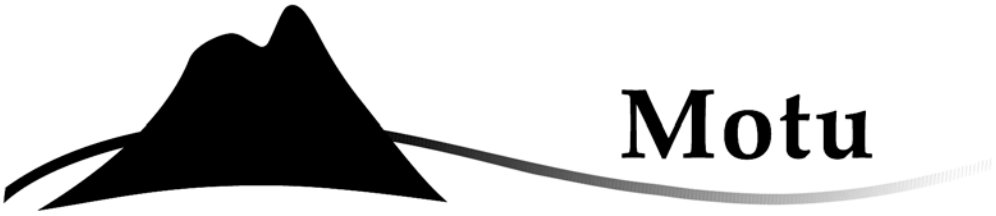

Spatial Effects of 'Mill' Closures: Does Distance Matter?

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Abstract

When small towns experience a major infrastructure shock, such as a 'mill' closure, the effects can be devastating. We analyse the effects of two major freezing works closures in New Zealand, in Patea (1982) and Whakatu (1986). These two examples provide an interesting comparison: Whakatu is located close to a city, while Patea is relatively isolated. We describe the impacts of these shocks on population, employment and house values in each town, relative to two sets of comparators. These descriptions allow us to contrast long-run trends and adjustment dynamics resulting from the differing locations of both towns. We find that both towns experience negative population and employment impacts; however, consistent with benefits of a near-city location, the effects on Whakatu are mainly temporary, whereas the effects on Patea are more permanent. Population age-groups respond very differently to the shocks, in ways that are consistent with homeownership being a factor stifling migration responsiveness in the face of a shock. The results have implications for regional development policy choices with respect to infrastructure location and also for programmes designed to stimulate homeownership.

JEL classification
R230, R280, R380, R530, R580

Keywords
Mill closures; rural infrastructure; homeownership

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1 Introduction

Any small town with employment heavily concentrated at one employer (the "mill") has the threat of mill closure as an ever-present concern. We examine the impacts of two large mill closures in New Zealand that occurred in the early-mid 1980s in towns with some contrasting features. Using a difference-in-difference approach, we examine how the dynamic adjustments differed across the two towns and relate these contrasting adjustments to features of the towns and their populations.

Our purpose in this analysis is twofold. First, understanding factors that affect adjustments to negative employment shocks is important in its own right, especially where policymakers aim to facilitate improved economic and social responses in the wake of such a shock. Second, the impact of a major exogenous closure can tell us a considerable amount about the benefits of a similar mill opening. Where the closure is unanticipated (as in our examples), we can treat the observed impacts as akin to the outcomes of a natural experiment, whereas this is more difficult in the case of an opening where many other (positive) factors may be operating in tandem with the mill opening.

In New Zealand and internationally, regional development programmes have often attempted to promote the construction of large processing facilities (mills) in areas away from major urban areas. The rationale for their establishment in non-urban areas relates to the net economic and social benefits these developments may bring to rural towns. These benefits include employment, higher revenues, urban growth, and better education and health services. In effect, the mill is a form of infrastructure, often servicing multiple suppliers (e.g. as in the case of meat works[1] or dairy factories) and providing the commercial substance to attract other service providers to the locality. In this latter respect, they are similar to a transport link that attracts new firms and population to an area. However, the effects associated with the closure of these major items of infrastructure on the towns in which they are located can be devastating. Given the immobility of houses and commercial properties, these structures are not likely to disappear as quickly as they emerged;

[1] We refer to abattoirs interchangeably as meat works and freezing works.

many may fall into disrepair and cheap rents may encourage those without employment to move in.

The meat industry in New Zealand was once the country's leading export industry. External economic developments progressively reduced profitability (Evans et al, 1996) and its structure was inflexible in the face of heavy regulation and licensing. In the early 1980s, the New Zealand Government's decision to de-license and deregulate the industry caused major disruptions in this industry. The Government's decision, coupled with falling animal prices, led to an over-capacity of meat processing plants, especially in the lower North Island. As a result, many of these freezing works were forced to close as part of a national rationalization of the industry. Two major closures in the mid North Island occurred at Patea (1982) and Whakatu (1986) respectively. There were major job losses in both cases, with Patea's closure resulting in the direct loss of 800 jobs and Whakatu's closure leading to over 1600 direct job losses. The two freezing works were the chief employers in their respective towns, and the closures had serious impacts on each town.

We draw on a range of prior research internationally and in New Zealand to derive a set of hypotheses concerning adjustment dynamics that we then confront with the data from the Patea and Whakatu closures. Previous employment adjustment literature suggests that the closures will induce long term employment and population loss with net outward migration from each town. Homeownership characteristics may affect the adjustment dynamics since homeowners may incur greater costs in shifting towns than do non-homeowners. In addition, the adjustment dynamics are expected to vary according to the proximity of the affected localities to larger urban areas. Patea is a relatively isolated rural town, while Whakatu is located reasonably close to the major urban areas of Hastings and Napier. Location close to a major urban area may improve risk-sharing and labour market matching for Whakatu relative to Patea meaning that the effects of the closure on Whakatu may be relatively short-lived and of a different nature to those experienced in Patea. In both cases, we hypothesise that house prices will be affected negatively by the closure, accompanied by stability in dwelling numbers.

We use descriptive evidence to deduce whether the hypothesised effects above are observed and analyse the marginal and overall effects of each closure on population numbers, housing and employment within each town. Also, we compare

responses across the two towns to test whether there are differing adjustment processes relating to proximity to a larger city. With the use of census and housing data, we analyse a number of variables for each town and plot these over time to assess the marginal and long-term effects of each closure. In each case, we express the town data relative to (two sets of) comparator data, detrend the resulting ratio, and then examine the temporal differences in the responses of the detrended ratios. This difference-in-differences approach enables us to isolate the adjustment components due to the respective mill closure.

Our findings are mostly consistent with our hypotheses. For instance, out-migration is observed in each case and adjustment dynamics are faster (and less dislocative) in Whakatu than in Patea. Older age-groups, who are characterised by high homeownership rates, are less likely to migrate than are younger age-groups. However, we also find two surprising results: relative unemployment (after five years) is *lowered* as a result of the closures, while relative house prices suffer no noticeable reduction in response to each closure. We analyse reasons behind these two findings in some detail. Our results assist in understanding the role of major infrastructure investments in rural areas, and provide insights for regional development policy makers who may be considering the location and construction of these types of rural infrastructure.

We provide a background to our analysis in the next section with a brief survey of related international and New Zealand literature, together with descriptions of the two closures. Section 3 outlines our data and methodology. Results are presented in section 4, with conclusions following.

2 Background Information and Hypotheses

2.1 Prior Literature

Our analysis of adjustment dynamics following the closure of two major examples of rural infrastructure is conceptually related to analyses of the impacts of regional employment shocks. Blanchard and Katz (1992) analysed regional adjustments to employment shocks using United States state-level data. They found that the dominant adjustment mechanism following an employment shock is labour mobility. Their study established that US employment shocks have a permanent component to them. In the case of a negative employment shock, the employment

response after five to seven years is almost entirely reflected in net outward migration from the region, leaving the unemployment rate and participation rate relatively unaffected at this time horizon.

European studies find some similarities and some differences relative to the Blanchard and Katz findings. For instance, Frederiksson (1999) finds even stronger migration responses using Swedish data than do Blanchard and Katz, while Decressin and Fatás (1995) find labour force participation rate changes to be a major adjustment mechanism over a three year window across Europe. Mauro and Spilimbergo (1998) find different adjustment responses according to skill level, with out-migration observed for higher skilled workers and labour force participation or unemployment responses more prevalent amongst lower skilled workers.

Another factor that is relevant to the dynamic effects of negative employment shocks is the prevalence of homeownership in affected localities. Oswald (1996, 1999) conjectured that homeownership establishes a barrier to migration for the homeowner if that person (or a family member) loses a job. The costs of selling the house (possibly in a depressed market compared with time of house purchase) and then purchasing or renting elsewhere are added to other economic and social costs of relocation. These extra costs may tip the decision towards staying in the affected locality rather than seeking new employment elsewhere. Additional studies in the United Kingdom and the United States confirm this finding, and additionally indicate that the impact of this factor falls disproportionately on more disadvantaged groups (South and Crowder, 1998a and 1998b; Green and Hendershott, 2001; Partridge and Rickman, 1997; Pehkonen, 1999).

Glaeser and Gyourko (2005) examine adjustment dynamics across cities, including the 'rust-belt' cities of the United States, paying particular attention to the impacts of employment shocks on house prices. They find a strong convexity in population change and a strong concavity in house prices with respect to exogenous shocks. The convexity of population change means that negative shocks have a relatively smaller effect on population compared to positive shocks of the same magnitude. Conversely, the concavity of house prices implies that negative shocks have a relatively larger effect on house prices compared to positive shocks of the same magnitude. Thus a positive employment shock causes a positive change to

population and a positive, but small, change to house prices, while a negative employment shock results in a small migration away and a relatively large fall in house prices. These patterns arise as a result of the adjustment dynamics of the housing stock; the stock of dwellings increases (through new building) in the face of a positive employment shock, but remains broadly static following a negative shock. A downward employment (and population) shock requires a steep fall in house prices in order to equate existing supply to the new lower level of demand.

One feature that may further condition adjustment dynamics following a shock is the location of the affected area in relation to urban agglomerations. Agglomerations of economic activity historically resulted from the efficiency and strategic advantage of settlement at specific locations, for instance those that were rich in natural resources (de Groot et al, 2009). The productivity and growth of these areas is facilitated by spatial factors, such as infrastructure availability, knowledge generation facilities, density and interactions with other cities or regions. Productivity improvements lead to expansion in the capital base and to expanding employment opportunities, and these new jobs are filled through natural population increase or net inward migration. Advantages of agglomeration include greater risk-sharing and improved matching between firms and their suppliers (including labour) and between firms and their customers. Glaeser and Maré (2001) note that denser areas save on transport costs and so facilitate matching. Better matching within a larger urban area results not only in higher productivity, and hence higher wages, but also reduces the chance of a worker (or firm) not finding any suitable match, thus inducing an inward shift in the Beveridge Curve (i.e. the equilibrium locus of unemployment and vacancies) for that area.

New Zealand evidence indicates that firms that operate in denser urban areas are on average more productive, and pay higher wages, than those in non-urban areas (Maré and Timmin, 2006; and Maré, 2008). Ceteris paribus, denser areas are therefore more attractive to firms and workers, although offsetting costs (including greater congestion and higher land rents) may counter-balance these effects.

A number of New Zealand studies have examined adjustment dynamics following employment shocks in the spirit of the Blanchard and Katz analysis. Building on previous work by Maré and Timmins (2000) and Choy et al (2002), Grimes et al (forthcoming) examine regional adjustments across New Zealand

following an employment shock. They use panel estimation techniques to estimate a structural vector autoregression (VAR) containing variables relating to employment, migration and housing prices. Their results indicate positive responses in the employment rate, participation rate and the working age population (and hence in net inward migration) following an upward regional employment shock. Population and employment rise to permanently higher levels following such a shock.

However, that study also finds that the response of house prices, both in the short and long terms, is negligible. This negligible response of regional house prices is a surprising result, especially since at a national level they find a significant positive response of house prices to a similar employment shock. They offer some possible explanations for this paradox. The first is that the housing market is somewhat a national market, rather than regional. If national trends determine regional house prices, it should be expected that a regional employment shock will have little effect on local house prices. The second explanation is that the house price effects may be further localised than the regional definition used. The third explanation is put down to high sampling error. In the light of the Glaeser and Gyourko analysis, another explanation could be that most regional employment shocks over their estimation period were in an upwards direction, in which case a responsive housing supply would mitigate long run upward pressure on house prices. However, this possibility does not explain why the New Zealand study also found negligible short run house price responses. Furthermore, there were several notable downward shocks over their sample which Glaeser and Gyourko's analysis implies would be accompanied by sharp downward house price shifts.

A related study, by Velamuri et al (2008), looked at the effects of structural reforms on local communities, focussing on employment, population and housing price effects in the medium- and long-term. Like Grimes et al, they find no relationship between employment shocks and house prices. Furthermore, employment, population and housing price shocks have no relationship with any future outcomes of employment rates, population levels or house prices, other than on their own respective future outcomes.

In other work, Stillman and Maré (2008) studied the relationship between house prices and migration within New Zealand. They find that, at both national and regional level, a significant positive correlation exists between population change and

house prices; specifically, a net inflow from migration leads to house price inflation. (They caution, however, about the temporal stability of the relationship.) Grimes and Aitken (forthcoming) also find a strong regional relationship between population and house prices over time within New Zealand.

