cities and the unemployment rate, which is usually used to capture business fluctuations, are the two main explanatory variables. The results of previous studies have also shown that some socioeconomic variables affect the growth or decline in the self-employment sector in a region. Therefore, we also considered some other important variables mentioned in previous studies. Our explanatory variables in this study are described as follows.

3.1.3. Gender ratio

This variable uses women as the standard (100) to measure the population gender ratio in that county or city. The higher the ratio, the greater is the proportion of men to women in that county and city. As mentioned in the preceding literature review, as the motive for selecting self-employment differs between men and women, previous empirical research has drawn inconsistent conclusions. However, although more previous studies have pointed out that men have a greater probability of entering the self-employment sector compared with women (Blanchflower, 2000; Millán et al., 2012), self-employment has more flexible working hours than paid employment, enabling women to balance their time between work and family. This increases the likelihood of women selecting self-employment.

3.1.4. Unemployment rate

The unemployment rate is one of the important indicators of business fluctuations. According to the recession-push hypothesis, a higher unemployment rate results in a higher proportion of self-employed and unpaid family workers. Therefore, these two show a significant positive relationship. Conversely, the prosperity-pull hypothesis advocates that when economic performance is good and the unemployment rate has declined, employees expect better wages in the self-employment sector. This results in a negative relationship between the unemployment rate and self-employment rate.

3.1.5. Age

Leoni and Falk (2010) pointed out that age generally has positive effects on selecting self-employment. In theory, as age increases, people are more likely to succeed as entrepreneurs due to human capital or financial capability. Therefore, we include age to examine whether a relationship exists between age and the self-employment rate.

3.1.6. Education level

The empirical results of Millán et al. (2012), Wilkins (2014), and Svaleryd (2015) found that a higher education level has positive effects on the probability of becoming self-employed. However, the empirical results of Blanchflower (2000) pointed out that the population segments with the highest and lowest education levels have a higher probability of entering the self-employment sector. Thus, this study uses two variables, employed persons aged 15 years and above with an education level of junior high school and below (Education 1) and employed persons aged 15 years and above with tertiary education (Education 2) as the two variables to represent the difference between a low and high education level to further examine their relationship with the growth and decline in the self-employment sector.

Table 1
Definitions and descriptive statistics of the variables.

Variable	Definition	Unit	Mean	St. Dev	min	MAX
Self	Self-employment rate (share of total employment)	%	15.75	5.39	7.35	28.86
Gender	Gender ratio	Female = 100	104.76	4.76	92.37	116.76
Unemployment	Unemployment rate	%	4.15	0.86	1.2	6.0
Age	Age	year	36.94	2.55	31.09	42.35
Education1	Employed workers aged 15 years and above with high school education or below	%	31.14	12.56	4.48	62.07
Education2	Employed workers aged 15 years and above with tertiary education and above	%	33.60	12.75	8.69	76.05
Marriage	Crude marriage rate (per 1000 population)	‰	6.48	1.13	4.17	11.48
Income	Average disposable income per person per year	dollar	249,447.50	45,427.97	163,309	408,688
Year07_16	Year dummy (2007–2016 = 1, otherwise = 0)	dummy	0.53	0.50	0	1

Source: *National Statistics* (1998–2016) published by Directorate General of Budget, Accounting and Statistics (DGBAS), Executive Yuan, Taiwan. Website: <https://eng.stat.gov.tw/>

3.1.7. Marriage rate

Taniguchi (2002) found that marriage has significant catalytic effects on selecting self-employment. Parker (2008) also proved that married couples are more likely to increase the probability of each other becoming entrepreneurs. The main reason may be because married people obtain capital and assistance from their spouses and can become entrepreneurs with less worry. Another possible reason could be that the self-employment sector has higher autonomy and more freedom in time allocation. This enables the simultaneous juggling of family and work responsibilities, which is more attractive to married people.

3.1.8. Income

During economic development, the self-employment sector mainly consists of primary industries with lower technical levels such as agriculture, forestry, fishing, animal husbandry, mining, and handicraft industries or primary service work with lower barriers to entry such as the distribution, retail, and food and beverage industries. Workers employed in these industries are disadvantaged populations economically or in the labor market, and their income is generally low. Therefore, this study predicts that a higher income has negative effects on the self-employment sector.

As discussed above, gender will affect self-employment by itself directly, but it may have further indirect effect on self-employment via its potential interactions with other variables. For example, as Patrick et al. (2016) argued, males and females have different incentives to choose self-employment, and even for women, unmarried women and married women consider different factors in deciding on self-employment. Thus, in order to capture the channels through which gender affects self-employment, we also include five gender-related interaction terms

difference in the self-employment rate before and after the crisis.⁴

Table 1 shows the definitions and descriptive statistics of all variables. As seen in this table, we focus on gender ratios, and the unemployment and self-employment rates. The average self-employment rate during the research period is 15.75%, and the average gender ratio is 104.76, indicating that the proportion of males in the sample was higher than that of females. It is necessary to analyze whether the self-employment rate of men is higher than that of women. In addition, the average unemployment rate is 4.15%, and whether this supports the recession-push hypothesis has yet to be explained.

Based on the discussion above, we therefore propose the following three hypotheses for Taiwan in this study:

Hypothesis 1. The self-employment rate is higher for males than females.

Hypothesis 2. Recession-push hypothesis is more supported.

