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GROWING INCOMES, GROWING PEOPLE IN NINETEENTH-CENTURY
TASMANIA

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Growing incomes, growing people in nineteenth-century Tasmania

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Abstract

The earliest measures of well-being for Europeans born in the Pacific region are heights and wages in Tasmania. Evidence of rising stature survives multiple checks for measurement, compositional and selection bias. The challenges to health and stature seen in other nineteenth-century settler societies (the ‘antebellum paradox’) are not visible here. There was a strong correlation in Tasmania between stature and per capita GDP. We sketch an interpretation highlighting the role of relatively slow population growth and urbanization, a decline in food cost per family member available from a worker’s wage, and early recognition of the importance of public health.

INTRODUCTION

Emigration from Europe during the nineteenth century typically was a move to a ‘healthier’ environment in which food was relatively and often absolutely less expensive, fuel and building materials were more abundant, population densities were lower and industrialization less advanced. British expansion into Australasia was no exception, as was recognized from its earliest days.

‘The class of inhabitants that have been born in the colony affords a remarkable exception to the moral and physical character of their parents: they are generally tall in person, and slender in their limbs; of fair complexion, and small features. They are capable of undergoing more fatigue, and are less exhausted by labour than native Europeans ...’¹

A recent theme in the literature, however, points to interruptions in the colonial success story in many parts of the world. Industrialisation, urbanisation, the inflow of people and disease, the outflow of foodstuffs and other exports, constituted a series of factors each with the capacity to affect human welfare and growth. Early industrialization in the United States, for example, contributed to a decline in the stature of Americans born from the 1820s to the 1840s² and again later in the century.³ Similar patterns are observed in Canada and to some extent in South Africa and New Zealand.⁴ Neither is there

evidence of increasing stature in Argentina, Peru or before the 1870s in Brazil.⁵

Stagnation or decline of stature even in the healthiest of nineteenth-century environments is generally thought to reflect adverse pressures on health and nutrition that would have offset the positive effect of rising incomes. The immigrant-receiving countries are of particular interest because at the beginning of the nineteenth century populations were small and industrialization less advanced, and yet their economies grew quickly with robust urbanization – exactly the kind of environment that might generate stresses on personal health.⁶ Large cities emerged from an early date and grew fast enough to strain rudimentary public health infrastructure. High rates of internal mobility, the arrival of large numbers of immigrants and slowly increasing population density facilitated the circulation of disease and occasional epidemics of respiratory or diarrheal infection.

Moreover, the emergence of mining camps in some places, the advance of factory production, and an articulation of social classes signaled increasing inequality and the possibility that important subgroups in society would experience congested living conditions, child labour, inadequate nutrition or other influences that would limit their realization of physical growth potential.⁷ The benefits of aggressive public health investment and advancing medical science, which would have such a dramatic impact in the twentieth century, were not yet available.⁸ Many of these regions exported food reflecting its relatively low price in local markets, and yet inevitably there was upward pressure on prices as a declining cost of long-distance transportation opened up alternative outlets for producers.

The Australian story remains uncertain. Data from military recruits cast a shadow over the working man's paradise, suggesting stature fell from the 1880s to mid 1890s, after which it resumed its upward trajectory despite ongoing economic depression.⁹ Whitwell, De Souza and Nicholas argue that the interruption reflects a combination of urban disamenities – especially increases in the disease environment and an earlier than expected stagnation in wages dated in the 1880s. Shlomowitz considers several sources of data and argues the need for more work.¹⁰ Most evidence has been drawn from military recruiting during the early twentieth century. There is limited evidence of any kind for cohorts born before 1870 and for individual colonies within Australia.

This paper deploys data on prisoners, not the military, for Tasmania, a colony with markedly different characteristics from mainland Australia. Incomes rose and population expanded, but growth

and structural change were slower than elsewhere, urbanisation mild and the disease environment perhaps more benign.¹¹ Tasmania offers a new Europe without conspicuous adversity. What could happen to stature in such an environment? If stature did change, this was likely to implicate overall levels of economic growth, wages, exogenous price shocks and public health. By using prison data, we are also able to contribute to the recent debate on an old topic: selection bias in height samples.

Our analysis considers locally-born men descended from European and other immigrants because systematic evidence for the indigenous population is limited.¹² Similarly, we focus on men because sample size is larger. We attempt to cast a particularly skeptical eye on the Tasmanian evidence because of the apparent contrast with other settler colonies and a persisting uneasiness in the literature with samples selected by a process of imprisonment.

Of course, all historical sources are selective in some way. We are troubled only if the relationship between the imprisoned population and the rest of society changes over time. Bodenhorn, Guinnane and Mroz have argued that there is reason to be concerned about consistency over the business cycle, with economic downturn pushing taller, more successful workers into crime.¹³ This potentially matters a great deal. Large cross-sectional variation in stature within most populations implies that even a small change in selection might have substantial consequences.

Our first goal, therefore, is to consider potential challenges to the data. Next we undertake a multivariate assessment that controls for possible confounding effects and confirms that Tasmanians released from prison born from the 1840s to the 1880s experienced a substantial increase in stature. A full causal analysis of the stature increase is beyond the scope of this paper, however we identify alternate hypotheses and the ways in which each explanation might contribute to a new narrative of Tasmanian history. A final section of the paper offers concluding comments.

THE DATA

We have extracted the data from reports of discharged prisoners that were published in the *Tasmanian Police Gazette* between 1865 and 1924. *The Gazette* was a government newspaper that circulated widely throughout Tasmania and nearby colonies.¹⁴ Publication of the prisoner descriptions may have been motivated by concerns about the recidivist tendencies of an aging former convict population (59,000 male and 13,000 female convicts transported to Tasmania in the period 1803- 1853). There

may also have been a desire to keep track of the children and grandchildren of convicts.¹⁵ Certainly the colonial state was habituated into detailed record keeping.

Whereas most post-gold rush mainland colonies were shaped by progressive legislation that extended the vote and reduced the working day for skilled tradesman, Tasmania was an exception. It retained a restrictive franchise; this was particularly true of the upper house, which was dominated by a small landed elite. Aggressive Master and Servants Acts were introduced in 1837 and 1854 and were supported by other public order legislation used to prosecute vagrants, particularly former transported convicts and other more mobile elements of the population.¹⁶

Tabulated returns of discharged prisoners first appeared in the *Tasmanian Police Gazette* in 1865. Each table included the prisoner's name, age, place of birth, ship of arrival, height, hair colour, distinguishing physical features, date of trial, offence, length of sentence and place and date of discharge (Figure 1). Recorded ages range from five to 103. The returns include those released after serving sentences varying from one hour to life. The tables document offenders tried at all levels of the court system. As the range of sentences might suggest the offences for which they were tried varied from the petty (vagrancy, trespass etc) to murder. The most minor offences are under-represented because their sentences tended to be non-custodial eg a monetary fine rather than time in prison. Comparison of prison admission totals for years where data was provided in the annually produced statistics of the colony suggest that the discharges reported in *The Police Gazette* tables represented about half of the colonial total.¹⁷

The tabulated discharge data were discontinued in June 1910 although *The Tasmanian Police Gazette* continued to circulate information on prisoners as they were convicted. Thus the data collected to mid-1910 describe discharges from prison and data from subsequent years describe convictions. The discharge and conviction data are similar except that the latter include many men awarded non-custodial sentences. Until we can assess the two series more carefully, we do not pool them.

The Gazette information distinguishes those who were born in the colony from those born elsewhere, and those who freely migrated to Tasmania as opposed to those who had been transported as convicts (Table 1). We attempt to identify individuals who were incarcerated more than once. In the absence of a unique identification number, we link records for individuals with the same name, place of birth, year of birth plus or minus three years and additional information recorded in the Gazette such as

descriptions of tattoos, injuries and ship of arrival.¹⁸ The semi-automatic linkage process identifies 26,664 distinct individuals among 39,109 discharge and conviction records. As these figures suggest, a substantial proportion of the records describe individuals with multiple offending histories.