These conflicting results leave unanswered questions relating to the effects of a regional employment shock on local house prices within New Zealand. It is possible that nationwide studies, such as those cited, are unable to capture the diversity of reactions that arise from different shocks given the differing spatial characteristics of the regions included in each study. In particular, the Glaeser and Gyourko analysis and agglomeration theories suggest that adjustment dynamics may differ materially depending on whether the shock is positive or negative, and on whether the affected locality is rural or is part of (or close to) a larger urban area. Case study analyses may be able to shed light on these issues in ways that nation-wide regional panel studies cannot, owing to the need for the latter studies to assume similarity of response across regions. Therefore by focussing on local case studies, we are able to generate new hypotheses for broader studies.

Case studies also enable us to delve more deeply into the role of differing population characteristics in determining adjustment dynamics. The majority of international and New Zealand studies cited above examine the effects of shocks on the whole population (or, at least, on the working age population). However, it is likely that differing age groups respond in materially different ways from one another following an employment shock. This observation follows, in part, from the work of Oswald (1996, 1999) on the effects of homeownership on mobility. In New Zealand and elsewhere, older adults tend to have higher rates of home-ownership than do young adults. Carne (2004) showed that homeownership rates were much higher for older age-groups. Those who were aged 45 to 59 years and those aged 60 years or more had very similar homeownership rates of around 80 to 90%, for the eight cities considered. The younger age-group of those aged 25 to 44 years had homeownership rates that were 10 to 15 percentage points lower than the two older age-groups and homeownership rates for those aged 15 to 24 years were even lower still. Morrison (2008) finds similar results to those of Carne (2004). In his report, Morrison found that the probability of homeownership increased with age, but at a decreasing rate. If Oswald's findings extend to New Zealand, we would expect to see young adults

(predominantly non-homeowners) being more mobile than are older adults (predominantly homeowners) in situations where a locality suffers a negative employment shock. Our study extends the approach of prior studies and breaks down population movements based on age bands. Specifically, we focus on population ages grouped by: 0-14 years (children), 15-24 years (youths), 25-44 years (young adults), 45-64 years (older adults), and 65+ years (mainly retired).

Another distinction that we make, following the agglomeration literature, is to contrast the adjustment dynamics to a negative employment shock across two separate localities that exhibit material differences in their respective proximity to a city. This comparison enables us to observe whether the better risk-sharing and matching characteristics of a city location leads to differing adjustment dynamics relative to those observed for a locality in a rural environment. Because Whakatu is located near the cities of Hastings and Napier, while Patea is relatively isolated, we hypothesise that there will be differences in the way each town adjusts to its employment shock. We expect that Whakatu, being closer to a city, will adjust more quickly to the employment shock than does Patea.

If this hypothesis is true, it has implications for policy development. Regional development policies have been used as tools to assist regions to recover from unfavourable shocks or, more generally, to promote growth in local economies. They may be designed to attract major infrastructure investments including large processing plants servicing local suppliers (e.g. forestry mills and meat works) or a social services institution (e.g. a hospital or polytechnic), plus people with skills and ideas into areas which need assistance. However, caution must be taken in regard to how the benefits of new infrastructure are distributed. If the majority of the benefit accrues to migrants into the area, any improvements may fail to raise the standard of living for the original residents (Maré and Timmins, 2000). In addition, attention must be paid to the sustainability of the new infrastructure; if population and other services gravitate to the locality serviced by the new investment, major costs could subsequently be experienced if it were later closed. This potential reversibility of major investments (and the resulting local impacts) potentially makes their location in relation to other activities of crucial importance. Our hypothesis is that the risk-sharing and matching benefits of larger agglomerations are factors favouring location of large facilities in, or near to, larger towns or cities.

2.2 Patea[2]

Patea is a small country town located on the western bank of the Patea River, between Wanganui and New Plymouth. It lies in the South Taranaki District of the North Island of New Zealand. Patea is an isolated community: its nearest city (Wanganui, with population of 39,595 in 1981) is 60.8 kilometres (kms) distant (with an estimated travel time of 48 minutes). New Plymouth (population of 44,095 in 1981) and Palmerston North (population of 66,691 in 1981) are 98.3 kms (90 minutes) and 152 kms (112 minutes) distant, respectively.

Figure 1: Geographical locations of Patea, Whakatu and nearest cities.

Source: Google Maps

In 1910, The Patea Freezing Company was established to operate the local meat-processing plant. After a reformation in 1933, it provided work for approximately one thousand workers during the peak season. The British Vestey Group, who owned W and R Fletcher (NZ) Ltd (Dare, 1999), later acquired the freezing works at Patea; they were the owners of the plant at the time of the closure (The Evening Post, 1982a).

On 21 May 1982, it was announced that the Patea Freezing Works would close in three months time (Puke Ariki, 2003). The Patea Freezing Works was one of

[2] Background information on Patea and Whakatu from the cited sources is supplemented by information from Google Maps and Wikipedia.

the first meat-processing plants to close as a result of the downturn in the New Zealand meat industry in the 1980s. Its closure left 800 employees of the works without jobs, amounting to a loss of around $10 million per annum in wages (The Dominion, 1982a).

There were a number of factors precipitating the plant's closure. One major proximate determinant was the Government's decision to de-license the meat industry in the early 1980s (The Evening Post, 1982b). This de-licensing led to the over capacity of meat processing plants throughout the country, and especially in the lower North Island (Taranaki Daily News, 1982a), meaning there was a surplus in facilities for processing meat. In addition, the Patea Freezing Company had a reputation of low productivity and poor plant performance. The national average of stoppages for the year previous to the closure was 43, while Patea's number of stoppages was 179 (The Dominion, 1982b). Another determinant in the closure was the heightened hygiene standards and other requirements demanded by foreign parties (including the US Ministry of Agriculture and the European Economic Community) as well as by New Zealand's Ministry of Agriculture and Forestry (MAF). The upgrades required were to cost between $1.5 – 2 million per year, which was not financially justifiable at the time (Taranaki Daily News, 1982a).

On 1 September 1982, the plant let 350 mutton slaughter-men go. Boners joined them the next day and the plant officially closed on 3 September 1982 (The Evening Post, 1982a). Staff of around 100, which included load-out men, clerks, maintenance workers and managerial staff, continued through to late September to close and clear any of the produce left in storage (The Dominion, 1982c). Negotiations between the firm and the meat-workers union over redundancy payments were lengthy. Redundant workers demanded four weeks pay for the current year's work plus two weeks pay for each preceding year, while W and R Fletcher Ltd offered slightly less (The Evening Post, 1982a). Workers considered that they were in need of a good settlement as there were no real alternative jobs nearby. In addition, it was reported that many redundant workers owned homes in the area and were not able to move easily, as transport or selling of houses was not possible (The Evening Post, 1982c). Approximately 65% of the workers in the freezing works lived in Patea (The New Zealand Herald, 1982a).

Local marae proposed to employ a few of those made redundant (The Evening Post, 1982d), but it was considered unlikely that the unemployed would be absorbed by other firms in the area. This was especially the case given that those already unemployed in the area were not able to find work (Taranaki Daily News, 1982b). The company arranged transfers for many senior and middle management staff; other offers were also made, but the majority were turned down because many owned houses in the single-industry town (The Dominion, 1982b). Many surrounding businesses, reliant on the meat workers for business, as a result of the closure, were also forced to close.

Melser (1982) produced a technical report assessing the social and economic impacts of the meat works closure on Patea. The report was generated after the announcement of the closure, but before the actual closure took place. In this report it was expected that Patea's population would decline from the closure of the freezing works. Highly skilled workers, along with younger and unattached workers, were predicted to be among the largest group of migrants. Patea had always had an issue retaining its younger population, with approximately 50% migrating from the town in the 20 years leading up to the closure. It was believed that the remaining 50% were retained through job security which the freezing works offered. However, once the freezing works closed, Patea should have expected an even higher proportion of its younger population to leave. A large number of redundant workers were in the older generation, whose children had grown up and left home. Many of these workers owned houses; therefore the cost of relocation was high and migration may not have been a viable option for this group.

Melser (1982) also predicted that physical infrastructure and property within Patea would suffer a major impact from the closure of the freezing works. With the decline in the local population due to migration, the local council faced a diminishing financial base. This meant that residential rates bills for those who remained would rise sharply to cover the costs of local council provided public services. Also, the town itself would be faced with the possibility that many of its streets would contain empty dwellings.

2.3 Whakatu

Whakatu is located in the Hastings District of the Hawke's Bay region in New Zealand's North Island. Its population in 1981 was 936. In contrast to Patea, Whakatu lies comparatively close to twin cities, Hastings and Napier. Hastings (population 52,563 in 1981) lies 6.8 kms (10 minutes) away while Napier (population 51,330 in 1981) is 14.3 kms (14 minutes) distant.

The Whakatu freezing works was established in 1912, owned by the Hawke's Bay Farmers Meat Company (HBFMC) (Hawke's Bay Today, 2006). It became one of the largest meat works in the country. On 10 October 1986, the meat works plant at Whakatu was officially closed, leaving between 1500 and 1600 of some 1900 employees (during the peak periods) redundant (The New Zealand Herald, 1986b). The closure came as a shock, with most employees finding out via television or radio; even some top management staff were unaware that the decision had been made. A joint statement detailing the closure was issued by the four companies[3] involved in the works (The New Zealand Herald, 1986b). Although the slaughtering operations were closed, the fellmongery, freezing chambers and casing operations continued. There was also hope that other processing facilities would be developed (The New Zealand Herald, 1986b), and the cold-stores were converted, in part, to store apples and other commodities.

The reasons surrounding the closure of the Whakatu freezing works again included the deregulation of the industry. Deregulation led to the national rationalisation of freezing works operations around the country to reduce the killing capacity and improve the efficiency of the national industry (Keefe-Ormsby, 2001). Furthermore, there was a drop in sheep numbers around the region in the year preceding the closure, which worsened the overall capacity (The New Zealand Herald, 1986b). The major determinant of the closure possibly came after a complex series of mergers and takeovers that resulted in a successful takeover bid by W Richmond Ltd of HBFMC. Once Richmond acquired the freezing works from HBFMC, they implemented their plans to rationalise their operations, which included closing the Whakatu freezing works (The New Zealand Herald, 1986b).

[3] The four companies involved were W Richmond Ltd, Waitaki International, HBFMC and Weddel Crown Corporation.

After months of bargaining, redundancy packages were paid to ex-workers and a special worker support group was established to assist redundant staff find new employment (The New Zealand Herald, 1986b). However, with the high level of pre-existing unemployment in the region, very few of the redundant workers were able to find work. As was the case in Patea, many local businesses in Whakatu were affected by the closure and were forced to close also (Hawke's Bay Herald Tribune, 1986a).

Unlike Patea, where 65% of freezing workers lived in Patea, only 4% of Whakatu's freezing workers lived in Whakatu. The residence of the remaining 96% of Whakatu's freezing workers comprised: 42% living in Hastings, 36% living in Napier, 10% in Havelock North, 4% in Clive and the remaining in outlying areas (Hawke's Bay Herald Tribune, 1986b).

2.4 Hypotheses

Overall, the prior studies and the information about the closures of the two plants lead to our formulation of a number of hypotheses that we subject to examination in this study. First, we hypothesise that a negative employment shock will induce outward net migration, at least for the working age population; unemployment will rise initially before converging back to a lower value while falls in the levels of employment and population will exhibit permanent effects. Second, we hypothesise that these effects will be more marked for younger (non-homeowning) adults than for adult (homeowning) age groups. Third, given that Whakatu is located near a major urban area, we hypothesise that its adjustment to the employment shock will be faster than that of Patea. Fourth, following Glaeser and Gyourko, we hypothesise that house prices will fall sharply following the shocks, with a greater effect in (isolated) Patea than in Whakatu. In addition, the number of dwellings will remain broadly static following the shocks.

3 Data and Methodology

3.1 Census Data

Census data, collected by Statistics New Zealand, captures information on each individual located in New Zealand on census night[4]. It also records information

[4] Censuses are usually conducted during March. Given that killing seasons generally run from November to July, there appears to be no timing issues surrounding our analysis.

on dwellings (i.e. houses, flats, apartments) in New Zealand (Statistics New Zealand, 2008a). We use census data for population, employment and dwellings from 1981, 1986, 1991, 1996, 2001 and 2006. All census data are coded to a census meshblock (the lowest geographical area used by Statistics New Zealand), before being aggregated to area units (AUs), territorial local authorities (TAs) and higher levels[5]. We focus on using AU data and some TA data. The geographical boundaries are sensitive to which census years they refer[6]. Because of this difference in boundaries, the census data used in this study were re-mapped to 2001 geographical boundaries so that there was a consistent set of boundaries used[7]. This also made the data consistent with the housing data we use.

For population, the total population count is used, as well as counts of the total population broken down into population age-bands. The total population is recorded as the usually resident population. There are five population age-bands constructed as 'age 1' if individuals are aged 14 years and younger, 'age 2' if individuals are aged 15 to 24 years, 'age 3' if individuals are aged 25 to 44 years, 'age 4' if individuals are aged 45 to 64 years, and 'age 5' if individuals are aged 65 years and older.