Hypothesis 3. Gender has heterogeneous impacts on self-employment via age, education, marriage and income.

3.2. Model specifications

In this study, we use county- and city-level panel data suitable for examining the dynamic trends of data changes (Hondroyannis, 2010), following Benedict and Hakobyan (2008)'s method of data construction, to analyze the relationship between gender and self-employment and through what channels.⁵ By incorporating the potential variables raised earlier in the literature, we propose the following benchmark regression model, i.e., equation (1):

$$\begin{aligned}
 Self_{it} = & \alpha + \beta_1 Gender_{it} + \beta_2 Unemployment_{it} + \beta_3 Age_{it} + \beta_4 Education1_{it} + \beta_5 Education2_{it} \\
 & + \beta_6 Marriage_{it} + \beta_7 \ln(Income)_{it} + \beta_8 Gender_{it} \times Age_{it} + \beta_9 Gender_{it} \times Education1_{it} \\
 & + \beta_{10} Gender_{it} \times Education2_{it} + \beta_{11} Gender_{it} \times Marriage_{it} + \beta_{12} Gender_{it} \times \ln(Income)_{it} \\
 & + \beta_{13} Year07_16 + \varepsilon_{it}
 \end{aligned} \tag{1}$$

(with age, education levels, marriage status, and income) in the estimation. Also, considering the possible impacts of global financial crisis on people's choice of employment, we include as well the year dummy variables in the model to examine whether there is a significant

where i denotes the observed county or city; t denotes the year observed; α is a constant; β s are the coefficients of various explanatory variables, and ε is an error term. Notice that for equation (1), we will first apply the ordinary least square (OLS) method for estimation (Model 1), and then apply the Hausman test to determine whether the fixed or random effect

⁴ The conventional structural change tests such as the Chow test of Chow (1960), the CUSUM test of Brown et al. (1975), the fluctuation tests of Ploberger et al. (1989) and the tests of Bai and Perron (1998) are not applicable in the dynamic panel data model. Therefore, considering the shocks to the global economy around 2007–2008, the dummy variables for the years 2007–2016 are included in our regressions to consider the probability of structural changes.

⁵ We use county- and city-level panel data because on the one hand, there are no self-employment panel data on an individual basis in Taiwan, and on the other hand, Benedict and Hakobyan (2008) pointed out that national data cannot clearly validate the relationship between economic performance and the self-employment sector.

model is more suitable for estimation (Model 2).⁶

The self-employment rate may be affected by its previous value. We thus extend our benchmark model by adding the one-year lagged self-employment rate and apply the dynamic panel data analysis for estimation. The extended regression model is equation (2) as follows:

$$Self_{it} = \alpha_i + \beta_1 Self_{it-1} + \beta_2 Gender_{it} + \beta_3 Unemployment_{it} + \beta_4 Age_{it} + \beta_5 Education1_{it} + \beta_6 Education2_{it} + \beta_7 Marriage_{it} + \beta_8 \ln(Income)_{it} + \beta_9 Gender_{it} \times Age_{it} + \beta_{10} Gender_{it} \times Education1_{it} + \beta_{11} Gender_{it} \times Education2_{it} + \beta_{12} Gender_{it} \times Marriage_{it} + \beta_{13} Gender_{it} \times \ln(Income)_{it} + \beta_{14} Year07_16 + \varepsilon_{it} \tag{2}$$

where $Self_{it-1}$ represents the one-year lagged self-employment rate.

To estimate equation (2), we use the first-differenced generalized method of moments (Model 3; denoted as DIFF-GMM) and the system generalized method of moments (Model 4; denoted as SYS-GMM), which are both suitable for short dynamic panels according to Chen (2014). Arellano and Bond (1991) indicated that DIFF-GMM is an estimation method proposed for dynamic panel data models aiming to overcome endogeneity and improve estimation efficiency. Caselli et al. (1996) introduced this method to the empirical study of economic growth to effectively alleviate the problem of measurement errors and missing variables. However, DIFF-GMM still has its limitations.⁷ In order to conquer these limitations, Arellano and Bover, 1995 and Blundell and Bond (1998) proposed the SYS-GMM approach, which explains that the delay value of the variable and the first-order difference delay value are instrumental variables of the difference equation and the level equation, respectively, so as to alleviate the weak instrumentation problem of DIFF-GMM and improve the estimation efficiency.⁸ Therefore, we will mainly explain the relationship between gender and self-employment rate with the empirical results of the SYS-GMM approach. In addition, we adopt the Sargan test to determine the valid order lagged value of the variable that is treated as the instrumental variable.

To avoid spurious regressions and overestimations of the panel data regression, a panel data model requires that the variables in the model be stationary. We hence employ the panel unit root tests for the panel data proposed by Levin et al. (2002), and show the results in Table 2. We find

Table 2
Panel unit root test.

Variables	Levin et al. (2002)
Self	-2.02***
Gender	-2.17***
Unemployment	-7.50***
Age	-7.23***
Education1	-8.90***
Education2	-7.10***
Marriage	-3.66***
ln(Income)	-3.16***

Notes: ***, ** and * indicate the 1%, 5% and 10% significance levels, respectively.

⁶ Notice that since we use two methods to estimate equation (1), the constant term is then α in Model 1, and α_i in Model 2.