Insert Figure 2 here

Insert Table 1 here

Our first examination of the stature of Tasmanian-born adult males by year of birth (Figure 2) suggests a considerable gain from a trough in the 1840s through to the early 1880s followed by a partial and temporary reversal later that decade. There is no sign of a decline from the 1870s to the 1880s, as has been reported for WWI soldiers in Victoria and nationally.¹⁹ Of course there is no reason to expect Tasmania to follow the pattern of other Australian colonies. Convict transportation uniquely shaped Tasmania. It received 42 percent of all those transported to Australia, and convicts were a larger share of the pre-1850 population than elsewhere. Another unusual circumstance was the Victorian gold rush of 1851, which triggered a decade of net population loss. It is estimated that 30,000 of the 72,000 former convicts transported to the colony left, the majority departing for the Australian mainland after the news of the discovery of gold. Whereas the post-gold rush mainland colonies were shaped by progressive legislation that extended the vote and reduced the working day for skilled tradesman, Tasmania retained a restrictive franchise.²⁰ Aggressive Master and Servants Acts in 1837 and 1854 allowed custodial sentences twice the length of similar legislation in England and Wales for workers who broke employment agreements.²¹

Given the many differences between Tasmania and the other colonies, we should not be surprised if there is a different experience of stature. And yet, as with the reading of any historical source, we need to check that our initial impression is not influenced by inaccuracies or inconsistencies in the recording of information, or changes in the composition of the population of convicted felons. One example arises from the likelihood that during hard times a broader section of the population is likely to end up before the courts, linking together economic hardship, crime rate and stature.²² Taller men who have generally more favourable labour market options might be more likely to engage in crime and to be imprisoned during recessions than at other periods. We need to consider such

possibilities in order to demonstrate that the relationship between the inmates whose descriptions were circulated and the wider population remained reasonably consistent over time.

The accuracy of recorded heights is the most basic concern. We have so far failed to locate instructions for recording heights of Tasmanian prisoners. Of course official stipulations provide limited comfort, as we would not know if rules were always followed. Were all prisoners measured with their shoes off? Was the same equipment used, or were the convicted merely lined up against a wall and their height estimated? Were drunks and those arrested on a Saturday night for being violent measured with the same accuracy as more compliant inmates? All of these questions are potentially pertinent.

Information on the physical characteristics of prisoners, including their height, typically was collected at one of four possible times: a) on arrest, b) on conviction, c) on admission to an institution, d) on discharge. From 1865 to June 1910 the data that we have used in this study are described as having been taken on discharge. From June 1910 to December 1924 they were recorded on conviction. Of course, while discharge data provided an opportunity for prisoners to sober up or calm down, there is no guarantee that prison officials did not merely copy across the height recorded on entry and supply this to the compilers of the Gazette.

We examine these issues more closely by comparing the heights recorded for prisoners with known multiple conviction histories (roughly one-quarter of all prisoners). If someone's stature was reported more than once, we can examine whether or not the detail was identical on each occasion. Providing an independent measurement was taken on each occasion, this gives an indication of the variability and hence accuracy of measurement.

This feature allows us to identify the extent to which the height recorded for one conviction differed from that of a previous Police Gazette entry (limited to entries in which the prisoner was aged between 21 and 40 years). The results reveal significant uniformity in measurement practice. The stature of 64 percent of adult male prisoners and 67 percent of adult females was recorded as being exactly the same as in the person's previous record. Additionally 15 percent of male and 11 percent of female terminal heights differed by half an inch or less (in other words within the bounds of what might be expected from rounding). Even with accurate measurement some variation in individual stature is to be expected. Individuals are at their tallest in the morning but tend to shrink during the day due to the

compression of the fibrous discs of cartilage that separate the vertebrae. Depending on the times in the day in which measurements are taken, variations of up to an inch should be expected.²³ Only one in ten of the records differed by more than half an inch, and there was no evidence of systematic over- or under-recording.²⁴

Insert Table 2 here

Admittedly, the height of prisoners convicted of being idle, drunk and disorderly displayed slightly greater variation than for other convictions (Table 2). And yet, even in this category, more than three quarters of all measurements differed by less than a half of an inch from the previous measurement. We conclude that there is nothing to suggest different institutional measuring practices and standards distorted the heights of prisoners recorded in the Tasmanian Police Gazette. Nor is there evidence that height recording was wildly imprecise. Indeed, some variation in reported heights is comforting because it confirms that prison officials did not merely copy the last recorded entry for a prisoner rather than measuring anew.

COMPOSITIONAL CONSISTENCY AND REPRESENTATIVENESS

It is useful to situate the *Police Gazette* reports of discharge and conviction within the context of the colony as a whole. Accordingly we report in Figure 3 information on conviction rates from the published annual statistical account of Tasmania. The number of convictions per 1000 varied substantially over the period 1867–1922; it fell from a plateau in the early 1880s to a low in the late 1890s before recovering. Given a conventional understanding of the colony’s business cycle,²⁵ it would appear that economic depression coincided with a reduction in prosecution and conviction rather than increasing it, as observed elsewhere.²⁶ Of course, the problems associated with inferring underlying crime rates from conviction data are well established.²⁷ Changes in conviction rates are a poor guide to underlying offending. Nevertheless, to the extent the movement of prosecutions are likely to reflect fluctuations in crime, it is noteworthy that crime appears not to have increased during the late-century economic downturn.

Insert Figure 3 here

Another potential complication arises if prisoners born in rural areas were taller, and the rural-born

share of prisoners changed over time. WWI soldiers born in Hobart and Launceston were two centimeters shorter than other Tasmanians (controlling for other possible influences).²⁸ For most prisoners, we cannot examine directly the rural-urban differential because the gazettes do not report birthplace within Tasmania. Fortunately, we are able to obtain information about birth location and the occupation of the father for a small number of adolescent prisoners by finding their birth registrations.²⁹ For this small and specialized sub-sample we can control for birth location and social class (via father's occupation) in order to identify the secular trend more precisely.

We report in Table 3 a series of OLS regressions that identify mean stature, separately for men and women aged 13-20, born before 1865 and after 1880, after controlling for the influence of age, birth location and father's occupation for men and women. The constant term reported in Table 3 confirms that even in the presence of these controls stature at 18 years increased by 1.5 inches from earlier- to later-born cohorts. Indeed, stature increased at all ages (comparing the constant term with successive year-specific effects in the two periods). The stature increase appears to be especially large for women although it varies a great deal by age reflecting, no doubt, the small sample size for women.³⁰ A shift upward in the adolescent growth curve, of course, is consistent with the increase in adult stature.

Insert Table 3 here

The linked records also shed light on the extent to which location of the court might proxy for place of birth. For this purpose we ignore the higher courts, which would have drawn from across the island. A cross-tabulation of court location with birth location indicates that roughly three-quarters of those convicted in rural courts were born in rural areas. A smaller proportion, 55%-60%, of prisoners convicted in Hobart and Launceston were born in urban areas. Clearly, there was more rural-to-urban migration than vice-versa. Some of those who migrated from rural areas are likely to have done so as children and therefore spent part of their growing years under the influence of urban conditions. It is also possible that those who migrated from rural areas were shorter, on average, than those who stayed behind. Generally, however, the linked data supports the identification of birth location using location of the court. Not surprisingly, when we examine stature over time separately for those convicted in rural and urban courts, the former are consistently taller. Of more immediate interest, over the decades stature increased for both groups implying that we be confident of a long-run stature increase

regardless of a changing rural proportion.

A similar question about the potential effect of recomposition arises with any stature differential between subgroups. The personal information available for prisoners is limited, however we do know that a substantial minority (23 percent) of prisoners were convicted multiple times (Table 2). If offenders with a multiple conviction history were taller or shorter than those with only one conviction, this might distort the analysis. Again, as with birth location, we examine known recidivists separately from other prisoners. And again, both groups experienced a rise in stature. A similar result emerges from a consideration of prisoners tried in different kinds of courts and convicted of different kinds of crime. All distinguishable subgroups increased in stature. The proportions of convictions in the various categories fluctuated, and the fluctuations may have been partly endogenous to wider economic process. Nevertheless, an upward trend in all of the underlying series confirms that the Tasmanian stature increase is not simply a misleading byproduct of shifting selection bias or demographic recomposition.

MULTIVARIATE ASSESSMENT OF COMPOSITIONAL CHANGE

We now know that the stature of prisoners differed by court type and location, type of crime and whether or not the individual is a recidivist. Accordingly, we must control for compositional shifts that influence the trajectory of observed stature. Similarly, we need some assurance that fluctuations in crime rate or in reporting by the Police Gazette do not distort our understanding of stature change by changing the mix of prisoners. We consider these influences jointly in a simple multivariate regression reported in Table 4.

Insert table 4 here

We consider all men in 5-year birth cohorts between 19 years and 60 years with age-specific dummy variables to adjust for those who might still be growing at ages 19-22 or shrinking aged 50-60. We estimate separately on men identified in the pre-1910 discharges and post-1910 convictions because the inclusion of many non-custodial sentences in the latter signals a different selection of the population. Separate terms in the regression capture the compositional and selection influences identified above. The omitted categories, reflected in the constant term, are birth 1845-49 for discharge data and 1900-1904 for conviction data, age 23-49, tried in Hobart, only one conviction, and crimes against property.