Employment census data classifies each individual according to their employment status on census night. 'Total employment' comprises those who are either full-time employed or part-time employed; 'unemployment' refers to those who are currently without a job and are actively seeking one; and 'not in the labour force' refers to those who are currently without a job and are not actively seeking one.

The dwellings census data used in this paper count private and non-private dwellings which are occupied[8] as at midnight on census night (Statistics New Zealand, 2008b).

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[5] In order to protect confidentiality, Statistics New Zealand randomly round all census data to base 3.
[6] For example, 1996 census data are coded to 1996 geographical boundaries and 2006 census data are coded to 2006 geographical boundaries, but 1996 geographical boundaries are not identical to 2006 geographical boundaries.
[7] When mapping each census year to 2001 geographical boundaries, care must be taken as AUs change from census year to census year. Our study only requires eight AUs and for each of these AUs there were no mapping problems.
[8] Data for non-occupied dwellings and total number of dwellings had incomplete coverage (earlier data are not available) and hence were not used.

3.2 Housing Data

The housing data used in this analysis are collected by Quotable Value New Zealand (QVNZ), a state-owned entity. This paper uses QVNZ sales data to obtain observations of median sales prices and median land values for the years 1981 through to 2006. The data are collected for each year ended 30 June and are based on properties that have been sold[9]. Median values are used as these are less likely than mean data to be affected by extreme outliers. For each year of valuation, there are multiple categories for types of property. We use the residential dwelling (RD) category. As with the census data, the QVNZ data are coded to meshblock level before being aggregated further. All QVNZ data have been mapped to 2001 geographical boundaries and there are no problems associated with comparing different years.

Definitions of all variables used in the paper are given in Table 1.

3.3 Methodology

The purpose of the paper is to examine and contrast the impact of each freezing works closure on the town in which it was located. First, we analyse the marginal impacts of each closure on its town by (a) comparing each closure town to a group of control towns, determined by a set of characteristics, and (b) comparing each closure town to its respective TA. Secondly, we contrast the impacts of the two closures. This second comparison allows us to examine the differences in the adjustment processes for each town, given that Patea is relatively isolated and Whakatu is located relatively close to a city.

Initially, we compare both Patea and Whakatu[10] to a group of control towns, dubbed 'like localities' (LLs). These like localities are selected AUs that have similar characteristics to those of Patea and Whakatu respectively. The purpose of adopting these LL controls is to filter out influences on each of the variables under

[9] For median land values, it may have been preferable to use actual valuation data covering all properties in the area, rather than sales data, which only covers those houses that are sold. However, the valuation dataset does not cover the desired time period, whereas the sales dataset does. Land value is the value that QVNZ attributes to the unimproved land parcel on which the residence is located; it is used by some local authorities as the legal rating base and is required by law to reflect a best estimate of market values.

[10] Given that a large proportion of those who worked at Whakatu lived in Flaxmere, we also looked at effects on Flaxmere, but found no major effects from the Whakatu closure.

Table 1: Variables

pop	total population measured as the total of the usually resident population on each census night.
age1	the first population age-band measured by the number of the usually resident population aged 14 years and younger.
age2	the second population age-band measured by the number of the usually resident population aged 15 to 24 years.
age3	the third population age-band measured by the number of the usually resident population aged 25 to 44 years.
age4	the fourth population age-band measured by the number of the usually resident population aged 45 to 64 years.
age5	the fifth population age-band measured by the number of the usually resident population aged 65 years and older.
emp	total employment measured by the number of the usually resident population aged 15 years and older, who are in either full-time or part-time employment (Statistics New Zealand, 2008c).
unemp	total unemployment measured by the number of the usually resident population aged 15 years and older, who are without employment and are actively seeking employment (Statistics New Zealand, 2008c).
nlf	number not in the labour force measured by the number of the usually resident population aged 15 years and older who are not employed and are not actively seeking employment (Statistics New Zealand, 2008c).
occupied	the total number of occupied dwellings[11] measured as the sum of private occupied dwellings (houses, flats, apartments, etc) and non-private occupied dwellings (hotels, hospitals, etc).
averagehh	the average household size of each occupied dwelling, measured by dividing *pop* by *occupied*.
spmedian	median sales price measured by the median sales price of residential dwellings sold. This variable is measured annually from 1981 through to 2006.
lvmedian	median land values measured by the median land value of residential dwellings sold. These data are measured tri-annually from 1981 through to 2005.

consideration that are due to generalised economic developments impacting on similar localities and that are not specific to the mill closure. The characteristics used to select the LLs include distance from nearest major urban area and the processing infrastructure within the towns. Given that Patea is relatively isolated, its LLs were chosen on the basis of isolation from a major urban area together with the existence of an operating meat-processing plant from 1981 through to at least 2006. Considering these criteria, we found three like localities: Wairoa, Takapau and

[11] A dwelling is defined as occupied if it is occupied at midnight on census night or occupied at any time during the 12 hours following midnight of the census night (Statistics New Zealand, 2008b).

Mataura[12]. Using the same method for Whakatu, a town relatively close to the major urban area of Hastings, we chose LLs based on their proximity to a major urban area and the existence of an operating meat-processing plant from 1981 to 2006. Like Patea, we found three like localities for Whakatu: Horotiu, Pareora and Makarewa. Table 2 details information on each of the LLs across a number of characteristics.

Table 2: Like Locality Characteristics

Town	1981 Population	Name of nearest city	Distance to nearest city (kms)	Meat works operating dates during sample
Patea	1,983	Wanganui	60.8	1981-1982
Wairoa	5,448	Gisborne	99.8	1981-2006
Takapau	474	Hastings	69.4	1981-2006
Mataura	2,376	Invercargill	51.7	1981-2006
Whakatu	936	Hastings	6.8	1981-1986
Horotiu	711	Hamilton	13.6	1981-2006
Pareora	546	Timaru	12.1	1981-2006
Makarewa	1,134	Invercargill	10.1	1981-2006

Source: Census; Google maps

To compare Patea with its LLs, we average observations from the LLs to obtain an LL average and then form the ratio of Patea to LL average for each variable over time. Before any averages or ratios were formed, all data were normalised, using 1996 as the base year. This gives each like locality an equal weight in the comparison. The same process was adopted for Whakatu and its LL average. For example, for the Patea-LL population ratio in year *t*, we have:

$$LL\_pop\_ratio_{Patea,t} = \frac{pop_{Patea,t} / pop_{Patea,1996}}{pop_{LL\_average,t} / pop_{LL\_average,1996}}, \qquad (1)$$

where $$pop_{LL\_average,t} = \frac{1}{3}\left(\frac{pop_{Wairoa,t}}{pop_{Wairoa,1996}} + \frac{pop_{Takapau,t}}{pop_{Takapau,1996}} + \frac{pop_{Mataura,t}}{pop_{Mataura,1996}} \right) \qquad (2)$$

[12] Mataura contained another 'mill' type infrastructure in the form of a paper mill. This mill was mothballed in 2000. However, as our analysis focuses on the impacts during the first 15 years following the closures, this mothballing does not affect our analysis.

The movements of the LL town variables will influence the observed behaviours of the LL ratios. Figures 2 and 3 display the behaviours of the normalised population data for each closure town's LL comparators over time. We use population behaviour because its movement is the main driver behind many of the other effects. From Figure 2, we see that Patea's LL average settles around unity, indicating that the LL average does not display abnormal behaviours that could affect the LL ratio. Whakatu follows a similar pattern, as pictured in Figure 3.

As an alternative approach to controlling for external influences, we compared both Patea and Whakatu to their respective TAs, South Taranaki District and Hastings District[13]. This second comparison was done to take into account region-specific effects that may have affected trends in each closure town. The ratios of Patea and Whakatu to their respective TAs were formed, and the ratios normalised to one in 1996. For example, the TA population ratio for Patea in year *t*, is:

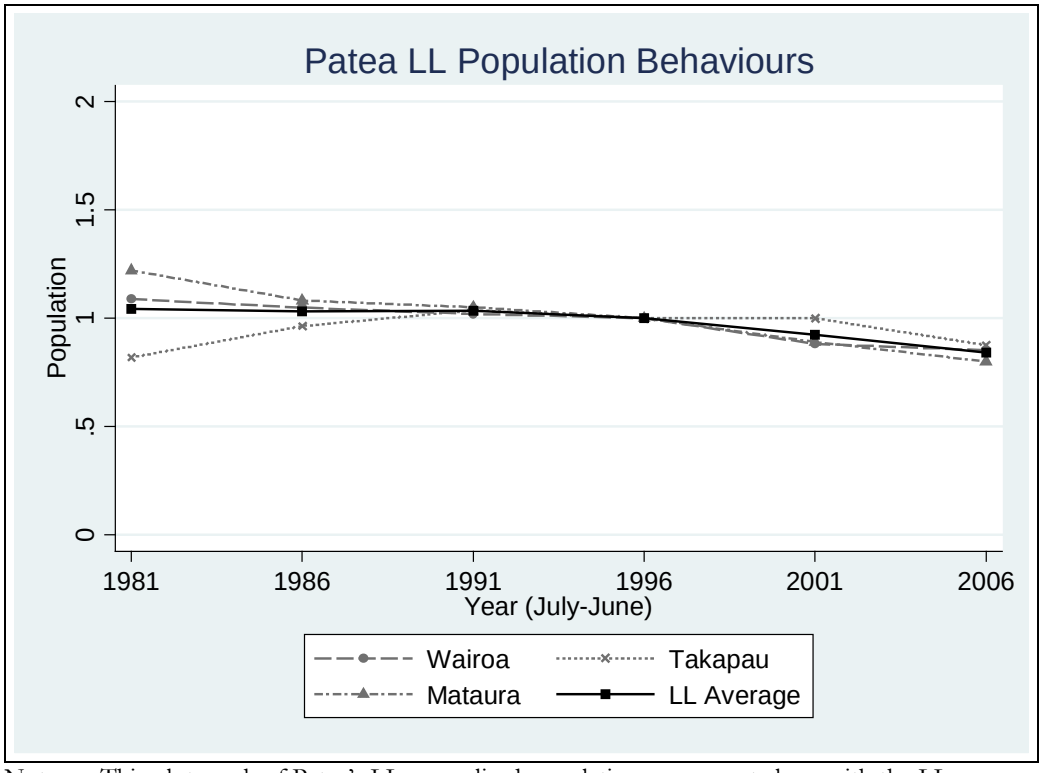
$$TA\_pop\_ratio_{Patea,t} = \frac{pop_{Patea,t} / pop_{Patea,1996}}{pop_{SouthTaranakiDistrict,t} / pop_{SouthTaranakiDistrict,1996}} \qquad (3)$$

All analysis is conducted using each set of controls to determine whether our results are sensitive to the particular controls chosen. Once the ratios for all variables were obtained for each town, with respect to their LL average and their TA, they were plotted over time to analyse the differences in the marginal effects of the closure between the two sets of comparators, and to gain an overall perspective of the long-run trends in each town.

We then compare the two towns by examining the differences in the adjustment processes of each town following the closure. These were computed by taking the ratio of actual observations to the linear trend values. The linear trend was calculated for each variable for the period 1981 to 2006. We detrended the ratio data to control for any longer term divergent tendencies that may be present between the affected towns and their controls. The adjustment processes begin in the period of the closure and illustrate the first 15 years following the closure. The Patea

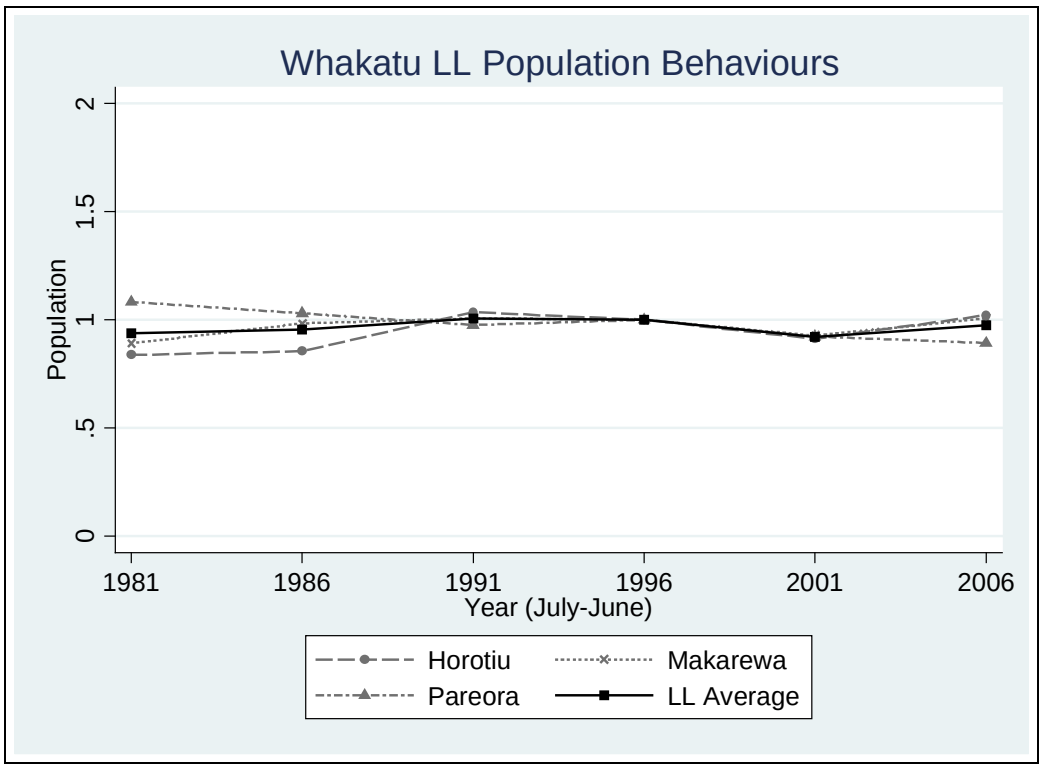
[13] Pre-closure, Patea's population (1,983) accounted for only 6% of the South Taranaki District population (32,955) and Whakatu's population (903) comprised only 1.4% of the Hastings District population (65,835). Therefore, neither closure town will exert any great influence on the TA levels.