⁷ It is easy for DIFF-GMM to produce weak instrumental variables, which will then result in estimation inconsistency.

⁸ Arellano and Bover (1995) and Blundell and Bond (1998) mentioned that the estimated results might be more accurate when using SYS-GMM than when using DIFF-GMM.

that all variables used in this study are stationary.

4. Empirical results

The empirical results of the benchmark regression model (equation (1)) are presented in Table (3), in which both the OLS (Model 1) and

fixed effect model (Model 2) are reported.⁹ As seen in Table 3, gender has a negative and significant impact on the self-employment rate in the OLS model, but a positive one at an insignificant level in the fixed effect model. The OLS model suggests that, on average, locations with a higher ratio of males in population have lower self-employment rates, while those with higher female ratios have higher rate. However, the fixed-effect model does not consistently offer this suggestion. As to the gender interaction terms, we also find inconsistencies between these two models, which might be caused by the related econometric issues raised

Table 3
Estimation of the gender effect of Self-employment I.

VARIABLES	Model 1	Model 2
	(OLS)	(FIXED-EFFECT)
Gender	-7.24** (-2.50)	2.72 (1.25)
Unemployment	-0.10 (-0.80)	0.16** (2.35)
Age	-8.34*** (-5.09)	1.53 (0.90)
Education1	1.27** (2.13)	0.89** (2.47)
Education2	2.01*** (3.07)	0.12 (0.29)
Marriage	-6.40** (-2.38)	-2.45* (-1.87)
ln(Income)	-46.82* (-1.84)	17.64 (0.98)
Gender × Age	0.08*** (5.40)	-0.02 (-1.06)
Gender × Education1	-0.01 (-1.42)	-0.01** (-2.14)
Gender × Education2	-0.02*** (-2.71)	-0.001 (-0.29)
Gender × Marriage	0.06** (2.31)	0.02* (1.93)
Gender × ln(Income)	0.38 (1.57)	-0.17 (-1.03)
Year07_16	-1.10*** (-3.02)	-0.55*** (-2.62)
Constant	818.97*** (2.72)	-255.93 (-1.10)
Observations	380	380
Adjusted R ²	0.87	0.77
F-Statistics	194.33***	99.72***
Hausman test		28.60***

Notes: 1. t-statistics in parentheses. 2. ***p < 0.01, **p < 0.05, *p < 0.1.

⁹ We run the Hausman test and find that the fixed effect model is superior to the random effect model.

Table 4
Estimation of the gender effect of Self-employment II.

VARIABLES	Model 3	Model 4
	(DIFF-GMM)	(SYS-GMM)
Selft-1	0.46*** (11.65)	0.90*** (31.82)
Gender	6.24*** (2.81)	1.85* (1.83)
Unemployment	0.17** (2.13)	-0.02 (-0.28)
Age	-0.27 (-0.12)	-2.42*** (-2.73)
Education1	1.42*** (3.04)	0.42 (1.15)
Education2	0.23 (0.48)	0.20 (0.60)
Marriage	-2.38* (-1.85)	-3.51*** (-3.52)
ln(Income)	51.94*** (3.16)	22.56** (2.50)
Gender × Age	0.003 (0.14)	0.02*** (2.82)
Gender × Education1	-0.01*** (-2.97)	-0.003 (-1.05)
Gender × Education2	-0.002 (-0.56)	-0.002 (-0.57)
Gender × Marriage	0.02* (1.92)	0.03*** (3.64)
Gender × ln(Income)	-0.50*** (-3.21)	-0.22** (-2.56)
Year07_16	0.001 (0.01)	0.05 (0.38)
Constant		-183.12* (-1.79)
Observations	340	360
Abond Test for AR(1)	-3.21*** (0.001)	-3.53*** (0.001)
Abond Test for AR(2)	-0.07 (0.95)	0.06 (0.95)
Sargan Test	219.92 (0.84)	279.55 (0.50)

Notes: t-statistics in parentheses. 2. ***p < 0.01, **p < 0.05, *p < 0.1.

earlier. We therefore move on to Models 3 and 4 for further results of better econometrical quality, as shown in Table 4.

We present the empirical results for Model 3 (DIFF-GMM) and Model 4 (SYS-GMM) in Table 4. Before reporting the results, notice that the value of R^2 is not available, since DIFF-GMM and SYS-GMM have no classical degree of R^2 . AR (1) and AR (2) are used to test the estimated residual sequences. The results of the test show that both methods reject the null hypothesis of AR (1), but accept the null hypothesis of AR (2), meaning that the estimated residuals have a first-order sequence correlation, but do not have a second-order sequence correlation. In addition, for the over-identification test of the instrumental variables, this study uses the Sargan test to test the null hypothesis that “over-constrained is correct in the model.” The results show that as the third- and fourth-order lagged values of the variables are used as the instrumental variables in DIFF-GMM and SYS-GMM, respectively, the p -values derived from the Sargan test are all greater than 0.1, suggesting that the null hypothesis cannot be rejected. This means that the choice of instrumental variables is valid, and the estimation is valid by using DIFF-GMM and SYS-GMM models. Finally, as mentioned above, we will mainly apply the empirical results of SYS-GMM to alleviate the weak instrumentation problem of DIFF-GMM, and improve the estimation efficiency. The estimated results might be more accurate than using DIFF-GMM (Arellano and Bover, 1995; Blundell and Bond, 1998).