All estimated coefficients are of potential interest although we especially wish to determine if the evidence of stature increase is statistically significant after controlling for various correlates. The evidence of Table 6 confirms that the choice of court and location of the trial mattered. Those brought before the courts in the countryside were half an inch taller than defendants in Hobart or Launceston. The evidence of Tables 4, 5 and 6 confirms that among prisoners, as among soldiers, rural men were taller, presumably because as rural children they were less exposed to disease and had access to food at a lower relative price. There is no easy way to assess if this rural effect might be reinforced by labour market sorting of taller men to work in the countryside. Work in the countryside undoubtedly rewarded workers who were tall, strong and experienced in rural employment.³³ The empirical significance of this effect is more challenging to establish.

We examine higher courts (the Supreme Court and Quarter Sessions) separately since they were empowered to try more serious cases involving defendants drawn from across the colony (and probably across a wider class spectrum). Compared with those tried in police and magistrates' courts in Hobart, those convicted in higher courts were two-thirds of an inch taller. More 'white-collar crimes' – forgery, offences against the currency, and those relating to carrying out laws – were associated with taller offenders – presumably because the literacy requirement restricted entry to those who grew up in the kind of household that had resources to cover the cost of education. Contemporary criminology similarly reflected upon the superior social status and stature of forgers.³⁴ At the other extreme, the rough and rowdy convicted of offenses against good order were relatively short. The conviction data, while not identical, hints at class distinctions.

The coefficients for recidivists on the whole take a negative sign but the effects are small and insignificant, with one exception: Launceston. There, repeat offenders discharged from prison were nearly three-quarters of an inch shorter than other inmates. Were short individuals in Launceston more discriminated against in employment markets, turning to crime instead?³⁵ Alternately, police may have picked on short individuals—as stature is correlated with socio-economic status this might reflect a wider heavy-handed attitude to the policing of the poor in Launceston. Another possibility is that childhood deprivation had life long consequences and that those raised in poverty remained poor, and as such, were more likely to offend. Most obviously, urban populations are typically shorter and more policed, creating the appearance of short recidivists, at least in one town. Our data at present do not

allow us to discriminate among these hypotheses. Importantly, although we remain agnostic on interpretation of the associations between height and the likelihood of offending, height and recidivism, and height and type of crime, we see no evidence that these associations undermine our assessment of an overall stature increase.³⁶

Finally, we also consider if rising stature might be a product of the declining proportion of convictions reported in the Gazette or the declining incidence of conviction in Tasmanian society. The degree of under-representation of convictions recorded in the Tasmanian Police Gazette makes little difference, as is apparent from the small and statistically insignificant coefficient on the recording rate.³⁷ We conclude that recording changes, while worrisome in principle, had no impact on the reported mean height of Tasmanian born male prisoners.

We do see, however, an inverse association between the annual conviction rate for the colony as a whole and the heights of prisoners. Total convictions ranged between 20 and 50 per thousand of the population. When conviction rates rose by 10 per 1000 per annum, the mean height of adult prisoners recorded in the Gazette dropped by one-tenth of an inch. This runs contrary to an hypothesis of labour market behavior that sees taller men driven into crime at the same time as crime rates increased.³⁸ The conviction rate was associated with a decrease in mean height, rather than a rise, and depression drove the crime rate down, not up. It is possible that what we observe is the outcome of what might be termed a Casablanca effect—‘round up the usual suspects’. According to this alternate interpretation, rises in the conviction rate reflect crackdowns on offending that targeted the less well off.³⁹

These results are unlikely to surprise a criminologist. Recent work on crime in nineteenth-century contexts has explored the difference between persistent and serious offending (categories that are often confused in popular perceptions of criminals). Many of the repeat offenders in Tasmania were convicted of public order offences, such as vagrancy, indecent behavior and gambling, which in total account for 68% of all convictions 1876-1909.⁴⁰ Many of these convictions led to fines rather than a custodial sentence and therefore do not appear in the Police Gazette. Custodial sentences for public order offending accounts 28 per cent of all convictions reported in the Gazette and a large majority of charges awarded to recidivists.

In Tasmania, as elsewhere, persistent offenders accounted for most offending, although they

were rarely convicted of serious offences. Historians of crime have identified these repeat offenders as drawn disproportionately from marginalized groups that were vulnerable to prosecution for offences such as vagrancy. It seems likely that this was happening in Tasmania as well, and if so we should not be surprised that the Tasmanian recidivists were comparatively short. They also tend to be well-known to the police. Serious offenders, by contrast, were often casual offenders in the sense that they are less likely to have a previous record of conviction. Because of the nature of the crimes these men were more likely to be tried in higher courts and be sentenced to longer sentences.⁴¹ Our data reveal that they are also likely to be taller.

The patterns identified through multivariate estimation are of individual interest and should attract additional research. Our immediate objective, however, is to assess whether or not the impression of rising stature survives the control for other influences. This directs attention to the birth cohorts in Table 6. As is evident from the size and significance of these co-efficients, they point to an unambiguous upward trend in stature. Stature increased with notable gains in the early 1850s, more gradually across 1865-75, with further progress in 1880-84, with plateaus in between. Stature in each of these quinquennia was greater than the benchmark 1845-1849 group by a margin that was statistically significant. Then, from 1885-89, heights trend downwards, precipitously in 1890-94 (although it should be noted that sample size also plummets for this birth cohort). The conviction data follow a similar although less clearly delineated pattern. Prior to 1875 the conviction data are sparse and the coefficients volatile: afterwards, they track the shape of the discharge data and extend it into the early 20th century. The depression years 1890-94 stunted significantly, by more than half an inch, before the upward trajectory in stature resumed.⁴² Thus, the observation of a stature increase in Tasmania, only interrupted by the depression, survives the controls for possible complications in the data.

STATURE INCREASE IN THE NARRATIVE OF TASMANIAN DEVELOPMENT

We have taken some care to investigate the accuracy and consistency of our data. While it is not possible to assess fully every potential problem, there seems little risk that compositional change or selection bias misleadingly created the appearance of stature increase. Multivariate adjustment for changing composition has little effect because most components of the population moved together. Admittedly, there was considerable inequality. Rural men were taller than those in Hobart and Launceston.⁴³ Men convicted repeatedly and those convicted of offences against public order were

consistently shorter, although those convicted of offenses against good order converged toward those convicted of crimes against person and property.

Insert Figure 4 here

We derive Figure 4 by adapting the multivariate regression above to consider individual years of birth rather than 5-year cohorts. At least 150 observations underpin each of the annual estimates. This permits a finer grain in the trend line. We then compute a five-year trailing average: so, for example, the figure for 1850 reflects the weighted (by number of cases) average for boys born in the previous five years. The underlying logic is that children born from 1846-1850 will be influenced (in varying degree) by conditions prevailing in 1850. The moving average for stature, after controlling for compositional and selection influences in Figure 4 reveals a wavering but persistent increase in stature from the mid 1840s until the late 1870s in the discharge data (and, in the conviction data, for another few years) for an overall gain in excess of one inch.

The economy was also growing. Figure 4 presents Tasmanian annual real GDP per capita, from Sinclair.⁴⁴ From a trough in 1858 with an average of £33 per capita, Tasmanian GDP rose to a peak of £61 per capita in 1889 – a near doubling of income. It has long been recognized that while per capita income and stature are likely to move together in the long term this has not necessarily been so over shorter periods.⁴⁵ Here, there is a surprisingly close fit. Annual real GDP per capita explains 41% of the variation in Tasmanian stature on a moving average basis and 12% using annual average stature (combining, for the moment, conviction and discharge data into one series). Remarkably, if we turn from annual averages to individual heights, income still explains 5% of the variation.⁴⁶ While space precludes a thorough investigation of this relationship, rising income clearly was associated with the realization of biological dividends.

Other settler colonies, as noted in the introduction, have seen some divergence between the trajectories of per capita income and stature. And yet, Tasmanian families during the middle decades of the nineteenth century apparently shared in the benefits of economic growth and improved their living conditions in ways that facilitated a rise in stature. We turn to the evidence of working class wages and food costs in order to understand more clearly how families were able to translate aggregate economic change into individual welfare improvement.

In Figure 5 we report long-run series of wages and the prices of various foodstuffs in Hobart.⁴⁷ Rural communities in Tasmania had easy access to field grains, fish, rabbit, wallaby and other animal protein, thanks to a benign climate and extensive tracts of both forest and well-watered cultivable land. Unfortunately, in the absence of systematic records, we can say little about informal food harvesting by rural families. Fortunately, we are able to examine wages and food prices for urban-dwellers.

