



Testosterone is associated with self-employment among Australian men



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ABSTRACT

Testosterone has pronounced effects on men's physiological development and smaller, more nuanced, impacts on their economic behavior. In this study of 1199 Australian adult males, we investigate the relationship between the self-employed and their serum testosterone levels. Because prior studies have identified that testosterone is a hormone that is responsive to external factors (e.g. competition, risk-taking), we explicitly control for omitted variable bias and reverse causality by using an instrumental variable approach. We use insulin as our primary instrument to account for endogeneity between testosterone and self-employment. This is because prior research has identified a relationship between insulin and testosterone but not between insulin and self-employment. Our results show that there is a positive association between total testosterone and self-employment. Robustness checks using bioavailable testosterone and another similar instrument (daily alcohol consumption) confirm this positive finding.

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1. Introduction

Testosterone, an androgen produced mainly in the testes, has been shown to have pronounced effects on men's physiological development and smaller, more nuanced, associations with economic behavior (Dabbs et al., 1990; Dabbs, 1992). However, alongside cognate genetic research on monozygotic and dizygotic twins (Nicolaou and Shane, 2010; Nicolaou et al., 2008), more recent research has begun to identify that individuals with higher levels of testosterone are associated with new venture creation activities (White et al., 2006, 2007) and with behaviors and characteristics commonly associated

with self-employment. Carney and Mason (2010) showed that those with high testosterone levels are more likely to make use of utilitarian decision making. Strong and Dabbs (2000) also found that high testosterone individuals are more likely to be independent, a motive that is characteristic of individuals that are self-employed (Birley and Westhead, 1994; Cassar, 2007). Equally, Cashdan (1995) identified that high testosterone individuals are more self-centered which relates to findings that the self-employed are more likely to be achievement orientated and focused on their own personal goals (Shane, 2003; Chell, 2008).

We investigate if testosterone levels are associated with self-employment. We focus on self-employment because it differs in one key respect from other labor market states. At its root, indeed the *sin non qua* of self-employment is that the self-employed are uncertain about their future income (Storey and Greene, 2010). While employees or the unemployed, at least in the short-term, can be fairly certain of their wages or benefits from the state, the self-employed are only certain of their costs. To achieve any

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income, therefore, the self-employed are reliant upon their own proactive endeavors.

There are also other reasons for considering that there will be a positive association between testosterone and self-employment. Integral to self-employment is risk-taking behavior under uncertainty (Kirzner, 1973). Recent cognate research has investigated the link between both organizational and circulating testosterone and financial risk-taking proclivity.¹ Using the ratio of second to fourth finger (2D:4D) as a marker of organizational testosterone, Brañas-Garza and Rustichini (2011) found in their study of 188 college students that lower digit ratio was associated with financial risk-taking in men. These results are similar to that found among 413 college students by Stenstrom et al. (2011) who found that $rel2$ (length of the second finger relative to the sum of the lengths of all four fingers) was associated with financial, social and recreational risk-taking. Using circulating testosterone, Sapienza et al. (2009) found that MBA students with higher testosterone levels were more likely to choose a career in finance rather than a less risky career after graduation. Coates and Herbert's (2008) small study of 17 male UK City of London traders also found that morning levels of testosterone were associated with their profitability for that day.

Because self-employment involves proactive behaviors, other studies focused on testosterone's role in competition and status seeking/maintenance also provide clues as to why testosterone may be associated with self-employment. Competition studies (Archer, 2006) generally indicate that actual or prospective competitive activities lead to changes in testosterone levels (Fry et al., 2011; van der Meij et al., 2012) while Saad and Vongas (2009) found that testosterone levels were linked to displays of social status: men that drove a Porsche had higher testosterone levels than when they drove a lower status vehicle such as a family sedan.

Overall, given the direct evidence of a link between testosterone and self-employment (White et al., 2006, 2007) and cognate evidence that links testosterone with risk-taking and agentic behaviors (Archer, 2006; Sellers et al., 2007; Zyphur et al., 2009), we hypothesize that higher serum testosterone levels in men is associated with being self-employed – particularly compared with those in employment but also potentially those that are unemployed and inactive in the labor market.

In doing so, we are conscious of two issues. First, we are unaware of any other large-scale community based study that specifically examines the effect of testosterone on self-employment. Second, the tendency in prior cognate studies has been to assume that because testosterone levels are, in part, heritable (Meikle et al., 1988) then

the direction of causation flows from testosterone to the behavior.

Testosterone, though, is a labile hormone. Studies show that it changes with age (Gray et al., 1991; Tennekoon and Karunanayake, 1993; Harman et al., 2001); and is influenced by environmental conditions. Gray et al. (2006) found testosterone levels to be higher in urban rather than rural dwellers (Saad and Vongas, 2009). Mazur and Booth (1998), Booth et al. (2006), and van Anders and Goldey (2010) also found that higher testosterone levels are more likely among divorced and single males than in men who are married. Higher testosterone levels have also been found to be associated with increased alcohol consumption (Lenz et al., 2012). By contrast, further meta-analytic studies have shown that testosterone is inversely related to insulin levels with men with low testosterone levels being more prone to insulin resistance (Grossmann, 2011).

This plasticity of testosterone means that even if testosterone levels are higher among the self-employed this may not reflect that role occupation has been shown to have a genetic basis (Zhang et al., 2009), particularly in relation to self-employment (Nicolaou et al., 2008). Instead, testosterone may be higher because the self-employed have to take risks and adopt agentic and competitive behaviors in order to survive in self-employment. Cognate research into honor subcultures in the US (Mazur and Booth, 1998) associates higher testosterone levels among young black men in communities in which there is a cultural expectation that individuals will adopt a defensive posture to protect their honor or reputation. In short, we cannot ignore, particularly as our data are cross-sectional, the potential for reverse causality.

Our contribution is 2-fold. First, rather than using samples of particular groups (e.g. MBA students) or small groups of subjects, we use a large representative study of 1199 adult Australian males from the Florey Adelaide Male Aging Study. We also use blood samples (collected at similar times of the day) of the two types of activation testosterone: total testosterone levels and bioavailable testosterone levels. Second, we use an instrumental variable (IV) approach to control for endogeneity due to omitted variable bias and reverse causality in the relationship between testosterone and self-employment. The rationale for using an IV approach is explained in Section 2. In Section 3, we provide an overview of our data and detail the variables used in the study. We then present the results in Section 4 while conclusions are presented in Section 5.

2. Estimating testosterone and self-employment

Our outcome variable is an indicator of being self-employed (SE) and we adopt a linear probability model so that:

$$\text{Prob}(SE = 1) = \Phi(\alpha_0 + \alpha_1 T + \beta X + u) \quad (1)$$

where $\Phi()$ is the cumulative distribution function of the standard normal distribution. $\text{Prob}(SE = 1)$ here stands for the probability a sample male is self-employed. T is the basal activation testosterone level, X is a vector of

¹ Among men, testosterone is circulated principally through the testicular Leydig cells. Much of this circulating testosterone, however, is bound to sex hormone-binding globulin. A lesser proportion is not bound to this globulin. This latter type of testosterone is commonly called 'free' or 'bioavailable' testosterone (Kapoor et al., 2005) while total testosterone refers to levels of both bound and unbound testosterone. Testosterone can also have organizational effects, which persist in the absence of the hormone. Typically, these organizational effects of testosterone occur prenatally and lead to masculinization.

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