Figure 2: Patea LL Population Behaviours



Note: This plots each of Patea's LL normalised population movement along with the LL average of these normalised population movements.

Figure 3: Whakatu LL Population Behaviours



Note: This plots each of Whakatu's LL normalised population movement along with the LL average of these normalised population movements.

(Whakatu) plant was closed shortly after the 1981 (1986) census, so these are our base years respectively for the two towns when comparing the adjustment processes. We re-centre all detrended ratios to 1.0 for the respective base years by dividing each series through by its base year value. By comparing the time paths of the (detrended) data after accounting for each town's control locations, we are adopting a difference-in-differences approach in analysing the adjustment data.

4 Results

In order to investigate the hypotheses posed earlier in the paper, we examine the effects of the infrastructure closures on a number of variables. First we examine population variables to test whether out-migration occurred following the closures, and to test whether the migration patterns vary by age-band, potentially reflecting influences of homeownership on propensity to migrate. Second, we examine labour market data to test whether the initial job losses have prolonged employment effects, and whether they affect participation rates and the unemployment rate in both the short and longer term. Third, we examine impacts of the closures on the housing market, examining house sale prices, land values and dwelling numbers.

Table 3 presents descriptive statistics of the raw data for the variables considered (i.e. prior to taking ratios relative to LL or TA), along with the percentage changes over the 15 years following each closure. The population age-bands are omitted as they are described later in the analysis.

4.1 Population

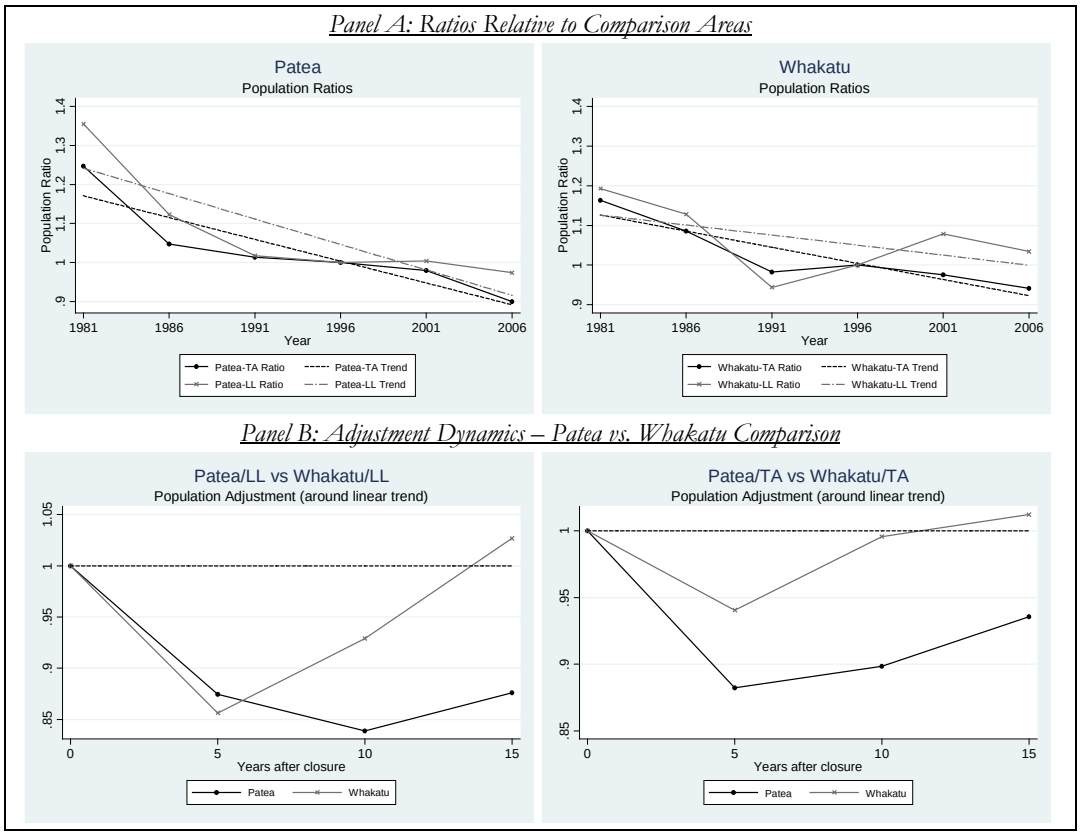
Figure 4 compares the two closure towns' population ratios relative to their respective LL average and TA; it also depicts the adjustment dynamics for the population ratios of both towns with respect to the two comparators. The population ratios trend downwards over time for both towns in relation to both comparators. Each closure town experiences a large population decline over the five years following the closure: Patea's population ratios fall by 28% (LL) and 28% (TA), while the falls for Whakatu are 13% and 19% respectively. Along with the initial magnitudes of each drop being slightly smaller for Whakatu, there is also a marked difference in the behaviour of the ratios after the initial falls. Whakatu shows relatively rapid signs of recovery and is back above trend in 15 years on both

Table 3: Descriptive Statistics

Pre-closure Level *15 Year % change*	**Patea**	**TA (South Taranaki District)**	**LL**	**Whakatu**	**TA (Hastings District)**	**LL**
Population (pop)	1983 ***-29.2%***	32955 ***-11.7%***	2766 ***-9.2%***	903 ***-8.0%***	65835 ***+2.4%***	832 ***-3.1%***
Employment (emp)	792 ***-49.6%***	13875 ***-5.4%***	1120 ***-12.7%***	456 ***-13.2%***	30288 ***-1.5%***	398 ***+3.8%***
Unemployment (unemp)	42 ***+93.0%***	495 ***+85.0%***	53 ***+98.1%***	39 ***-15.4%***	2250 ***+9.6%***	22 ***+27.3%***
Not in the Labour Force (nlf)	495 ***+6.7%***	7923 ***-13.9%***	729 ***-7.5%***	162 ***-1.9%***	15942 ***+2.1%***	220 ***-22.3%***
Total Occupied Dwellings (occupied)	570 ***-2.6%***	9699 ***+7.3%***	816 ***+5.4%***	252 ***+8.3%***	20781 ***+16.5%***	242 ***+15.3%***
Average Household Size (averagehh)	3.48 ***-27.3%***	3.40 ***-17.6%***	3.32 ***-13.6%***	3.58 ***-15.1%***	3.17 ***-12.0%***	3.45 ***-16.8%***
Median Sales Price (spmedian)	12000 ***+137.5%***	23250 ***+188.2%***	27067 ***+71.8%***	39000 ***+125.0%***	57500 ***+130.0%***	43250 ***+79.2%***
Median Land Values (lvmedian)	2300 ***-63.0%***	5500 ***+145.5%***	3567 ***+36.0%***	10500 ***+147.6%***	14100 ***+201.4%***	6083 ***+200.8%***

Note: The figures in normal text represent the pre-closure levels, while the bold and italic figures represent the percentage change after 15 years.

Figure 4: Population, All Ages: Ratios and Adjustment Dynamics



Note: Panel A shows the normalised ratio of each town, with respect to both sets of comparators, in separate plots. The ratios depicted are those defined earlier in equations (1) and (3).
Panel B compares the two closure towns' adjustments to the shock, for the first 15 years follow each closure. Each plot represents a different set of comparison data. These adjustments are the detrended movements of the ratios depicted in Panel A.

measures. In contrast, Patea experiences a further fall in its population ratio over the second five year period (using the LL controls, with little pick-up using the TA control) and is still well below (a declining) trend after 15 years.

The relative losses in population in both towns are consistent with migration of those made redundant by the closures from the two towns, a result consistent with those found by most other empirical studies of negative employment shocks. The findings, however, contrast with those of Glaeser and Gyourko (2005) who found very little population movement in response to such shocks. What is evident from Figure 4 is that Whakatu suffers a relatively temporary shock, while Patea endures a more permanent shock to its population. This difference in population dynamics is consistent with our hypothesis regarding the risk-sharing and job matching benefits of larger agglomerations. Even though Whakatu experiences an initial net population outflow following the closure, because it is in the vicinity of an urban area it is able to draw back or gain new residents attached to the neighbouring cities (and labour markets) of Hastings and Napier.

Splitting the population into age-bands, we are able to assess population movements of different age groups resulting from the closures. Table 4 provides a summary of the percentage changes for each age-band, the respective LLs and TAs, and the respective ratios, across the first 15 years following each town's closure.

Table 4: Age-Band Percentage Changes for each closure

Percentage Change (1981 – 1996)					
Age Cohort	*0-14*	*15-24*	*25-44*	*45-64*	*65+*
Patea	-45.5%	-52.1%	-28.4%	-11.3%	42.3%
• *LL*	-15.5%	-33.8%	15.1%	3.8%	24.4%
• *TA (South Taranaki)*	-24.0%	-32.6%	1.7%	4.8%	20.6%
• *Patea-LL Ratio*	-35.5%	-38.1%	-37.8%	-14.5%	14.4%
• *Patea-TA Ratio*	-28.2%	-28.9%	-29.6%	-15.3%	18.1%
Percentage Change (1986 – 2001)					
Whakatu	-23.2%	-31.0%	-13.7%	-33.3%	61.5%
• *LL*	-11.2%	-36.1%	1.9%	31.4%	4.0%
• *TA (Hastings)*	-1.0%	-23.4%	5.4%	33.7%	28.7%
• *Whakatu-LL Ratio*	-13.7%	8.0%	-15.3%	19.3%	55.4%
• *Whakatu-TA Ratio*	-22.7%	-9.9%	-18.1%	17.3%	25.5%

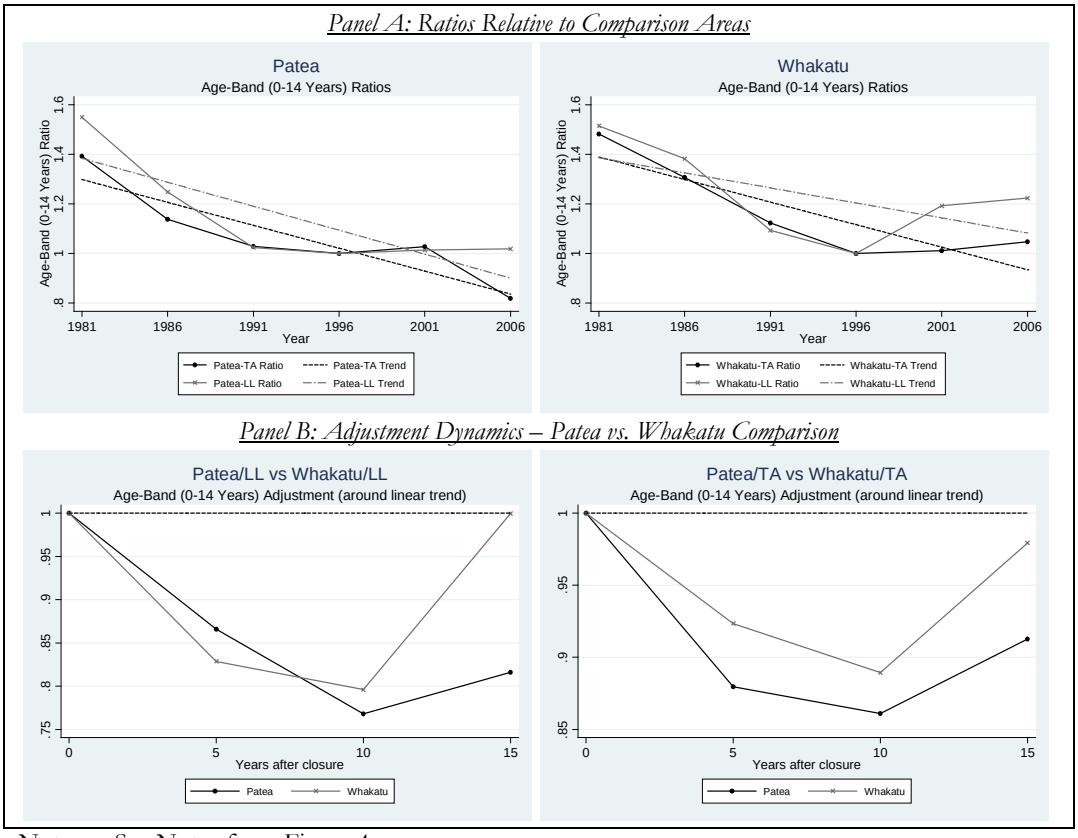
Note: Each period covers the first 15 years following each closure.
"Patea" and "Whakatu" refer to percentage changes of actual counts within each town.
"LL" and "TA" refer to the percentage change in actual counts of each closure town's respective "LL" or "TA".
The ratio percentage changes refer to the percentage changes in the normalised ratios of each age-band for each town with respect to each set of comparators.