Insert Figure 5 here Insert Figure 6 here

The price evidence suggests that from the 1840s to the 1860s in Hobart mutton became modestly less affordable relative to wages. Bread, on the other hand, became significantly more affordable. If demand elasticities were large enough to influence the patterns of consumption, over time Tasmanians would have tended to sacrifice mutton in favour of bread, and hence protein in favour of carbohydrates. Admittedly, there is no evidence that consumption was sufficiently sensitive to relative prices. But substituting wheat for meat should have increased total calories.

In Figure 6 we broaden the evidence to consider the cost of a basic food ration, relative to the daily wage. The food ration includes tea, sugar, salt, soap, bread and meat for a family of six.⁴⁸ The ratio of food costs to wage income would have been lower for any families in which more than one person worked.⁴⁹ The ratio declined in an irregular but persisting fashion from the 1840s to 1880s indicating that food was becoming more affordable during the entire period of stature increase. Admittedly, protein was becoming more rather than less costly. The decline in family food cost relative to wage would be even more decisive if we took into account the decline in family size in this period.⁵⁰ Hatton and his coauthors argue that falling fertility made available more resources for individual children and thereby contributed to the rise of stature in Britain.⁵¹ A similar process may have been at work in Tasmania.

The declining cost of food relative to wages helps to explain why Tasmania was able to translate GDP growth into stature gains through the middle decades of the nineteenth century. Not surprisingly after 1880, when food cost relative to wage no longer was declining, and the growth of GDP lost its momentum, stature was no longer rising. Another likely influence on stature is the disease and public health environment. The Tasmanian climate is mild in both winter and summer. Relatively short spells of hot weather probably limited the duration of fast food spoilage and accompanying

dysentery. It is useful to look to the evidence of infant mortality, a sensitive indicator of childhood conditions. Many of the influences that gave rise to infant death are the same or similar to the factors that would compromise the physical growth of children, including poor maternal nutrition (and maternal health more generally), limited breast-feeding, exposure to bacteria from unsafe water and food and airborne contagion because of crowded conditions.⁵² Rebecca Kippen has documented a significant decline in infant mortality during the 1850s; she attributes this change to an abatement of outbreaks of epidemic disease and an amelioration of infant death among the children of convict mothers.⁵³ These same influences may well have contributed to the initial upturn in Tasmanian stature for men born in the late 1840s and 1850s.

Kippen further observes that infant mortality stabilized at the end of the 1850s and did not decline further for another three decades. Thus, while the infant mortality analysis helps to explain an initial rise in stature, the longer-term increase in stature must reflect a broader range of influences. In order to understand why a short-term and perhaps even cyclical recovery in stature turned into a pronounced four decade- long trend, we need to consider the broader circumstances of social and economic development in Tasmania.

Tasmania developed relatively early in the European experience of Australasia because of its role as a prison colony. Growth occurred, principally as a result of new inputs of coerced labour. Economic effort was channeled into agricultural, pastoral and extractive endeavours mainly aimed at the export market, and not towards industrial production. The ability to allocate convict workers directly to rural districts constrained the pressures for urbanisation felt elsewhere across Australia. Then, in 1851, the discovery of gold on the mainland wrought havoc. It drained away all free and some not-so-free labour. The population contracted, convict women's wages went up as they substituted for absent men, and eventually some farmland was retired from production.⁵⁴ Gold fever also extinguished any remaining 'dread' exercised by penal transportation on the British imagination.

Following the abolition of transportation in 1853, however, the growth of Tasmania slowed. From 1851 to 1891, Tasmania's population roughly doubled, whereas New South Wales increased five-fold and Victoria roughly ten-fold. Indeed, public authorities at the time reported that Tasmania experienced a net loss of population through migration during the 1870s and 1880s. The urban share of Tasmania diminished over this period; by 1891 towns and cities with more than 5000 people accounted

for more than half of the Victorian population, almost as much in New South Wales, but only one-third of Tasmania's population.

To the extent that fast population growth especially in cities created a threat to public health, Tasmania escaped the most severe pressures plaguing other colonial environments such as nearby Victoria.⁵⁵ It may have helped as well that from an early date Tasmanian public intellectuals engaged in vigorous debate about community health.⁵⁶ By the end of the century the colony's chief statistician argued that good habits of the people and local medical knowledge made significant contributions to Tasmanian health.

CONCLUSION

Tasmanians born in the 1870s and 1880s were considerably taller than their parents born in the 1840s and 1850s. Evidence for the rise in stature is robust to controls for compositional change and selection effects associated with the use of prison data. There are legitimate concerns with the use of prison data, but used carefully they provide helpful insight into the changing health of the population. Our study offers no support for the potential complication that economic depression increases crime and stature. Instead, when the economy turned down, so too did the conviction rate and average stature. We detect no indication that only some sectors of society shared in the stature gain or that we are being misled by inaccuracy or perverse selection bias. Admittedly, there is evidence of inequalities in stature among different subgroups of the population.

The Tasmanian experience of rising stature was unlike other nineteenth-century settler societies. Of course, economic expansion everywhere brought more resources that potentially might be available for public health investments or improving child nutrition. And yet, in Tasmania, the challenges to health from industrialization and urbanization in nineteenth-century conditions did not overwhelm the positive effects of growth.

One element in the explanation arises from circumstances encouraging a decline in infant mortality, such as the cessation of epidemic disease and improved infant care in the convict nursery in the 1850s. Another helpful circumstance was the falling price of bread. Taking into account the full cost of a basic ration, which includes imported as well as exportable items, food became more affordable relative to wages during the period of rising stature. An apparent decline in family size

reinforced the trend for the daily wage of a tradesman to become an increasingly comfortable way to meet family needs. There is no evidence of increasing inequality.

An underlying favourable circumstance may be simply that population growth and urbanization in Tasmania did not overwhelm public health authorities to the same extent as in faster-growing settler colonies. We are not yet in a position to know how much explanatory weight to put on a local Tasmanian tradition of sensitivity to public health as opposed to more muted challenges reflecting slow population growth and urbanization. This trade-off is difficult to assess for several reasons, including a lack of stature evidence for people born in the other colonies during the middle decades of the nineteenth century.

To summarize, height rose because GDP per capita increased, public health improved especially in the 1850s and cost of a basic food basket diminished relative to wages. The slow pace of population growth and urbanization, a reduction in over-crowding, and strong local awareness of the importance of basic public health safeguarded these benefits. Formal testing is needed to identify the precise importance of diverse influences for particular decades and over the entire period. Nevertheless, the Tasmanian evidence already allows us to say that adverse health pressures accompanying economic growth (the ‘antebellum paradox’) were a contingent rather than universal tendency. In the right circumstances, substantial improvement in stature and physical well-being might be realized in a growing, nineteenth-century settler society.

References:

¹ Bigge, Report of the Commissioner, p.81.

² Haines, Craig and Weiss, *The short and the dead*; Komlos, *Anomalies in economic history*; Steckel, *Stature and living standards*.

³ Maloney and Carson, *Living standards in Black and White*; Steckel and Haurin, *Health and nutrition in the American Midwest*; Zehetmayer, *The postbellum continuation*.

⁴ Cranfield and Inwood, *The great transformation*; Inwood and Masakure, *Poverty and physical well-being*; Inwood, Oxley and Roberts, *Was New Zealand the land*.

⁵ Baten, Pelger and Twrdek, *The anthropometric history of Argentina*; Salvatore, *Heights, nutrition, and well-being in Argentina*.

⁶ Haines, *Growing incomes, shrinking people*.