Let us turn to the results in Table 4. We first find that the self-employment rate is positively and significantly (at the 1% level) affected by its one-year lagged value in both models. For gender, the variable of greatest interest, both models deliver positive coefficients

which are significant at the 1% and 10% levels in Models 3 and 4 respectively, suggesting that counties and cities with a higher share of males have a higher share of self-employed workers, and those with a higher ratio of females have a lower share of self-employed workers. This finding is consistent with some previous studies, which find that men have a higher probability of entering and continuing in the self-employment sector (Blanchflower, 2000; Millán et al., 2012). Therefore, the Hypothesis 1 proposed in this study is supported based on our results.

The unemployment rate has a positive effect on the self-employment sector, with a significance level of 5% in Model 3. In other words, we find that when the unemployment rate rises, the share of self-employed workers also rises, supporting our Hypothesis 2 in this study; namely, the recession-push hypothesis is verified in Taiwan. Age has a negative effect on self-employment share at a 1% significance level only in Model 4. This means that, on average, younger people tend to have a higher self-employment rate in Taiwan, which might partially be caused by Taiwan's special self-employment environment, where there are more opportunities to be a street vendor, which requires less capital, compared with other countries. This result may have different causes from that found in Hatfield (2015), in which Spain has one of the highest youth unemployment rates in Europe, which may have forced many young people to try their hand at self-employment.

The Education 1 group has a positive and significant effect in Model 3, suggesting that regions with a lower education level are associated with a higher self-employment rate. A possible reason for this may be that the employment opportunities provided by the self-employment sector in Taiwan are mostly concentrated in primary service industries, which require lower professional and technical levels. It hence is easier for these industries to attract employed people with a lower educational level or less human capital.

The marriage rate has a negative and significant effect in both models, implying that the married status has a negative effect on self-employment. This result is consistent with the literature, say, Marshall and Flaig (2014), which finds that married self-employed women earn less than single self-employed women, and married status will reduce the willingness of married people to enter the self-employment sector. Income shows a positive and significant effect in both models, suggesting that higher average income level is associated with a higher self-employment rate. This result might be partly related to what Hanna (2014) finds, i.e., the decision to pursue self-employment is primarily taken by retirees with relatively high levels of wealth.

Now we pay more attention to the results of gender-related interaction terms. The positive coefficient (significant at 1% level) of the age interaction term in Model 4 shows that in a location with higher average age, the positive relationship between gender and self-employment will be stronger. In other words, gender has heterogeneous impacts on self-employment via age in Taiwan. That is, on average, older men have a higher tendency than younger ones to be self-employed. It is probably because males have higher economic resources and human capital to start a business (Hatfield, 2015). On the other hand, older women have a lower tendency to be self-employed than younger ones, probably because of their higher family responsibility (Brush, 1992; Green and Cohen, 1995). The education interaction term is not significant in Model 4, suggesting that gender might not affect self-employment through the channel of education. The positive and significant coefficients of the marriage interaction term in both models suggest that on average, married men have a higher tendency to be self-employed than unmarried ones, probably because they bear higher economic responsibility, and it is easier to be self-employed with wives' assistance at home (Parker, 2008). However, married women have lower such tendency than unmarried ones, probably due to their higher family responsibility that prevents them from being self-employed (Saridakis et al., 2014). Lastly, for the channel of income, we find that on average, men with higher income have a lower tendency to enter the self-employment sector than those with lower income. It is probably because as major family income

Table 5

Effect of gender on self-employment using different definitions of self-employment rate I (DIFF-GMM).

VARIABLES	Model 5	Model 6	Model 7
Self-I (Share of total employment in private sector)	0.46*** (11.32)		
Self-I (Share of non-agricultural employment)		0.45*** (9.31)	
Self_Ratio-I (Self-employment rate/paid employment rate)			0.48*** (10.28)
Gender	6.72*** (2.95)	7.84*** (2.83)	10.45*** (2.71)
Unemployment	0.19** (2.23)	0.29*** (2.61)	0.34** (2.21)
Age	-0.34 (-0.14)	-0.71 (-0.25)	-0.41 (-0.09)
Education1	1.47*** (3.00)	0.92 (1.46)	1.27 (1.24)
Education2	0.24 (0.47)	-0.37 (-0.60)	-0.48 (-0.48)
Marriage	-2.53* (-1.86)	-3.92* (-1.81)	-4.89** (-2.11)
ln(Income)	56.05*** (3.30)	71.55*** (3.51)	93.25*** (3.20)
Gender × Age	0.003 (0.16)	0.01 (0.28)	0.003 (0.07)
Gender × Education1	-0.01*** (-2.95)	-0.01 (-1.15)	-0.01 (-1.02)
Gender × Education2	-0.002 (-0.57)	0.004 (0.58)	0.004 (0.48)
Gender × Marriage	0.03* (1.94)	0.04* (1.87)	0.05** (3.17)
Gender × ln(Income)	-0.54*** (-3.36)	-0.68*** (-3.58)	-0.89*** (-3.24)
Year07_16	-0.004 (-0.03)	0.04 (0.20)	-0.14 (-0.51)
Observations	340	340	340
Abond Test for AR(1)	-3.14*** (0.02)	-3.10*** (0.02)	-3.25*** (0.02)
Abond Test for AR(2)	-0.11 (0.92)	-1.11 (0.27)	-0.28 (0.77)
Sargan Test	221.68 (0.82)	196.39 (0.99)	201.09 (0.97)