First, we examine changes to the population of children and young teenagers represented by people aged 14 years and younger (Figure 5). For the respective LL (TA) ratios, the relative child population in Patea dropped by 59% (26%) between 1981 and 2006, while Whakatu experienced a drop of 28% (29%) for the same period. For the first ten years after the closures, each of the ratios shows similar patterns. Both towns lose a large proportion of their relative young population in the two periods following the closure. Each town experiences a pick-up in the third period, with a significantly greater pick-up for Whakatu than Patea. The adjustment dynamics, in Panel B of Figure 5, show that both of Whakatu's detrended ratios end up at the starting levels while Patea's ratios remain well below their pre-closure levels. This age-band comprises children who are dependent on their parents/guardians for support so their migration patterns reflect the migration patterns of families with children. Accordingly, we conclude that the closures led to a substantial migration of households with children out of the affected towns, albeit with some longer term reversion of this pattern for Whakatu. For this group, therefore, homeownership or attraction to local community amenities (including schools) does not appear to have constituted a major impediment to outward migration.

The second population age-band represents those people aged between 15 and 24 years (Figure 6). These youths comprise some who are in the latter years of schooling but mainly comprise the young working population. As with the younger age-band, the youth population relative to both sets of controls decreases over time for Patea; however, the long term outcome is relatively static for Whakatu. In the periods immediately following the freezing works closures, each town suffers a large loss in this age group, both dropping by around 30%. In terms of adjustment dynamics, Whakatu adjusts back nearly to trend after 10 years, while Patea takes another five years for the same reversion to take place. The shorter adjustment period in Whakatu together with its static trend for this age-band, compared with the longer adjustment period and declining trend in Patea, suggests that the impact of the shock for the youth age-band is temporary for Whakatu, while Patea experiences a more permanent shock.

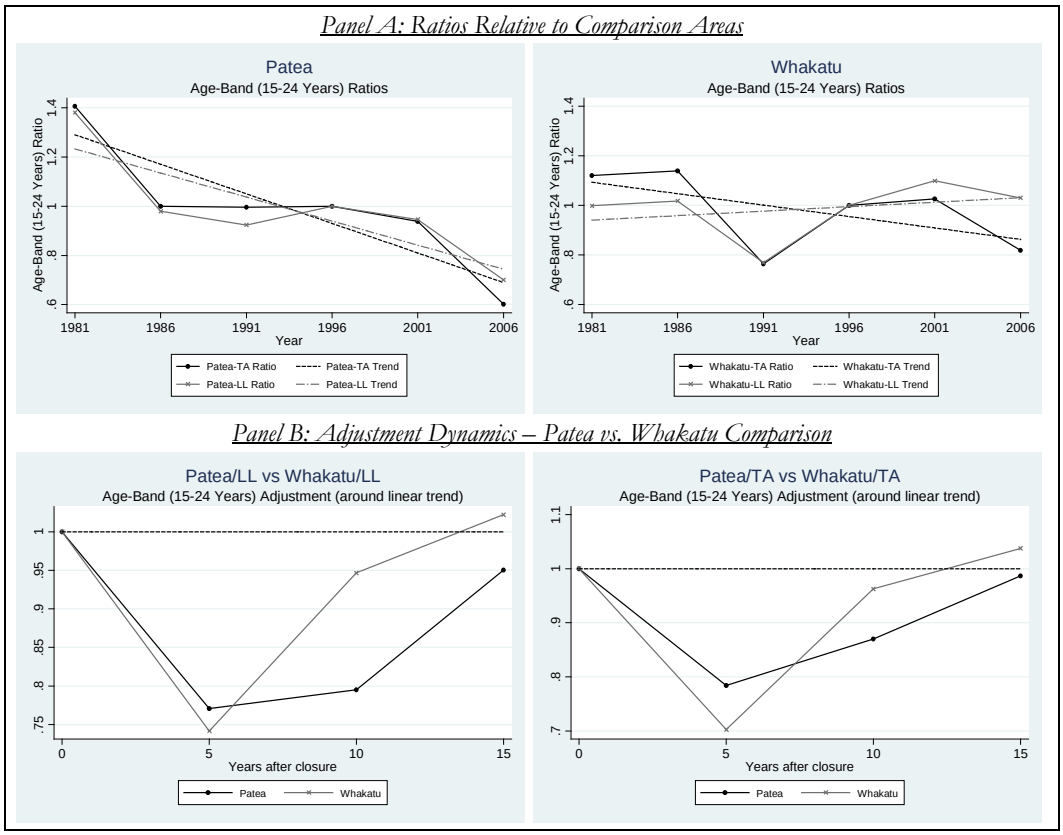
Considering that this population age-band comprises mainly the younger working population, who are considered more independent and are unlikely to have homeownership attachments to the area, the immediate migration following each

Figure 5: Population, 0 – 14 Years: Ratios and Adjustment Dynamics



Note: See Notes from Figure 4

Figure 6: Population, 15 – 24 Years: Ratios and Adjustment Dynamics



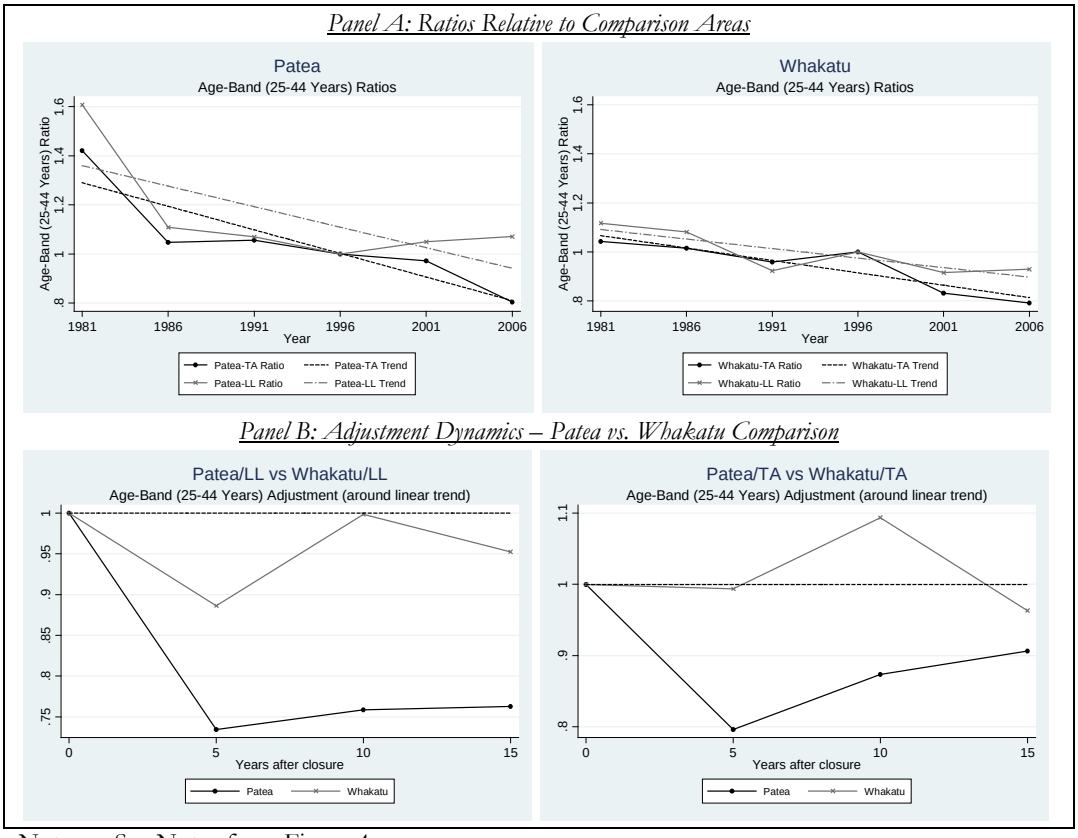
Note: See Notes from Figure 4

closure is as expected. If many of this age group were employed in the works when they closed, or were anticipating such employment, there would have been little holding them back from migrating to other areas in search of alternative employment opportunities following the closures. With Patea lacking alternative employment attractions, once this population age-group migrated, similarly aged youths were not drawn back. As Whakatu is near larger urban areas, those who migrated immediately following the closure may have been drawn back to Whakatu to pursue employment in the urban area, or new young migrants, who were willing to commute to work, were attracted into the town.

The third population age-band involves people aged between 25 and 44 years (Figure 7). This age-band can be considered representative of people who have strong workforce participation (especially for males) and who may also have school-aged children. For both towns, Panel A of Figure 7 indicates that the trends for this age-band are downward sloping, no matter which comparator is used. Immediately after the closure of the meat works Patea experienced a large decrease in its population ratio aged between 25 and 44 years (31% and 27% on the LL and TA measures), whereas Whakatu saw a much smaller drop (15% and 6% respectively). In addition, the trend decline is much greater in Patea than Whakatu. This differing behaviour is depicted clearly in the adjustment graphs. With respect to the LL average, Whakatu experiences a significantly smaller immediate drop than Patea, and the drop is only temporary, reverting fully after 10 years; Patea does not adjust back even after 15 years. This lack of adjustment for Patea is also observed using the TA control. Relative to its TA, Whakatu shows very little impact for this population group from the closure, with only the slightest of falls followed by an upwards bounce in the next period. This evidence reinforces the hypothesis of only temporary shock effects in Whakatu and more permanent effects in Patea for this age-group.

Given that this population age-band is representative of a sizeable component of the work force, many will have been affected by the closure of the freezing works. A material proportion of this age-band is likely to have children so, with the closure of each works, many in this age-band were left without jobs but with families to support. With no real alternative work opportunities in Patea, permanent migration away from the town in search of employment appears to have been a preferred option. Conversely, with Whakatu being close to an urban area, many made

Figure 7: Population, 25 – 44 Years: Ratios and Adjustment Dynamics



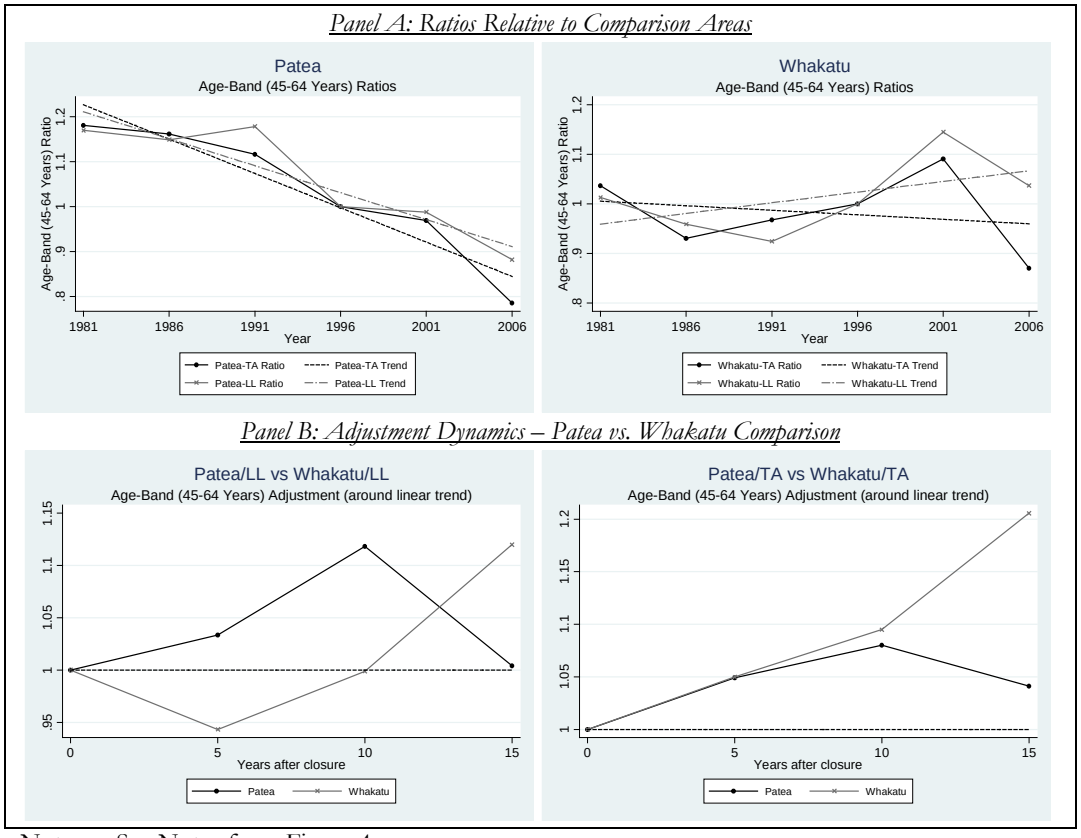
Note: See Notes from Figure 4

redundant by the closure of the Whakatu freezing works may have opted to look for employment in surrounding areas and commute, rather than endure a costly process of migrating themselves and their families to another new area with new schools and new communities.