- ⁷ Steckel, Stature and the standard of living.
- ⁸ Easterlin, Growth Triumphant; Floud et al, The Changing Body.
- ⁹ Whitwell, de Souza and Nicholas, Height, health and economic growth; Whitwell and Nicholas, Weight and welfare; Cranfield and Inwood, A tale of two armies.
- ¹⁰ Shlomowitz, Did the mean height of Australian-born men.
- ¹¹ Butlin and Sinclair, Australian Gross Domestic Product; Sinclair, Annual Estimates.
- ¹² Nicholas, Gregory and Kimberley, The welfare of indigenous.
- ¹³ Bodenhorn, Guinnane and Mroz, Caveat Lector.
- ¹⁴ Tasmania, Police Gazettes.
- ¹⁵ Police gazettes in colonies receiving no transportees, for example New Zealand, had a similar practice. Either New Zealand simply followed the practice of larger and older colonies or the publication of detail about prisoner conviction or release was independent of the convict system.
- ¹⁶ Quinlan, Australia, 1788-1902: A Working Man's Paradise.
- ¹⁷ The gazettes identify a small number of convictions for individuals who were admonished and discharged or bound over to pay a bond apparently without a custodial sentence. These represent under one percent of all cases reported in the gazettes before 1910. 28 per cent of all male court appearances in 1882 resulted in a custodial sentence declining to 13 per cent in 1908. This accounts for a decline in the ratio of gazette notices to convictions in the colony. Unfortunately, information is not available annually on the share of court appearances leading to a custodial sentence or the share of custodial sentences reported in the Gazette.
- ¹⁸ Beginning in 1895 the linking becomes easier because the Gazette provides an internal reference to the most recent issue in which the individual appeared.
- ¹⁹ Whitwell and Nicholas, Weight and welfare; Cranfield and Inwood, A tale of two armies.
- ²⁰ Boyce, Van Diemen's Land; Breen, Contested Places.
- ²¹ Quinlan, Trade unionism and industrial action.
- ²² Bodenhorn, Guinnane and Mroz, Caveat Lector.
- ²³ Krishan and Viji, Diurnal Variation of Stature.
- ²⁴ The mean difference between matched pairs was 0.04 of an inch. One possible explanation for the small positive skewing is that some ages were overstated, implying that a few prisoners thought to be 21 years old were in fact younger and still growing. It is also likely that some prisoners with 21 or more years were still growing.
- ²⁸ Cranfield and Inwood, A tale of two armies, Table 8. The soldiers were born over a much shorter period than were the prisoners.

- ²⁹ The prisoners linked to birth registration were 13-20 years old at conviction and born in Tasmania. ~557 were born in the 1840s and 1850s, 626 born 1860s, 308 born 1870s, 340 born 1880s, 709 born 1890s.
- ³⁰ Similar results for the linked children obtain using standardized z-scores as the dependent variable in a model similar to that of Table 4.
- ³³ Meredith and Oxley, Contracting convicts.
- ³⁴ Goring, *The English Convict* (1913)
- ³⁵ Bodenhorn, Guinnane and Mroz, *Caveat Lector*.
- ³⁶ Bodenhorn, Moehling, and Price, *Short criminals*.
- ³⁷ Admittedly, the share of non-custodial sentence is the largest influence on ‘recording rate’, as noted above, and there is little reason to anticipate an influence of the share of non-custodial sentences on patterns among those who were imprisoned.
- ³⁸ Bodenhorn, Guinnane and Mroz, *Caveat Lector*. It is worth noting that the influence of the business cycle could be even more complicated if economic hardship pressed hardest on the poor, thus increasing the proportion of short men among those committing crimes.
- ³⁹ In offering this observation we challenge, in effect, the presumption that a conviction rate may be taken as proxy for the crime rate.
- ⁴⁰ Tasmania, *The Statistics of Tasmania*, various years 1876-1909.
- ⁴¹ Godfrey, Cox and Farrall, *Criminal Lives*. Another possibility, that prisoners were positively selected on height, would be consistent with WWI soldiers’ heights (Cranfield and Inwood, *A tale of two armies*). A further possibility is that in a downturn those on the margins of survival were pressed even more such that, depending on the social structure, the increase in convictions of the poorest might offset any effect of the increase in conviction of the better off (taller). We are grateful to the anonymous readers who pointed out these possibilities.
- ⁴² The dramatic reversal of stature in the 1890s is not immediately relevant to the argument of this paper but it clearly invites further research - in part because it differs from Australian military evidence reported by Cranfield and Inwood, *A tale of two armies*.
- ⁴³ A similar rural-urban pattern is observed among World War One soldiers; see Cranfield and Inwood, *A tale of two armies*.
- ⁴⁴ Sinclair, *Annual Estimates*.
- ⁴⁵ Steckel, *Height and Per Capita Income*; Steckel, *Biological Measures*.
- ⁴⁶ We derive this result by substituting real GDP pc for the birth year dummies in our regression model. Thanks to an anonymous referee for suggesting this strategy.
- ⁴⁷ These data extend the series published by Meredith and Oxley (*Contracting convicts*) using additional data from *The Statistics of Tasmania*, various years 1824-1910.
- ⁴⁸ We extend the Meredith and Oxley series and add from the same source the wage of Hobart carpenters. Our family

includes one adult receiving a full ration, another adult and an older child receiving 0.75 of a ration, and three younger children who have half of the full ration.

⁴⁹ We assume the carpenter worked 6 days per week for 11 months of the year. The line in Figure 6 would shift down for every year if the family were smaller and shift up if work was not available full time year round.

⁵⁰ The Tasmanian census does not provide direct evidence of family size, however some reduction is indicated by decline in the number of Tasmanians divided by the number of dwellings on the island from 7.4 in 1840 to 5.3 in 1880 (Tasmania, Census and Statistics of Tasmania).

⁵¹ Hatton and Martin, Fertility decline; Bailey, Hatton and Inwood, Health, height and the household.

⁵² A reduction in the number of people per dwelling, mentioned above as likely evidence of fertility decline, also signaled a reduction in overcrowding.

⁵³ Kippen, Death in Tasmania, chapter 6; Kippen, The convict nursery.

⁵⁴ Meredith & Oxley, 'Contracting convicts'.

⁵⁵ Merrett, Economic growth and well-being; Sinclair, Economic growth and well-being: Melbourne.

⁵⁶ Kippen, The convict nursery.

⁵⁷ Petrow, Sanitary forum.

Bibliography

Bailey, R., Hatton, T., and Inwood, K. (2015) Health, Height and the Household at the Turn of the 20th Century. *Economic History Review*, forthcoming.

Baten, J., Pelger, I., Twrdek, L. (2009) The anthropometric history of Argentina, Brazil and Peru during the 19th and early 20th century. *Economics and Human Biology*, 7: 319-333.

Bigge, J. (1822) Report of the Commissioner of inquiry, on the State of Agriculture and Trade in the Colony of New South Wales. London: Parliament of Great Britain Sessional Paper 1823:136.

Bodenhorn, H., Guinnane, T., Mroz, T. (2014), Caveat Lector: Sample Selection in Historical Heights and the Interpretation of Early Industrializing Economies. National Bureau of Economic Research Working Paper 19955.

Bodenhorn, H., Moehling, C., Price, G.N. (2012) Short Criminals: Stature and Crime in Early America. *Journal of Law & Economics*, 55.

Boyce, J. (2008) *Van Diemen's Land* (Melbourne: Black).

Breen, S. (2001) *Contested Places: Tasmania's Northern Districts from Ancient Times to 1900* (Hobart: Centre for Tasmanian Historical Studies, University of Tasmania).

Butlin, N. (1985) *Australian National Accounts 1788-1983* (Canberra: Source Papers in Economic History 6).

- Butlin, N. and Sinclair, W. (1986) Australian Gross Domestic Product 1788- 1860: Estimates, Sources and Methods. *Australian Economic History Review*, 26: 126-147.
- Cranfield, J., and Inwood, K. (2007) The great transformation: A long-run perspective on physical well-being in Canada. *Economics and Human Biology*, 5: 204-28.
- Cranfield, J., and Inwood, K. (2015) A tale of two armies: Australian and Canadian soldiers in World War One. *Australian Economic History Review* 55.
- Easterlin, R. (1996) *Growth Triumphant: The Twenty-First Century in Historical Perspective* (Ann Arbor: University of Michigan Press).
- Floud, R., Fogel, R. W., Harris, B., and Hong, S. C. (2011) *The Changing Body: Health, Nutrition, and Human Development in the Western World since 1700* (Cambridge: Cambridge University Press).
- Godfrey, B., Cox, D. and Farrall, S. (2007) *Criminal Lives: Family Life Employment and Offending* (Oxford: Oxford University Press).
- Haines, M. R. (2004) Growing incomes, shrinking people: Can economic development be hazardous to your health? *Social Science History*, 28: 249-270.
- Haines, M. R., Craig, L. A., and Weiss, T. (2003) The short and the dead: Nutrition, mortality and the 'Antebellum Puzzle' in the United States. *Journal of Economic History*, 63: 382-413.
- Hatton, T. and Martin, R. (2010) Fertility decline and the heights of children in Britain, 1886-1938. *Explorations in Economic History*, 47: 505-519.
- Inwood, K. and Masakure, O. (2013) Poverty and physical well-being among the coloured population in South Africa. *Economic History of Developing Regions* 28: 56-82.
- Inwood, K., Oxley, L., Roberts, E. (2012) Was New Zealand the land of milk and honey? New evidence on New Zealand living standards. *Australian Economic History Review* 50: 262-283.
- Kippen, R. (2002) *Death in Tasmania: Using Civil Death Registers To Measure Nineteenth-century Cause-specific Mortality*. Ph.D. thesis, Australian National University.
- Kippen, R. (2010) The convict nursery at the Cascades Female Factory, Hobart. *Chainletter, Newsletter of the Founders and Survivors Project*, 5: 5-8.
- Komlos, J. (1996) Anomalies in economic history: Toward a resolution of the 'Antebellum Puzzle'. *Journal of Economic History*, 56: 202-14.
- Krishan, K. and Vij, K. (2007), Diurnal Variation of Stature in Three Adults and One Child, *Anthropologist*, 9 (2): 113-117.
- Nicholas, S., ed. (1988) *Convict Workers: Reinterpreting Australia's Past* (Melbourne: Cambridge University Press).
- Nicholas, S., Gregory, R., Kimberley, S. (1998), The welfare of indigenous and white Australians, 1890-1955. In: J. Baten and J. Komlos, eds., *The Biological Standard of Living in Comparative Perspective* (Franz Steiner Verlag), 35-54.
- Maloney, T.N. and Carson, S.A. (2008) Living standards in Black and White: Evidence from the heights of Ohio Prison inmates, 1829-1913. *Economics & Human Biology*: 237-251.
- Meredith, D., Oxley, D. (2004) Contracting convicts: the convict labour market in van diemen's land 1840-1857. *Australian Economic History Review* 45: 45-72.
- Merrett, D. (1977) Economic growth and well-being: Melbourne 1870-1914: A Comment. *Economic Record*, 53: 262-268.
- Pepper, J. and Petrie, C., (Eds) (2003) *Measurement Problems in Criminal Justice Research* (Washington: The National