Notes: 1. t-statistics in parentheses. 2. ***p < 0.01, **p < 0.05, *p < 0.1.

providers, males face higher opportunity costs and risks if leaving their current positions; in addition, it also may be due to the market structure of self-employment. For instance, Taiwan is more likely to have a larger proportion of self-employed workers in low- or mid-skilled occupations, where the income levels are lower, and these sectors are usually dominated by males. On the other hand, women with higher income have a higher tendency to enter the self-employment sector than those with lower income, probably because as relatively minor family income providers, their opportunity costs and risks are lower, and high income offers more capital for start-ups. As mentioned above, according to the [Hypothesis 3](#) we proposed in this study, we verify that gender affects self-employment differently across demographic variables; and its heterogeneous impact on self-employment in Taiwan is more significant via age, marriage and income but not through education.

Finally, the year dummy variable doesn't have any significant effect on self-employment, meaning that even if considering shocks to the global economy, there is no significant difference in the self-employment rate after the financial crisis.

5. Robustness checks

In order to test whether the empirical results are robust, following the suggestion of [Marcén \(2014\)](#), we used two different definitions of self-employment rate to estimate the DIFF-GMM and SYS-GMM models. They are the ratio of self-employed to the private sector employment (Model 5 and Model 8 in [Table 5](#) and [Table 6](#)), and the ratio of

Table 6

Effect of gender on self-employment using different definitions of self-employment rate II (SYS-GMM).

VARIABLES	Model 8	Model 9	Model 10
Self-I (Share of total employment in private sector)	0.90*** (29.95)		
Self-I (Share of non-agricultural employment)		0.90*** (30.43)	
Self_Ratio-I (Self-employment rate/paid employment rate)			0.88*** (29.41)
Gender	1.96* (1.89)	2.68* (1.87)	3.32* (1.75)
Unemployment	-0.02 (-0.23)	0.02 (0.17)	-0.01 (-0.08)
Age	-2.57*** (-2.68)	-3.51*** (-2.78)	-4.764*** (-2.84)
Education1	0.45 (1.14)	0.44 (0.97)	0.64 (0.91)
Education2	0.23 (0.63)	0.15 (0.34)	0.23 (0.35)
Marriage	-3.74*** (-3.55)	-5.20*** (-3.07)	-7.28*** (-3.82)
ln(Income)	23.87** (2.57)	33.87*** (2.59)	42.99*** (2.62)
Gender × Age	0.03*** (2.76)	0.04*** (2.86)	0.05*** (2.94)
Gender × Education1	-0.004 (-1.05)	-0.004 (-0.86)	-0.005 (-0.79)
Gender × Education2	-0.002 (-0.61)	-0.001 (-0.31)	-0.002 (-0.30)
Gender × Marriage	0.04*** (3.67)	0.05*** (3.17)	0.07*** (3.97)
Gender × ln(Income)	-0.24*** (-2.63)	-0.34*** (-2.63)	-0.43*** (-2.70)
Year07_16	0.06 (0.38)	0.22 (1.20)	0.08 (0.33)
Constant	-193.97* (-1.85)	-270.42* (-1.86)	-330.81* (-1.71)
Observations	360	360	360
Abond Test for AR(1)	-3.51*** (0.001)	-3.05*** (0.002)	-3.36*** (0.001)
Abond Test for AR(2)	0.03 (0.97)	-0.60 (0.55)	-0.18 (0.86)
Sargan Test	281.40 (0.47)	249.22 (0.47)	252.42 (0.88)

Notes: t-statistics in parentheses. 2. ***p < 0.01, **p < 0.05, *p < 0.1.

self-employed to non-agricultural employment (Model 6 and Model 9 in [Tables 5](#) and [6](#)).

In addition, to observe the relative growth versus decline relationship between the self-employment sector and paid employment sector, we further use the ratio of the self-employment rate to the paid employment rate (Self_Ratio) as another dependent variable for estimating the DIFF-GMM and SYS-GMM models (Model 7 and Model 10 in [Tables 5](#) and [6](#)). This is also used as a robustness test to check the results. [Tables 5](#) and [6](#) show the empirical results, which are generally consistent with those in [Table 4](#); thus, these results are not described again.

6. Conclusions and policy implications

As [Georgellis and Wall \(2005\)](#) argued, entrepreneurship is usually viewed as important for economy-wide innovation and job creation as well as for providing an avenue out of poverty and welfare-dependency for individuals. Therefore, understanding how self-employment is influenced is crucial to policy makers. It is well documented that there are certain factors which have been considered determinants of self-employment. In this paper, in addition to verifying the recession-push hypothesis, we mainly focus on how gender influences self-employment across different regions in Taiwan and whether it has potential interactions with other demographic variables.