We find little evidence of a material initial impact from the closures on those aged 45 to 64 years (Figure 8). Longer term, the ratios for Patea are decreasing while those for Whakatu are broadly stable. The adjustment dynamics, found in Panel B of Figure 8, indicate that for both towns, relative to their TAs, there is an increase in the population of this age-band over the five years following the closures of each plant. This is also observed for this population group in Patea, with respect to its LL average. There is a downward movement in this population age-band in Whakatu relative to its LL average; however, all the movements are small (note that the scale of the graphs differs from previous figures).

People in this age group are in the second half of their working life and (given national statistics) are more likely to own their own homes and have stronger

Figure 8: Population, 45 – 64 Years: Ratios and Adjustment Dynamics

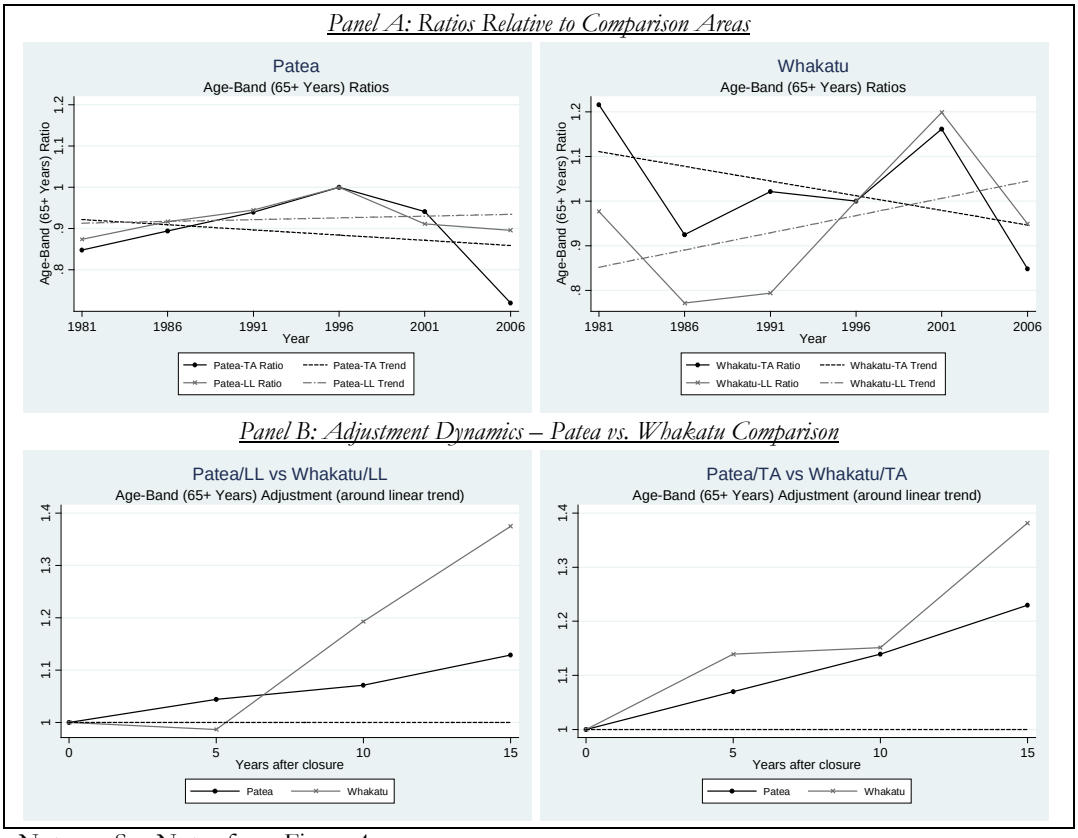


Note: See Notes from Figure 4

community ties than are younger age-bands. They are therefore more likely to have strong attachment to their town, accepting a redundancy package, and either taking early retirement or seeking other local employment. There may also have been an inflow of this population age-band into these towns from people who have already retired, following the emigration of younger workers, leaving relatively cheap housing to be occupied in the town.

The last age-band comprises those aged 65 years or older (Figure 9). We observe no immediate effects from the closures for this age-band in either town. Each town's ratio, in relation to its respective LL average, is slightly increasing over the period from 1981 through to 2006. In contrast, the TA ratios for each town are decreasing over time. Notably, the adjustment patterns indicate that this population group, relative to both comparators, is increasing follow the closure. This outcome is consistent with both towns becoming retirement destinations, possibly due to the availability of vacant, relatively cheap housing. The absence of any major impact from the closure on this age-group is as hypothesised. Many in this group will already have been in retirement; hence there was little direct effect on them as a result of the

Figure 9: Population, 65+ Years: Ratios and Adjustment Dynamics



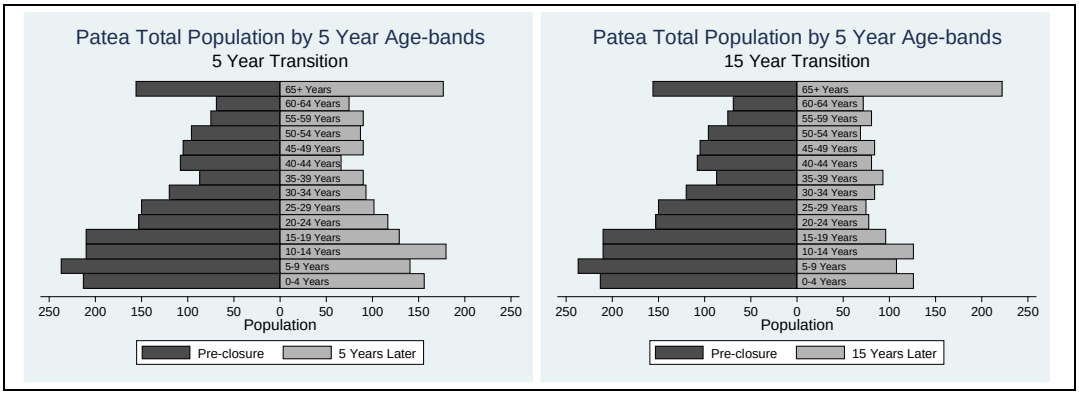
Note: See Notes from Figure 4

closures. Even those who lost employment will have been entitled to National Superannuation[14] giving them an ongoing income without needing to relocate.

Breaking these population age-bands down further, into five year age-bands, the patterns described above become even more evident. Figure 10 and Table 5 show that there is indeed a migration effect for Patea, especially for the younger age-bands. These younger age-bands experience around a 30-40% loss initially after the closure. 15 years later, these population losses are greater (around 60%). From Figure 10, the relative increase in the population aged 65 years and older is also noticeable, with a more pronounced increase 15 years after the closure. Whakatu (Figure 11 and Table 6) experiences material population movements only in the younger working population, who suffer initial losses of 40-50%. 15 years later, there is a sizeable shortfall of people aged 20-34 years compared with the pre-closure 5-19 year old cohort, reflecting the initial outflows of people in that cohort after the closure.

[14] A tiny proportion may have been affected by the means test for National Superannuation, but this is unlikely to have affected many, if any, of the affected workers. Note that at the time of the closures, the qualification age to receive Nation Superannuation was 60 years.

Figure 10: Patea Population Pyramids by 5 Year Age-bands



Note: See Notes from Figure 4

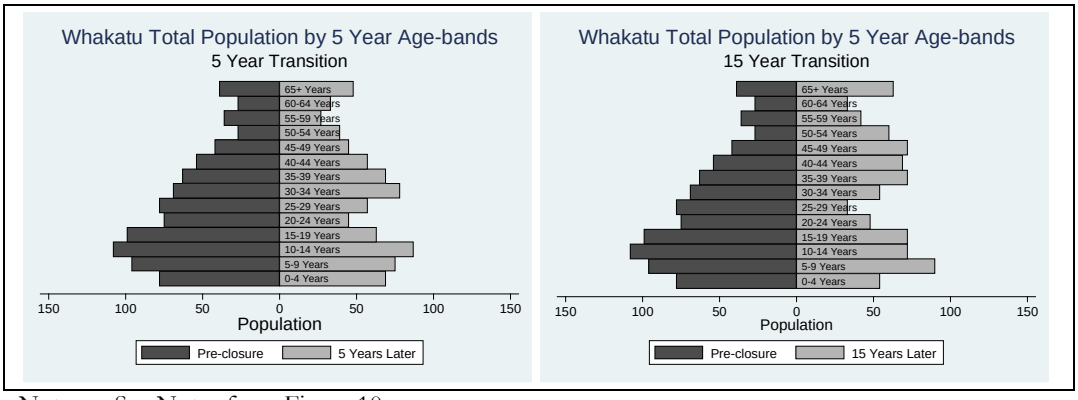
Table 5: Patea Population Cohort Transitions by 5 Year Age-bands

Patea	1981	1986	1996	5 Year Transition		15 Year Transition	
				Number	% Change	Number	% Change
Age-band 0-4 Years	213	141	96	-72	-33.8	-117	-54.9
Age-band 5-9 Years	237	180	78	-57	-24.1	-159	-67.1
Age-band 10-14 Years	210	129	75	-81	-38.6	-135	-64.3
Age-band 15-19 Years	210	117	84	-93	-44.3	-126	-60.0
Age-band 20-24 Years	153	102	93	-51	-33.3	-60	-39.2
Age-band 25-29 Years	150	93	81	-57	-38.0	-69	-46.0
Age-band 30-34 Years	120	90	84	-30	-25.0	-36	-30.0
Age-band 35-39 Years	87	66	69	-21	-24.1	-18	-20.7
Age-band 40-44 Years	108	90	81	-18	-16.7	-27	-25.0
Age-band 45-49 Years	105	87	72	-18	-17.1	-33	-31.4
Age-band 50-54 Years	96	90	222	-6	-6.3	n/a	n/a
Age-band 55-60 Years	75	75	222	0	0.0	n/a	n/a
Age-band 60-64 Years	69	177	222	n/a	n/a	n/a	n/a
Age-band 65+ Years	156	177	222	n/a	n/a	n/a	n/a

Note: This provides the data for Figure 10, whilst adding measurements (actual count and percentage changes) of each transition.

Tables 5 and 6 show that in both the Patea and Whakatu cases, those aged 65+ increased after the closures. However, we are unable to provide the transition numbers for this age-group since the over-65 years population is not broken down into 5 year age-bands.