Academies Press).

Petrow, S. (2013) Sanitary forum: The Royal Society of Tasmania and public health reform, 1853-1911. *Papers and Proceedings of the Royal Society of Tasmania* 147: 1- 10.

Quinlan, M. (1986) Trade Unionism and Industrial Action in Tasmania 1830-1850. *Tasmanian Historical Research Association: Papers and Proceedings*, 3: 8–31.

Quinlan M. (2004) Australia, 1788 - 1902: A Workingman`s Paradise? in D. Hay and P. Craven ed., *Masters, Servants, and Magistrates in Britain and the Empire, 1562 – 1955* (North Carolina: University of North Carolina Press), 219 – 250.

Salvatore, R.D. (2007) Heights, nutrition, and well-being in Argentina, ca. 1850– 1950: Preliminary Results. *Revista de Historia Económica*, 25: 53-85.

Shlomowitz, R. (2007) Did the mean height of Australian-born men decline in the late nineteenth century? A Comment. *Economics and Human Biology*, 5: 484-8.

Sinclair, W.A. (1975) Economic growth and well-being: Melbourne 1870-1914. *Economic Record*, 51: 153-173.

Sinclair, W.A. (2009) *Annual Estimates of Gross Domestic Product Australian Colonies/States 1861-1976/77* (Melbourne: Monash University); <http://arrow.monash.edu.au/hdl/1959.1/88855>.

Steckel, R.H. (1983) Height and Per Capita Income. *Historical Methods*, 16: 1–7.

Steckel, R.H. (1992) Stature and Living Standards in the United States. R. Gallman and J.J. Wallis eds. *Economic Growth and Standards of Living before the Civil War* (Chicago: University of Chicago Press, 1992), 265-308.

Steckel, R.H. (1995) Stature and the standard of living. *Journal of Economic Literature*, 33: 1903-4190.

Steckel, R.H. (2008). Biological Measures of the Standard of Living. *Journal of Economic Perspectives*, 22: 129-152.

Steckel, R.H., and Haurin, D. R. (1994) Health and nutrition in the American Midwest: Evidence from the height of National Guardsmen, 1850-1910. In: J. Komlos ed. *Stature, Living Standards and Economic Development* (Chicago: University of Chicago Press), 117-128.

Tasmania, Census, various years 1851-1911. Tasmania, Police Gazettes, various years 1865-1924 (known as Reports of Crime

1865-1883). Tasmania, *The Statistics of Tasmania*, various years 1824-1910. Whitwell, G., Nicholas, S., de Souza, C., (1997). Height, health and economic growth in Australia, 1860–1940. In: R.H. Steckel and R.H. Floud, eds., *Health and Welfare During Industrialization* (National Bureau of Economic Research, Chicago and London), 379–421.

Zehetmayer, M. (2011) The postbellum continuation of the antebellum puzzle: stature in the US, 1847–1894. *European Review of Economic History*, 15: 313-327.

Figure 1 Excerpt from the Police Gazette, 4 February 1892

PRISONERS discharged from H.M. GAOLS and HOUSES OF CORRECTION, Hobart and Launceston, during the Week ending 8 February, 1882; Country Districts for the Week ending 4 February, 1882.

Name.	Shp.	Where Tried.	When.	Offence.	Sen- tence.	Native Place.	Age.	Height	Hair.	Remarks.
<i>Hobart.</i>										
Choate, Charles	E. F. Herri- man	Hobart	22 Dec. '81	Breach M. Sea- men's Act	6 wks	America	29	5 9	Light brown	F.C. Scars over left eye right wrist and calf right leg.
Grant, Donald	G. Henderson	Bothwell	19 Jan. '82	Idle & disorderly	14 dys.	Inverness	74	5 6	Grey	F.S. Scar centre of forehead.
Ash, Charles	Stratheden	Hobart	24 Jan. '82	Ditto	1 mth	Stafford	76	5 5	Ditto	F.S. Died.
Curtis, George	E. F. Herri- man	Ditto	23 Dec. '81	Breach of M. Sea- men's Act	6 wks.	America	23	5 7	Dark brown	F.C. Bracelet right wrist.
Fentiman, John	Blenheim	Ditto	3 Nov. '81	Indecency	3 mths	Yorkshire	41	5 2½	Black	F.S. Scar on lip, lame left leg.
M'Quade, Wm.	Phoebe	Ditto	4 Jan. '82	Larceny	1 mth	Tyrone	44	5 5	Brown	F.C. Scars on fore- head upper lip and right temple.
Christopher, James	Ma. Hastings	Ditto	3 Feb. '82	Harbouring pros- titutes	6 mths	Northamp- ton	62	5 6½	Grey	F.S. Scar inside right arm, three moles in- side left arm, mole under right eye; dis- charged to bail.
Johnstone, Robert	Equestrian 3	Jerusalem	9 Dec. '81	Unlawfully as- saulting	2 mths	Essex	50	5 9	Dark brown	F.S. Mole right side of neck.
King, Ellen	...	Hobart	7 Dec. '81	Idle & disorderly	Ditto	fasmania	22	5 1	Light brown	Free. Eyes small, very deaf.
Clegg, Margaret	L. Auckland	Ditto	7 Nov. '81	Ditto	3 mths	Ireland	50	5 0	Ditto	F.S. Since received under sentence of 7 days.
Burgess, Margt.	Asia 2	Ditto	8 Nov. '81	Larceny	Ditto	Scotland	51	4 9	Ditto	F.S. Burn on elbow right arm.
<i>Launceston.</i>										
Kelly, Michael, as Kelly the Rake.	S. Boddington	Torquay	3 Aug. '81	Larceny	6 mths	Ireland	60	5 5½	Brown	F.S. Blind left eye.
Stanley, or Val- leley, James	Flinders	George Town	4 Jan. '82	Idle & disorderly	1 mth	Ditto	50	5 5½	Ditto	F.C. Scar right wrist, scar on nose.
Heffernan, Richard	Alhambra	Westbury	Ditto	Ditto	Ditto	Ditto	36	6 1½	Ditto	F.C.
Hennessey, Ma- thew	Mayflower	Launceston	4 Nov. '81	Ditto	3 mths	Spain	65	5 2	White	F.S. Cast left eye, left leg short.
Madden, Daniel	Ld. Dalhousie	Ditto	5 Dec. '81	Breach of Invalid Depôt Regulation	2 mths	Ireland	51	5 4	Brown	F.S.
Heatley, Mary	...	Ditto	19 Jan. '82	Absconding from Industrial School	14 dys.	Tasmania	14	5 0	Ditto	Free. Worts little finger left hand.
Lambert, Emily	...	Ditto	Ditto	Ditto	Ditto	Ditto	14	4 8½	Light brown	Free.
Beckett, Ann	...	Ditto	30 Jan. '82	Idle & disorderly	7 days	Ditto	22	5 3½	Brown	Free. Weak sight.