Our empirical results first show that counties and cities with a higher

proportion of men in Taiwan have a higher self-employment rate. This finding is similar to most previous studies, which have demonstrated that men usually have a higher probability to develop entrepreneurship because they might have more advantages of financial support and human capital, or men may be more likely to have higher acceptance of business risk; therefore, it is easier to observe this result. Another important factor in explaining differences in the characteristics of businesses operated by men and women, and also some of the challenges that they face, is the sector in which they operate. As [Leoni and Falk \(2010\)](#) conclude, an important difference between the male and female self-employed is related to the sector where they work. Women are primarily concerned with the health and education sectors, which can explain their relatively low rate of entrepreneurial activities. [Rietz and Henrekson \(2000\)](#) and [Watson \(2003\)](#) also show that women often open and work at companies in traditional female sectors, such as services and retail. The self-employment sector in Taiwan usually consists of primary service work such as in the distribution, retail, and food and beverage sectors, that is, Taiwan is more likely to have a larger proportion of self-employed workers in low- or mid-skilled occupations. For example, most self-employed workers are service and sales workers (38.29%), agriculture, forestry and fishery workers (24.92%), and craft- and machine-operation-related workers (25.3%) in 2017. These sectors are usually dominated by males in Taiwan.

Secondly, we also show that the unemployment rate in the 1998–2016 period has positive and significant effects on the self-employment sector in Taiwan. During economic recession and when faced with wage reductions and retrenchment in the paid employment sector, employees may enter self-employment to obtain a higher income. This finding supports the recession-push hypothesis and is consistent with the results of previous researchers. Third, although we have shown that gender is an important factor for choosing to be self-employed in Taiwan, we further demonstrate that it also will have different effects on self-employment via other possible channels. After considering the interaction effect of other demographic variables, we argue that older men, married men, men living in lower income level regions and women living in higher income level regions are more likely to become self-employed compared to their respective reference groups.

From our empirical results, we therefore argue that self-employed workers are not a homogenous group. Separately evaluating different groups according to their demographic characteristics should lead to better targeting of self-employment programs for governments. Thus, some policy implications can be drawn from our research. First, because the recession-push hypothesis is present, governments are encouraged to provide more specific self-employment policies and grants during recessions. [Caliendo and Künn \(2014\)](#) argued these policies and programs could have a “double dividend” because once the unemployed receive a capital grant and establish their own business, they are out of unemployment and may also create new jobs from their own enterprise and further reduce the unemployment rate. Second, compared to males, females are less likely to become self-employed in Taiwan; therefore, if a government wishes to boost self-employment among females, more assistance programs should be assigned to them. And for both genders, possible interactions of gender with other variables should be taken into account to target the groups which are in greatest need. Third, we found that in many developed EU countries, the self-employment sector has developed towards industries with higher professional and technical levels. In contrast, the self-employment sector in Taiwan still mainly consists of primary service industries that have lower professional levels. This implies that the structure of the self-employment market and even the labor market in Taiwan differs from those in developed countries. Although the self-employment sector cannot comprehensively represent the degree of economic development in a country, this indicator still has some reference value. In the future, Taiwan should continue to strive for industry transformation, invest resources in the integration of education and industry, and develop advanced service industries with higher professional and technical levels to improve the industry structure of its

self-employment sector.

Our study may contribute to the empirical literature on the self-employment rate in that we attempt to deepen the research on gender differences in self-employment. Research into the gender issue in self-employment so far mostly focuses on gender differences in different aspects such as family conditions, and only very few studies, such as [Patrick et al. \(2016\)](#), examine intra-gender differences in addition to inter-gender heterogeneity in these aspects. The topic of intra-gender differences in inter-gender differences has potential in becoming a promising research direction, especially because it requires more interdisciplinary integration between economics and other areas. However, in our current work, we only use the aggregate data based on the county and city level. One limitation of aggregate data is that when data are aggregated, groups of observations are replaced with summary statistics based on those observations. Therefore, if the individual-level panel data become available in the future, it would provide more personal information and increase the variation of observations, and further improve the quality of estimation.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.econmod.2020.02.030>.