Figure 11: Whakatu Population Pyramids by 5 Year Age-bands



Note: See Notes from Figure 10

Table 6: Whakatu Population Chohort Transitions by 5 Year Age-bands

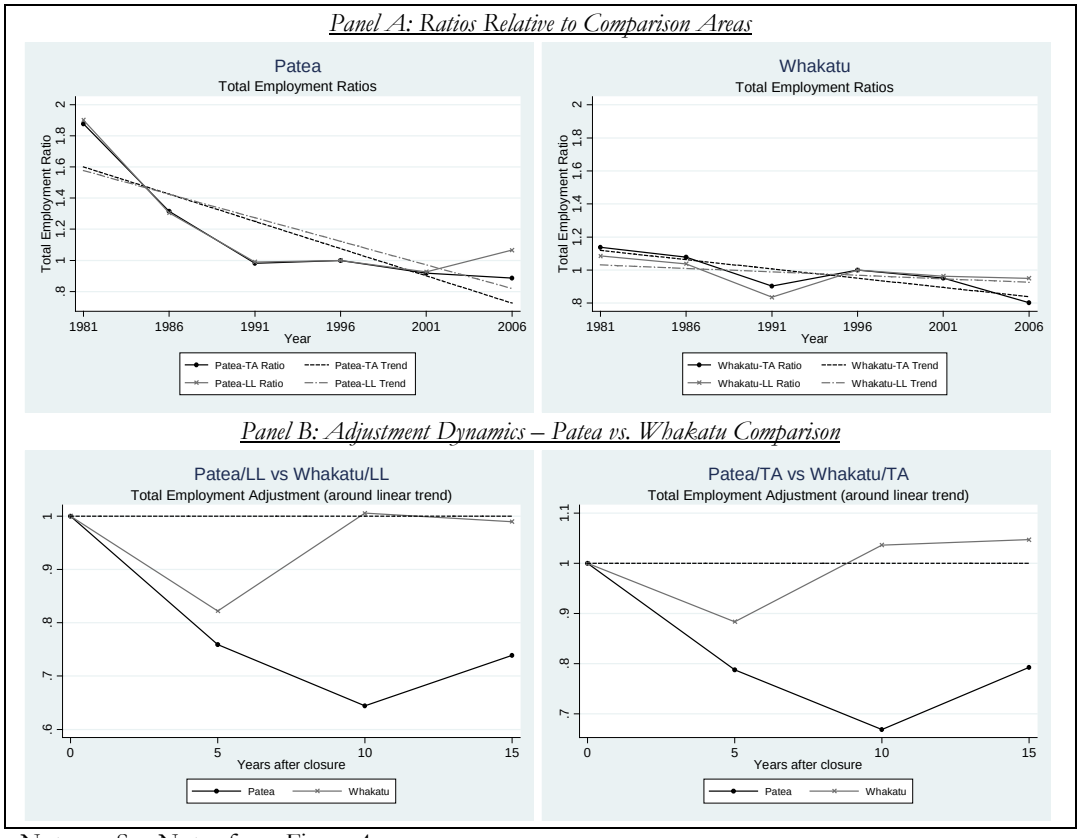
Whakatu	1986	1991	2001	5 Year Transition		15 Year Transition	
				Number	% Change	Number	% Change
Age-band 0-4 Years	78	75	72	-3	-3.8	-6	-7.7
Age-band 5-9 Years	96	87	48	-9	-9.4	-48	-50.0
Age-band 10-14 Years	108	63	33	-45	-41.7	-75	-69.4
Age-band 15-19 Years	99	45	54	-54	-54.5	-45	-45.5
Age-band 20-24 Years	75	57	72	-18	-24.0	-3	-4.0
Age-band 25-29 Years	78	78	69	0	0.0	-9	-11.5
Age-band 30-34 Years	69	69	72	0	0.0	+3	+4.3
Age-band 35-39 Years	63	57	60	-6	-9.5	-3	-4.8
Age-band 40-44 Years	54	45	42	-9	-16.7	-12	-22.2
Age-band 45-49 Years	42	39	33	-3	-7.1	-9	-21.4
Age-band 50-54 Years	27	27	63	0	0.0	n/a	n/a
Age-band 55-60 Years	36	33	63	-3	-8.3	n/a	n/a
Age-band 60-64 Years	27	48	63	n/a	n/a	n/a	n/a
Age-band 65+ Years	39	48	63	n/a	n/a	n/a	n/a

Note: This provides the data for Figure 11, whilst adding measurements (actual count and percentage changes) of each transition.

4.2 Labour Market

The employment ratios and associated dynamics for Patea and Whakatu are shown in Figure 12. The ratios for each town follow a similar pattern; all are decreasing over the period from 1981 to 2006. By 2006, the ratios for total employment in Patea had fallen to around half of what they were in 1981. As expected, the employment ratios for both towns suffer immediate impacts following the closures of the meat works. After the initial drop in the employment ratios, Patea

Figure 12: Employment: Ratios and Adjustment Dynamics



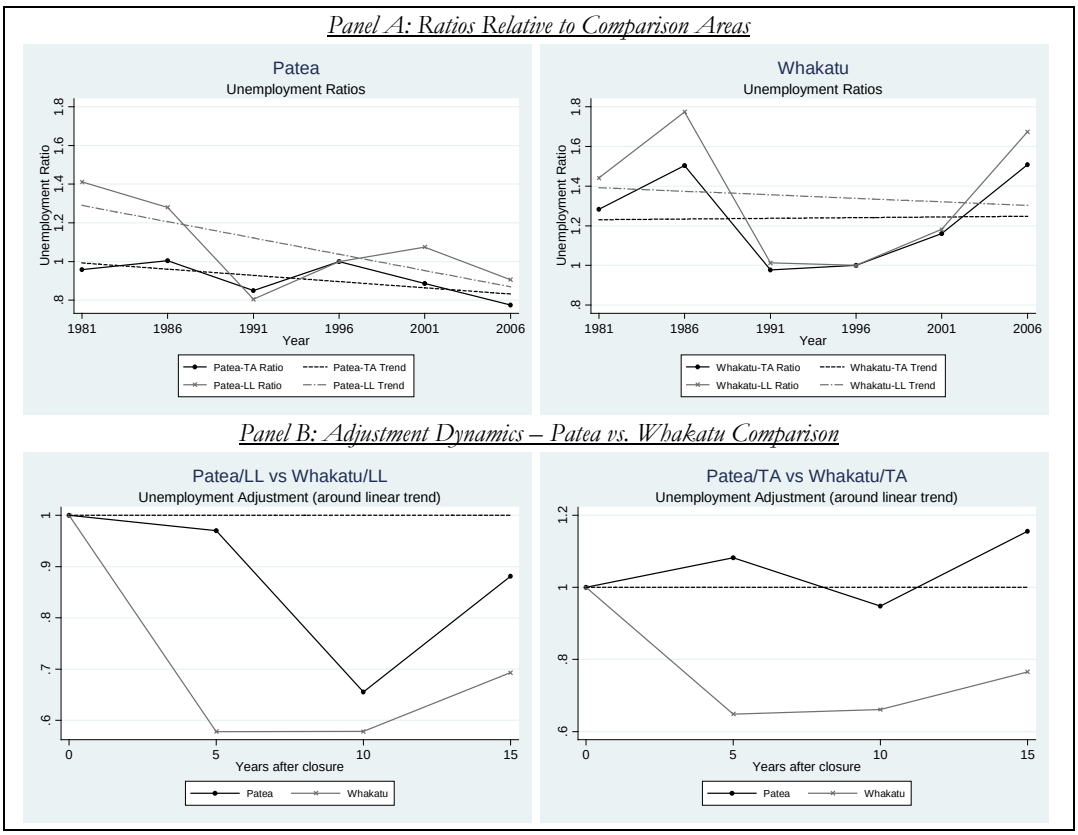
Note: See Notes from Figure 4

experienced a further decline in the following period, before the ratio settled to be around its floor, while the Whakatu ratios jump back within five years to the general trends.

The adjustment plots indicate that after the immediate falls, Whakatu recovered relatively quickly to be back on trend, while Patea endured a long period below trend. These observations provide evidence of a temporary effect of the employment shock in Whakatu versus a permanent effect in Patea, consistent with labour market benefits of agglomeration in denser urban areas. Those who became unemployed from the closure in Whakatu, or who chose to relocate to Whakatu to live in its newly vacated houses, found it easier to match their skills to other jobs available in the urban area, and therefore were able to bounce back from the employment shock. Patea residents, not possessing an urban area within a reasonable distance, found it hard to source work locally, and therefore emigrated, leaving employment numbers within Patea at a lower level. With no new employment attracting inward migration to Patea, total employment numbers remained at the lower level.

The ratios and adjustment dynamics of unemployment for each of Patea and Whakatu are shown in Figure 13. Unemployment is measured as those who are without a job and are actively seeking one. Surprisingly, most of the ratios do not follow the expected upward trajectory after a town experiences the closure of one of its main employers. Instead, both towns show a trend decrease in relative unemployment, with sizeable falls in the decade after each closure. When considering the adjustment processes around trends in Panel B of Figure 13, we see even more evidence of this phenomenon. Both adjustment processes for Whakatu experience sizeable falls immediately which do not return to the trend level within 15 years. Patea, on the other hand, has a delayed effect, with both ratios taking one period to show sizeable downward movement.

Figure 13: Unemployment: Ratios and Adjustment Dynamics

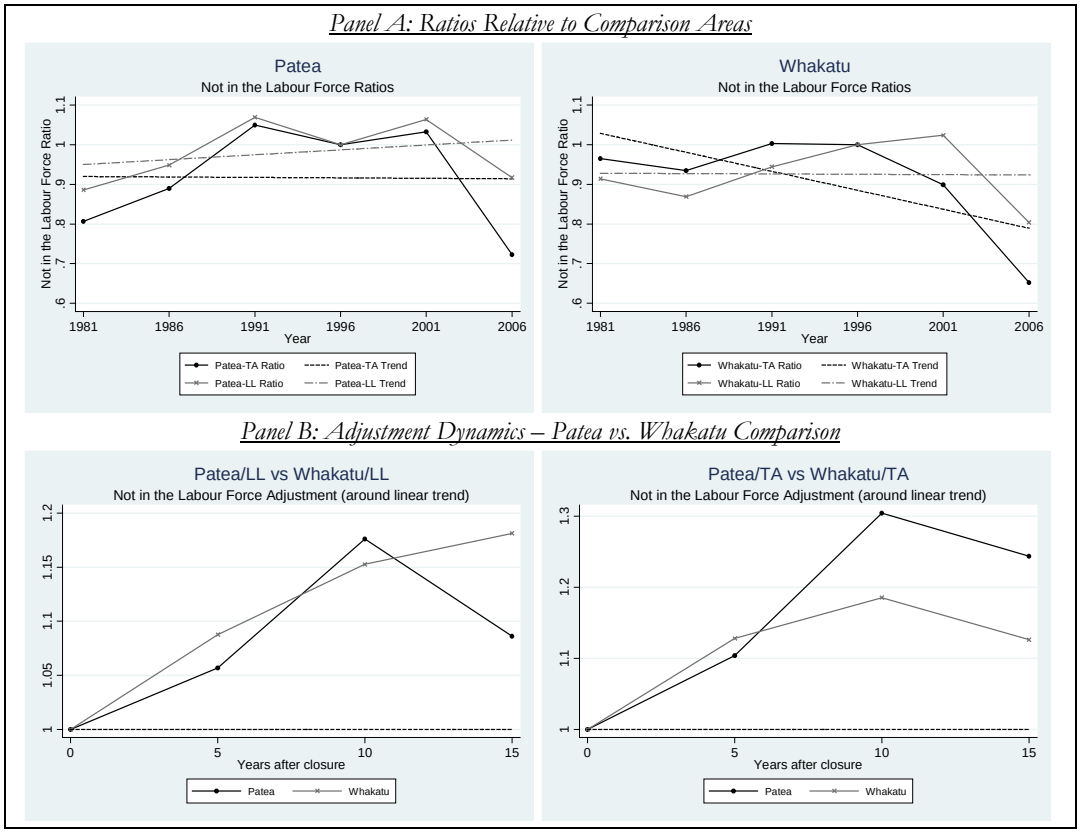


Note: See Notes from Figure 4

One explanation for relative unemployment falling rather than rising (five years) after the closures is that, consistent with the observed out-migration from the two towns, those who were previously unemployed may too have migrated. Seeing the closure, those already unemployed considered their chances of finding employment were even lower than before and consequently migration may have

become their best option. Others who remained may have given up job search completely and chosen not to be part of the labour force. This latter possibility is consistent with Figure 14 which shows the ratios of those who are not in the labour force. Those who are not employed and are not actively seeking employment are included within the 'Not in Labour Force' category. All the ratios for Patea and Whakatu increase immediately following the closures of the two plants. The adjustment plots provide evidence of increasing proportions for people not in the labour force for both towns following the closure. Patea increases and remains above trend for the whole period, while Whakatu also increases above trend for 15 years.