Figure 2: Five-year moving average of stature by year of birth, Tasmanian-born prisoners aged 21-50, and Tasmanian-born AIF

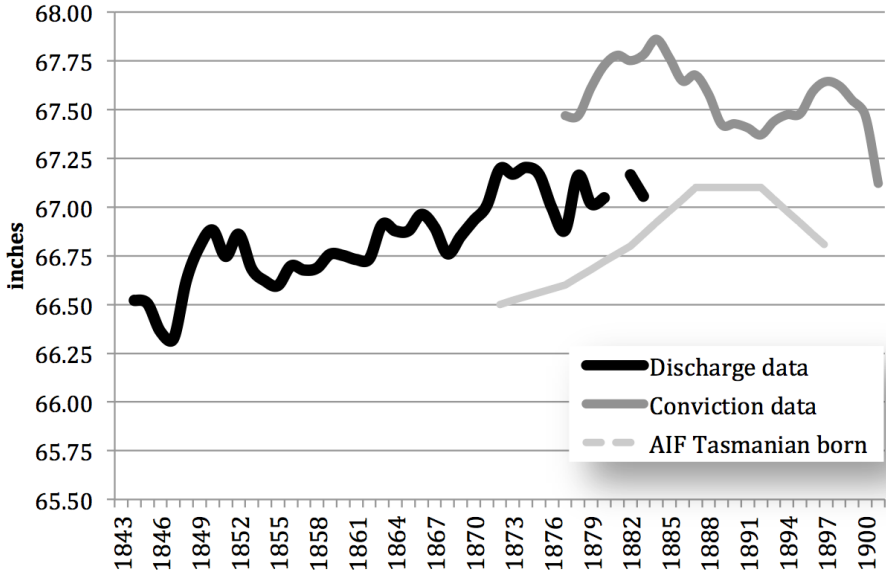


Figure 3

Fig. 5 Conviction rates per 1000 per sex, Tasmania 1867-1922

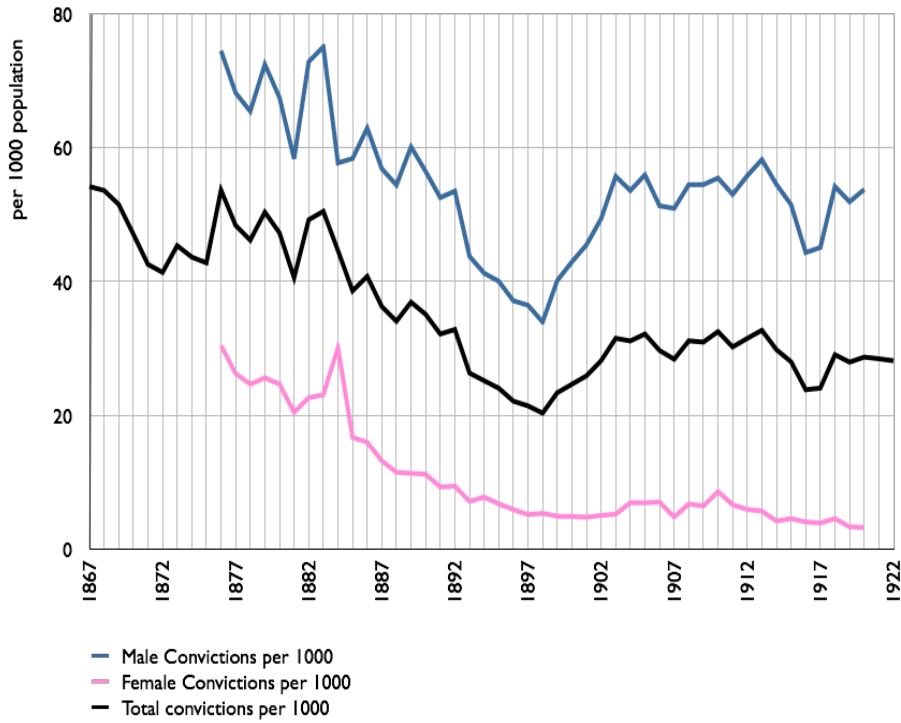


Figure 4: Moving Average of Stature by Year of Birth Adjusted for Compositional and Selection Influences for Tasmanians born 1840-1910

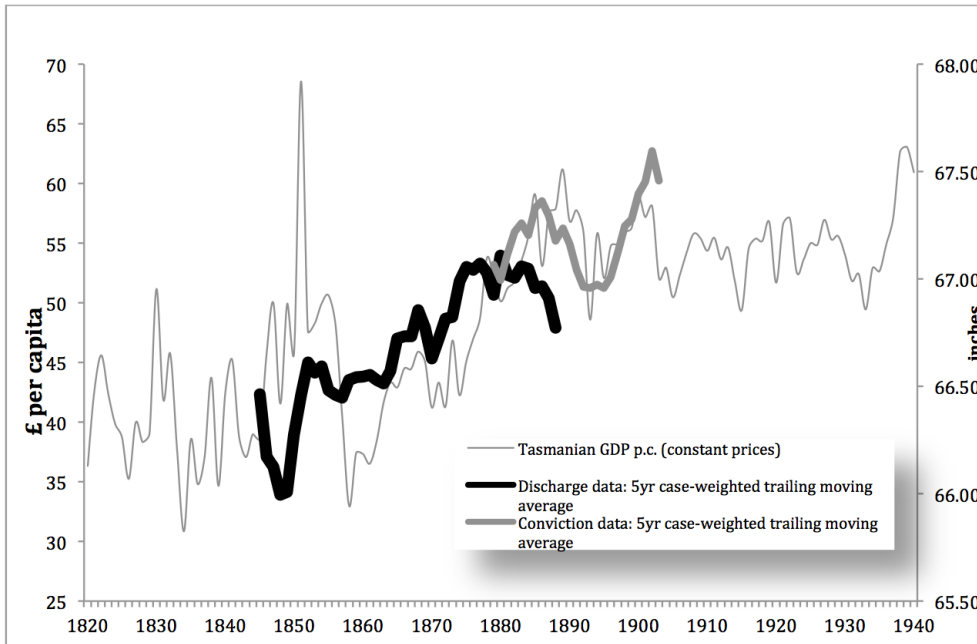
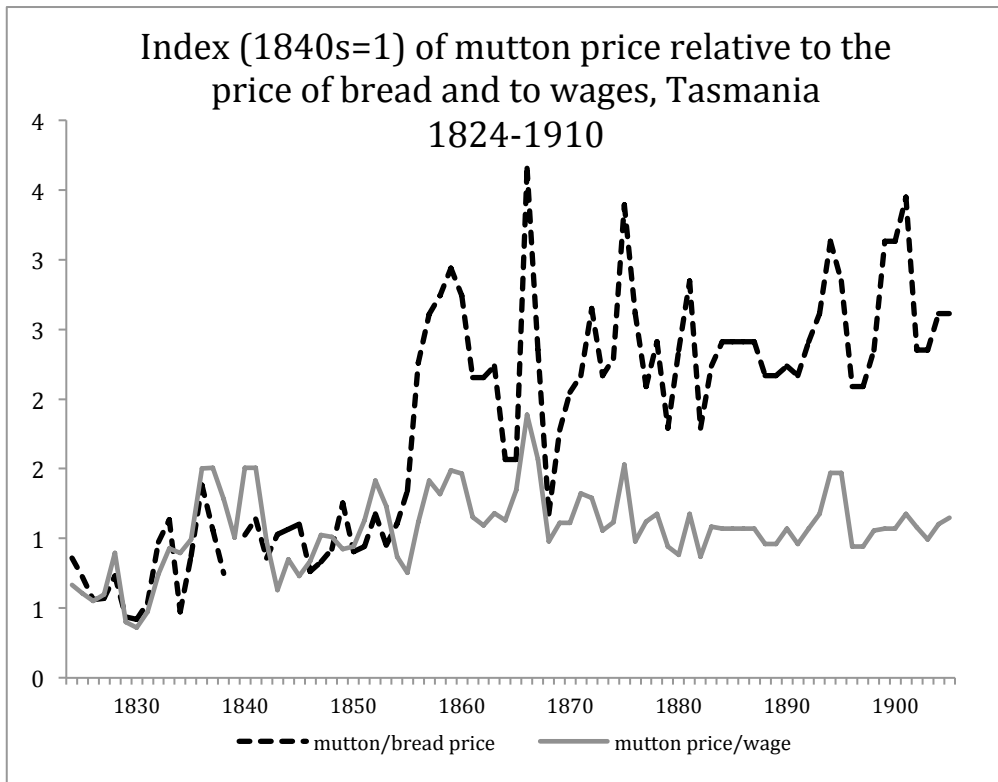