References

- [Arellano, M., Bover, O., 1995.](#) Another look at the instrumental variable estimation of error-components models. *J. Econom.* 68 (1), 29–51.
- [Arellano, M., Bond, S., 1991.](#) Some tests for specification for panel data: Monte Carlo evidence and an application to employment equations. *Rev. Econ. Stud.* 58 (2), 277–297.
- [Bai, J., Perron, P., 1998.](#) Estimating and testing linear models with multiple structural changes. *Econometrica* 66 (1), 47–78.
- [Benedict, M.E., Hakobyan, I., 2008.](#) “Regional self-employment: the effect of state push and pull factors. *Polit. Pol.* 36 (2), 268–286.
- [Blanchflower, D.G., Oswald, A.J., 1998.](#) What makes an entrepreneur? *J. Labor Econ.* 16 (1), 26–60.
- [Blanchflower, D.G., 2000.](#) Self-employment in OECD countries. *Lab. Econ.* 7 (5), 471–505.
- [Blau, D., 1987.](#) A time-series analysis of self-employment in the United States. *J. Polit. Econ.* 95 (3), 445–467.
- [Blundell, R., Bond, S., 1998.](#) Initial conditions and moment restrictions in dynamic panel data models. *J. Econom.* 87 (1), 115–143.
- [Brown, R.L., Durbin, J., Evans, J.M., 1975.](#) Techniques for testing the constancy of regression relations over time. *J. Roy. Stat. Soc.* 37 (2), 149–163.
- [Bruce, D., 2000.](#) Effects of the United States tax system on transitions into self-employment. *Lab. Econ.* 7 (5), 545–574.
- [Brüderl, J., Preisdörfer, P., Ziegler, R., 1992.](#) Survival chances of newly founded business organizations. *Am. Socio. Rev.* 57 (2), 227–242.
- [Brunjes, J., Diez, J.R., 2012.](#) Recession push’ and ‘prosperity pull’ entrepreneurship in a rural developing context. *Enterpren. Reg. Dev.* 25 (3–4), 251–271.
- [Brush, C.G., 1992.](#) Research on women business owners: past trends, a new perspective and future directions. *Enterpren. Theor. Pract.* 16 (4), 5–30.
- [Buttner, E.H., Moore, D.P., 1997.](#) Women’s organizational exodus to entrepreneurship: self-reported motivations and correlates with success. *J. Small Bus. Manag.* 35 (1), 34–46.
- [Caliendo, M., Künn, S., 2014.](#) Regional effect heterogeneity of start-up subsidies for the unemployed. *Reg. Stud.* 48 (6), 1108–1134.
- [Caselli, F., Esquivel, G., Lefort, F., 1996.](#) Reopening the convergence debate: a new look at cross-country growth empirics. *J. Econ. Growth* 1 (3), 363–389.
- [Chell, E., Baines, S., 1998.](#) Does gender affect business ‘performance’? A study of microbusinesses in business services in the UK. *Enterpren. Reg. Dev.* 10 (2), 117–135.
- [Chen, Q., 2014.](#) *Advanced Econometrics and Stata Applications*. Higher Education Press, April.
- [Chow, G.C., 1960.](#) Tests of equality between sets of coefficients in two linear regressions. *Econometrica* 28 (3), 591–605.
- [Congregado, E., Golpe, A., Stel, A.V., 2012.](#) “The ‘recession-push’ hypothesis reconsidered. *Int. Enterpren. Manag.* J. 8 (3), 325–342.
- [Cooray, A., Dutta, N., Mallick, S., 2016.](#) Does female human capital formation matter for the income effect of remittances? Evidence from developing countries. *Oxf. Dev. Stud.* 44 (4), 458–478.
- [Cowling, M., Taylor, M., 2001.](#) Entrepreneurial women and men: two different species? *Small Bus. Econ.* 16 (3), 167–175.
- [Devine, T., 1994.](#) Characteristics of self-employed women in the United States. *Mon. Labor Rev.* 117 (3), 20–34.
- [Dunn, T., Holtz-Eakin, D., 2000.](#) Financial capital, human capital, and the transition to self-employment: evidence from intergenerational links. *Journal of Labour Economics* 18 (2), 282–305.