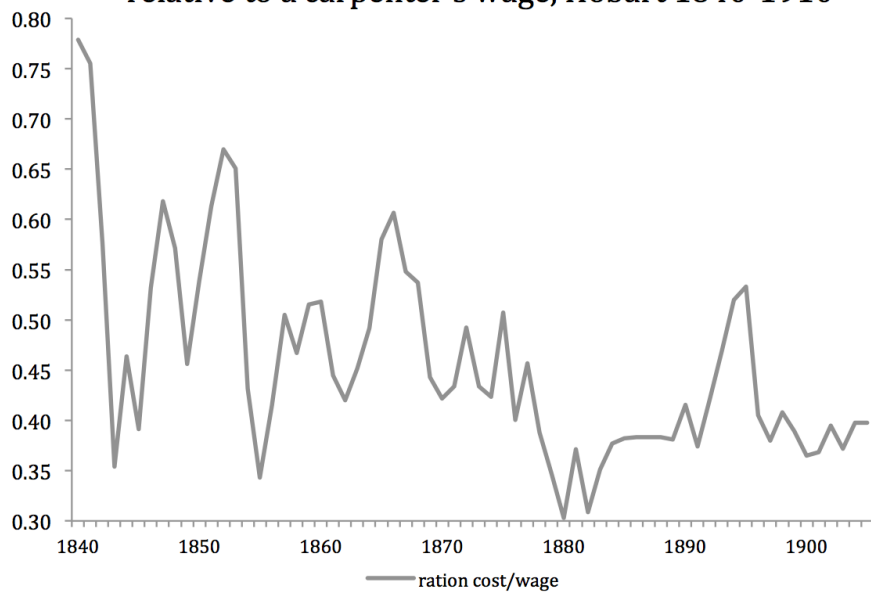
Fig. 5



Note: The wage is that of a carpenter in Hobart.

Source: Meredith and Oxley, Contracting Convicts; Tasmania, *Statistics of Tasmania*.

Figure 6: Cost of a basic family food ration relative to a carpenter's wage, Hobart 1840-1910



Note: Family size is proxied by the average number of people per dwelling. The wage is that of a carpenter in Hobart.

Source: Meredith and Oxley, *Contracting Convicts; Tasmania, Census and Statistics of Tasmania*.

Table 1, Convictions recorded in the Tasmanian Police Gazette by Sex and Status, 1865–1924

Status	Male	Female
Former transported convict	9814	3135
Free migrant	5318	655
Born in New Zealand or the Australian Colonies	16165	3530
Status uncertain	355	109
Total	31652	7429

Table 2.

Mean Variation and Standard Deviation for height measurements for multiply arrested prisoners aged 21–40
(male unless stated) Tasmanian Police Gazettes 1865-1910

	N	Diff = 0	Diff ≤ .5	Mean	St Dev
Idle & disorderly, drunk, disturbing the peace	485	60%	77%	0.02	0.94
Theft, housebreaking etc	1352	62%	78%	0.02	0.81
Indecent language	102	65%	77%	0.07	0.65
Fraud	198	67%	80%	0	0.66
Assault	659	67%	83%	0.07	0.97
Begging and Vagrancy	275	72%	82%	0.04	0.72
Discharge record (1865-1910)	2711	63%	79%	0.04	0.81
Conviction record (1910-1924)	1056	67%	80%	0.04	0.92
Colonially born men	2676	64%	78%	0.05	0.9
Colonially born women	619	68%	79%	0.04	0.83
Sentence ≤ 1 week (discharges only)	190	57%	73%	0.07	0.9
Sentence ≥ 1 month (discharges only)	2075	63%	80%	0.05	0.8

Table 3 Estimated Stature of Prisoners linked to Birth Registrations

	Born 1845-1865		Born 1880-1900	
	Co-efficient	t-stat	Co-efficient	
MALES				
constant	65.04	136	66.5	243
13 years	-9.34	-13.9	-11.23	-22.17
14 years	-7.41	-11.98	-7.24	-15.22
15 years	-4.78	-7.74	-6.23	-14.11
16 years	-3.72	-6.87	-2.69	-6.97
17 years	-0.16	-0.31	-1.08	-3.21
18 years				
19 years	0.96	1.81	0.36	1.04
20 years	1.57	2.74	0.65	1.9
farmer	-0.25	-0.57	-0.8	-2.71
tradesman	-0.02	-0.06	-0.08	-0.33
prop-clerical	0.23	0.43	-0.16	-0.32
born Hobart	-0.3	-0.88	-0.46	-1.82
born Launceston	0.51	1.1	-0.14	-0.46
N	557		871	
Adj. r-squared	0.5		0.53	
FEMALES				
constant	59.17	100	62.45	77
13 years	-5.17	-4.53	-3.92	-1.24
14 years	-2.07	-1.73	-7.14	-4.52
15 years	-1.68	-1.08	-0.29	-0.24
16 years	1.14	1.43	-0.04	-0.04
17 years	-0.95	-1.41	0.01	0.01
18 years				
19 years	2.02	2.89	0.2	0.22
20 years	1.82	2.26	1.29	1.48
farmer	1.07	1.55	0.99	0.93
tradesman	0.1	0.19	1.47	2.43
prop-clerical	0.97	0.94	3.46	2.01
born Hobart	0.22	0.41	-1.15	-1.28
born Launceston	-0.13	-0.17	-0.47	-0.59
N	289		130	
Adj. r-squared	0.14		0.19	

Notes: We link prisoners aged 13-20 years in the Police Gazette to their birth registrations. Omitted categories for the estimation are 18 year old labourers born outside of Hobart and Launceston.

Table 4

	Discharges 1865-1910		Convictions 1910-1924	
	coefficient	t-stat	coefficient	t-stat
Constant	66.106***	149.29	67.214***	49.75
Born before 1840	0.176	0.58		
Born 1840-44	0.623**	2.1		
Born 1845-49				
Born 1850-54	0.555***	2.48	0.023	0.02
Born 1855-59	0.500**	2.32	-0.573	-0.74
Born 1860-64	0.518**	2.26	0.165	0.26
Born 1865-69	0.703***	2.81	-0.568	-1.24
Born 1870-74	0.897***	3.33	-0.208	-0.53
Born 1875-79	0.836***	2.68	-0.46	-1.24
Born 1880-84	0.949***	2.88	-0.321	-0.94
Born 1885-89	0.487	1.32	-0.286	-0.89
Born 1890-94	-0.636	-0.89	-0.561**	-2.05
Born 1895-99			-0.26	-0.95
Born 1900-04				
Gazette % all convictions	0.018	1.13	0.03	0.61
Convictions per 1000 of the pop.	-0.008	-1.16	0	-0.01
Tried Launceston	0.07	0.42	-0.381*	-1.68
Tried Country court	0.513***	3.8	0.523***	3.3
Tried Supreme Court or QS	0.653***	3.33		
Recidivist Hobart	-0.051	-0.29	-0.356	-1.42
Recidivist Launceston	-0.786***	-3.63	0.06	0.17
Recidivist Country Court	-0.097	-0.63	-0.209	-1.02
Recidivist Supreme Court or QS	0.071	0.24		
Offences against the person	0.135	1.06	0.635***	4.49
Offences against person & property	-0.13	-0.36	-0.042	-0.1
Forgery & offences against currency	0.683**	2.06	0.477	0.75
Offences against good order	-0.367***	-2.74	0.029	0.15
Offences rel. to carrying out laws	0.707*	1.86	-0.435	-0.57
Offences relating to revenue	-0.406	-0.42	1.131**	2.26
Offences against public welfare	-0.143	-0.95	0.545	0.55
Unclassified offences	-0.3	-1.42	0.476	1.13
Age 19 years	-0.798***	-4.55	-0.887***	-3.33
Age 20 years	-0.558***	-3.16	-0.166	-0.62
Age 21 years	-0.04	-0.24	-0.377	-1.48
Age 22 years	-0.109	-0.62	0.331	1.27

Age 23-49 years					
Age 50-60 years	-0.035	-0.12		-0.456	-0.93
N	3256			1928	
Adjusted R ²	0.04			0.05	
<p>* significant at p =< 0.10</p> <p>** significant at p =< 0.05</p> <p>*** significant at p =< 0.01</p>					
<p>Dependent variable = height in inches</p> <p>Omitted category</p> <ul style="list-style-type: none"> • tried Hobart, first offence, crime against property, aged 23-49 • Discharge data: born 1845-49 • Convictions data: born 1900-05 <p>Note. Conviction data does not identify type of court, only location</p>					