- Dutta, N., Mallick, S., 2018. Enabling women entrepreneurs: exploring the mitigating factors for the negative effect of fertility rates on female entrepreneurship. *Kyklos* 71 (3), 402–432.
- Evans, D., Leighton, L., 1989. Some empirical aspects of entrepreneurship. *Am. Econ. Rev.* 79 (3), 519–535.
- Evans, D.S., Jovanovic, B., 1989. An estimated model of entrepreneurial choice under liquidity constraints. *J. Polit. Econ.* 97 (4), 808–827.
- Fan, W., White, M.J., 2003. Personal bankruptcy and the level of entrepreneurial activity. *J. Law Econ.* 46 (2), 543–567.
- Fujii, E.T., Hawley, C.B., 1991. Empirical aspects of self-employment. *Econ. Lett.* 36 (3), 323–329.
- Georgellis, Y., Wall, H.J., 2005. Gender differences in self-employment. *Int. Rev. Appl. Econ.* 19 (3), 321–342.
- Global Entrepreneurship Monitor, 2015. Informe GEM España 2014. Editorial de la Universidad de Cantabria, D.L. Santander, 2015, available at: www.gem-spain.com/.
- Goldin, C., 2006. The quiet revolution that transformed women's employment, education, and family. *Am. Econ. Rev.* 96 (2), 1–21.
- Green, E., Cohen, L., 1995. Women's business': are women entrepreneurs breaking new ground or simply balancing the demands of 'women's work' in a new way? *J. Gen. Stud.* 4 (3), 297–314.
- Hanna, V.S., 2014. Who opts for self-employment after retirement? A longitudinal study in The Netherlands. *Eur. J. Ageing* 11 (3), 261–272.
- Hatfield, I., 2015. Self-employment in Europe. Institute for Public Policy Research, London.
- Holtz-Eakin, D., Joulfaian, D., Rosen, H.S., 1994. Entrepreneurial decisions and liquidity constraints. *Rand J. Econ.* 25 (2), 334–347.
- Hondroyannis, G., 2010. Fertility determinants and economic uncertainty: an assessment using European panel data. *J. Fam. Econ. Issues* 31 (1), 33–50.
- Hout, M., Rosen, H.S., 2000. Self-employment, family background, and race. *J. Hum. Resour.* 35 (4), 670–692.
- Humbert, A.L., Drew, E., 2010. Gender, entrepreneurship and motivational factors in an Irish context. *International Journal of Gender and Entrepreneurship* 2 (2), 173–196.
- Jurik, N.C., 1998. Getting away and getting by: the experiences of self-employed homeworkers. *Work Occup.* 25 (1), 7–35.
- Langowitz, N.S., Morgan, C., 2003. Women entrepreneurs: breaking through the glass barrier. In: Butler, J. (Ed.), *New Perspectives on Women Entrepreneurs*. Information Age Publishing, Greenwich, CT, pp. 101–119.
- Lazear, E.P., 2005. Entrepreneurship. *J. Labor Econ.* 23 (4), 649–680.
- Le, A., 1999. Empirical studies of self-employment. *J. Econ. Surv.* 13 (4), 381–416.
- Leoni, T., Falk, M., 2010. Gender and field of study as determinants of self-employment. *Small Bus. Econ.* 34 (2), 167–185.
- Levin, A., Lin, C., Chu, C., 2002. Unit root tests in panel data: asymptotic and finite sample properties. *J. Econom.* 108 (1), 1–24.
- Lombard, K.V., 2001. Female self-employment and demand for flexible, nonstandard work schedules. *Econ. Inq.* 39 (2), 214–237.
- Marcén, M., 2014. The role of culture on self-employment. *Econ. Modell.* 44 (1), S20–S32.
- Marshall, M.I., Flaig, A., 2014. Marriage, children, and self-employment earnings: an analysis of self-employed women in the US. *J. Fam. Econ. Issues* 35 (3), 313–322.
- Mayer, H., 2008. Segmentation and segregation patterns of women-owned high-tech firms in four metropolitan regions in the United States. *Reg. Stud.* 42 (10), 1357–1383.
- Millán, J.M., Congregado, E., Román, C., 2012. Determinants of self-employment survival in Europe. *Small Bus. Econ.* 38 (2), 231–258.
- Minniti, M., Arenius, P., Langowitz, N., 2005. *Global Entrepreneurship Monitor, 2004 Report on Women and Entrepreneurship*. Center for Women's Leadership at Babson College.
- Minniti, M., Nardone, C., 2007. Being in someone else's shoes: the role of gender in nascent entrepreneurship. *Small Bus. Econ.* 28 (2–3), 223–238.
- Parker, S.C., 1996. A time series model of self-employment under uncertainty. *Economica* 63 (251), 459–475.
- Parker, S.C., 2008. Entrepreneurship among married couples in the United States: a simultaneous probit approach. *Lab. Econ.* 15 (3), 459–481.
- Patrick, C., Stephens, H., Weinstein, A., 2016. Where are all the self-employed women? Push and pull factors influencing female labor market decisions. *Small Bus. Econ.* 46 (3), 365–390.
- Ploberger, W., Kramer, W., Kontrus, K., 1989. A new test for structural stability in the linear regression model. *J. Econom.* 40 (2), 307–318.
- Poggesi, S., Mari, M., De Vita, L., 2016. What's new in female entrepreneurship research? Answers from the literature. *Int. Enterpren. Manag. J.* 12 (3), 735–764.
- Rico, P., Cabrer-Borrás, B., 2018. Gender differences in self-employment in Spain. *International Journal of Gender and Entrepreneurship* 10 (1), 19–38.
- Rietz, A.D., Henrekson, M., 2000. Testing the female underperformance hypothesis. *Small Bus. Econ.* 14 (1), 1–10.
- Robinson, P.B., Sexton, E.A., 1994. The effect of education and experience on self-employment success. *J. Bus. Ventur.* 9 (2), 141–156.
- Saridakis, G., Marlow, S., Storey, D.J., 2014. Do different factors explain male and female self-employment rates? *J. Bus. Ventur.* 29 (3), 345–362.
- Schuetze, H.J., 2000. Taxes, economic conditions and recent trends in male self-employment: a Canada-US comparison. *Lab. Econ.* 7 (5), 507–544.
- Storey, D., 1994. *Understanding the Small Business Sector*. Routledge, London.
- Svaleryd, H., 2015. Self-employment and the local business cycle. *Small Bus. Econ.* 44 (1), 55–70.
- Taniguchi, H., 2002. Determinants of women's entry into self-employment. *Soc. Sci. Q.* 83 (3), 875–893.
- Taylor, M.P., 1996. Earnings, independence, or unemployment: why become self-employed? *Oxf. Bull. Econ. Stat.* 58 (2), 253–266.
- Thurik, A.R., Carree, M.A., van Stel, A., Audretsch, D.B., 2008. Does self-employment reduce unemployment? *J. Bus. Ventur.* 23 (6), 673–686.
- Vosko, L.F., Zukevich, N., 2006. Precarious by choice? Gender and self-employment. In: Vosko, Leah F. (Ed.), *Precarious Employment: Understanding Labour Market Insecurity in Canada*, Montreal and Kingston. McGill-Queen's University Press.
- Wagner, J., 2007. What a difference a Y makes — female and male nascent entrepreneurs in Germany. *Small Bus. Econ.* 28 (1), 1–21.
- Watson, J., 2003. Failure rates for female controlled businesses: are they any different? *J. Small Bus. Manag.* 41 (3), 262.
- Wellington, A.J., 2006. Self-employment: the new solution for balancing family and career? *Lab. Econ.* 13 (3), 357–386.
- Wilkins, S.M., 2014. *An Analysis of Self-Employment from 2003-2013*, Open Access Honors Thesis, College Social Sciences, Florida State University.
- Wit, G., Van Winden, F., 1989. An empirical analysis of self-employment in The Netherlands. *Small Bus. Econ.* 1 (4), 263–272.
- Yu, L., Orazemb, P.F., Jolly, R.W., 2014. Entrepreneurship over the business cycle. *Econ. Lett.* 122, 105–110.