Figure 14: Not in the Labour Force: Ratio and Adjustment Dynamics



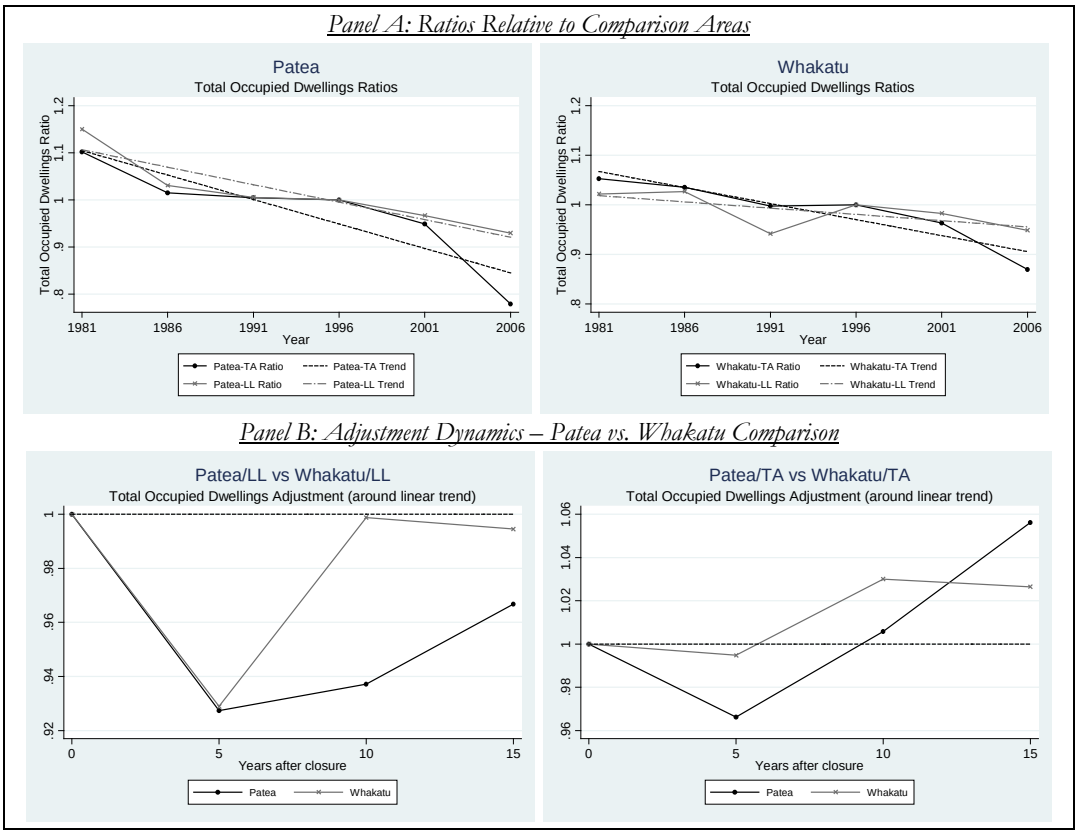
Note: See Notes from Figure 4

This rising proportion of the population opting to stay out of the labour force indicates that some of those who were already unemployed or had been made redundant gave up job search following the closure (i.e. a discouraged worker effect). In addition, the population age-band results suggest that part of the increase in this category is due to an increasing proportion of people aged at least 65 years who typically choose to stay outside the labour force.

4.3 Dwellings and Property Values

The ratios for total occupied dwellings in Patea and Whakatu are both decreasing across the period 1981 to 2006 (Figure 15) consistent with the population trends. In the period immediately following each closure, each town experiences noticeable drops in its occupied dwellings ratios. Once again, the shocks in Whakatu appear temporary, while Patea suffers longer term effects.

Figure 15: Total Occupied Dwellings: Ratios and Adjustment Dynamics

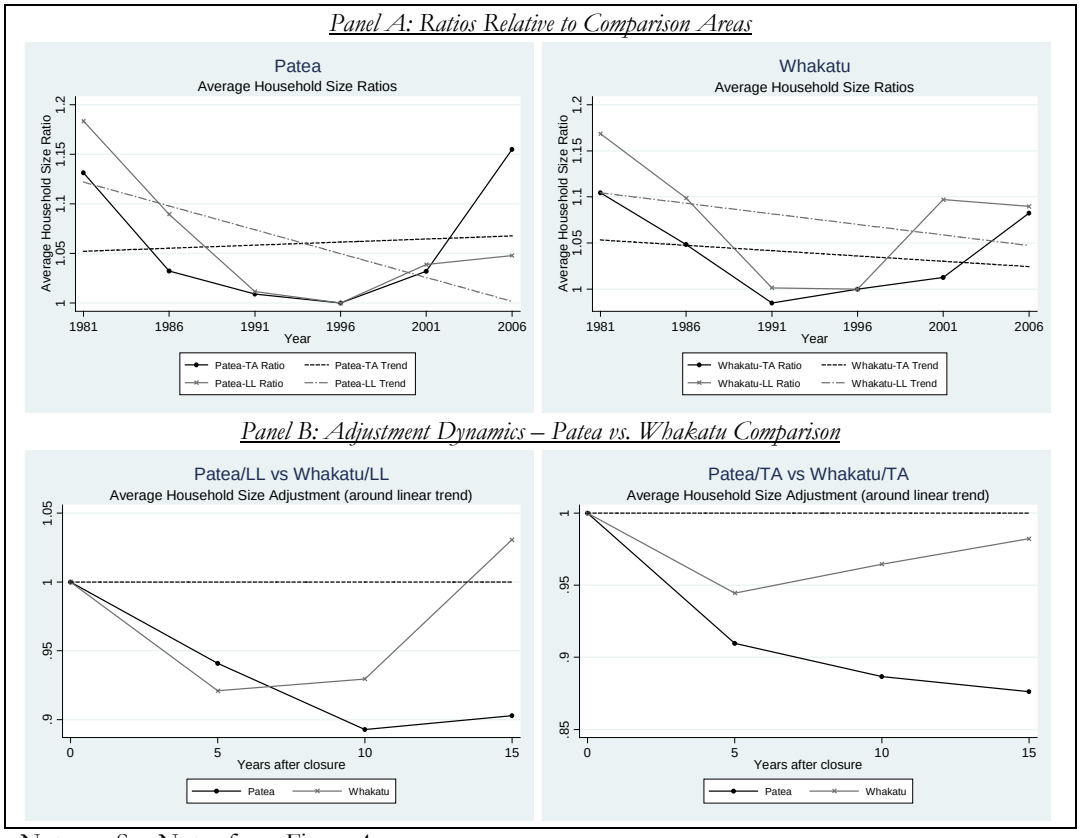


Note: See Notes from Figure 4

Figure 16 depicts average household size ratios (population/occupied dwellings). Both towns experience falling average household sizes initially, but the adjustment processes reflect initially falling average household size with a faster recovery being observed in Whakatu than in Patea. The initial downward movement of average household size is consistent with the out-migration of children (Tables 3 and 4) and the younger working age population groups, and hence of families comprising more than two people.

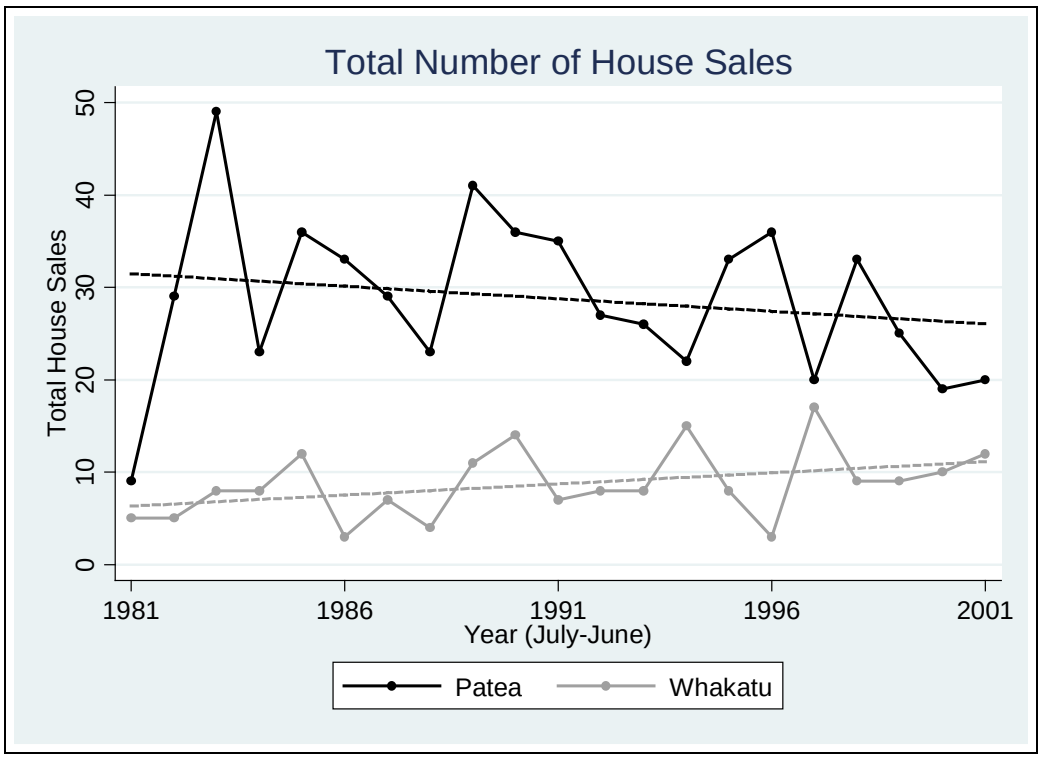
The total number of house sales (Figure 17) in Patea experiences a very slight fall over time, while Whakatu's trend is slightly increasing over time. The

Figure 16: Average Household Size: Ratios and Adjustment Dynamics



Note: See Notes from Figure 4

Figure 17: Total Number of House Sales

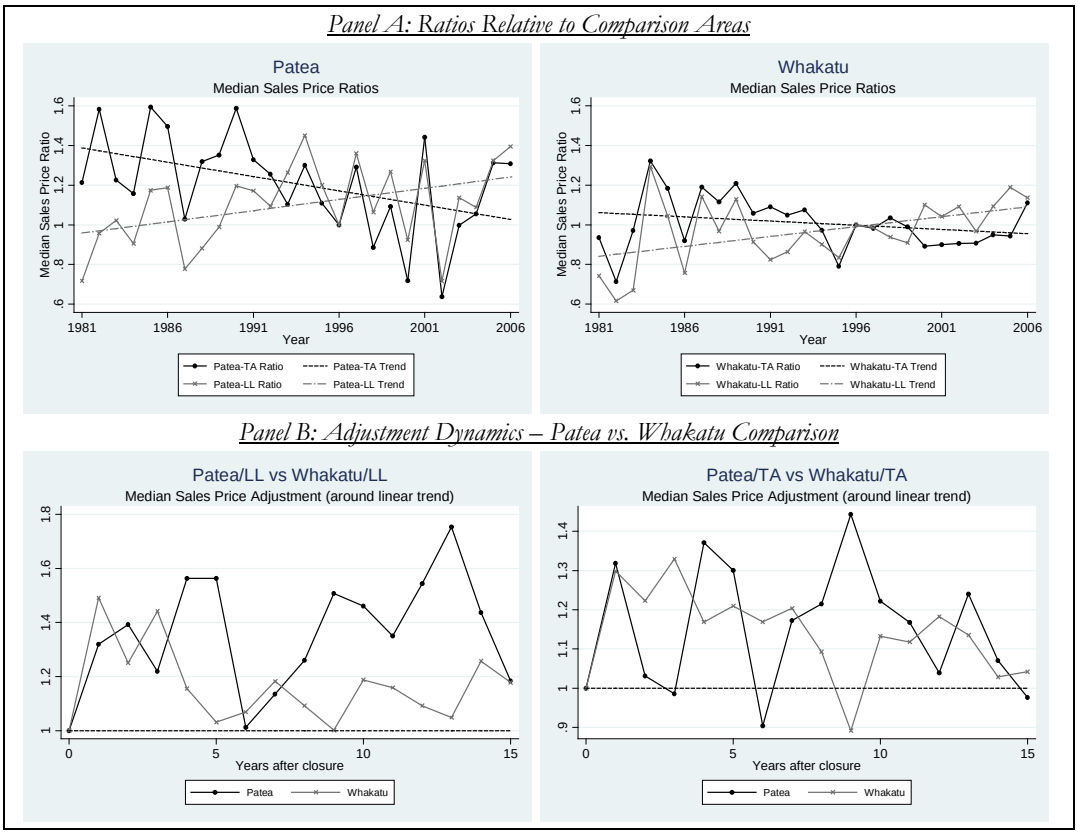


Note: This depicts the total number of annual house sales in each town.

gradients of each slope are small, but it does suggest that the demand for houses in Patea post-closure is falling, while Whakatu still experiences some increase in demand for housing. However, these (slight) trends are not reflected in the prices.

The ratios for median sale prices of residential properties in Patea and Whakatu, while both quite variable (reflecting the small number of sales each year in each locality), reveal no clear long-run trends in relative values (Figure 18). There is no obvious impact on the ratios of either town's plant closure. The adjustment graphs exhibit quite volatile behaviours, regardless of which comparator is used. The lack of discernable impact of the employment shocks on house prices contrasts with a number of other studies' findings. For instance, Stillman and Maré (2008) found a positive correlation between house prices and migration in New Zealand, while Glaeser and Gyourko found that outward migration is linked to large falls in house prices in the US rust-belt. Our results are consistent with those of Grimes et al (forthcoming) who found, in a nation-wide New Zealand study, that employment shocks had negligible impacts on local house prices.

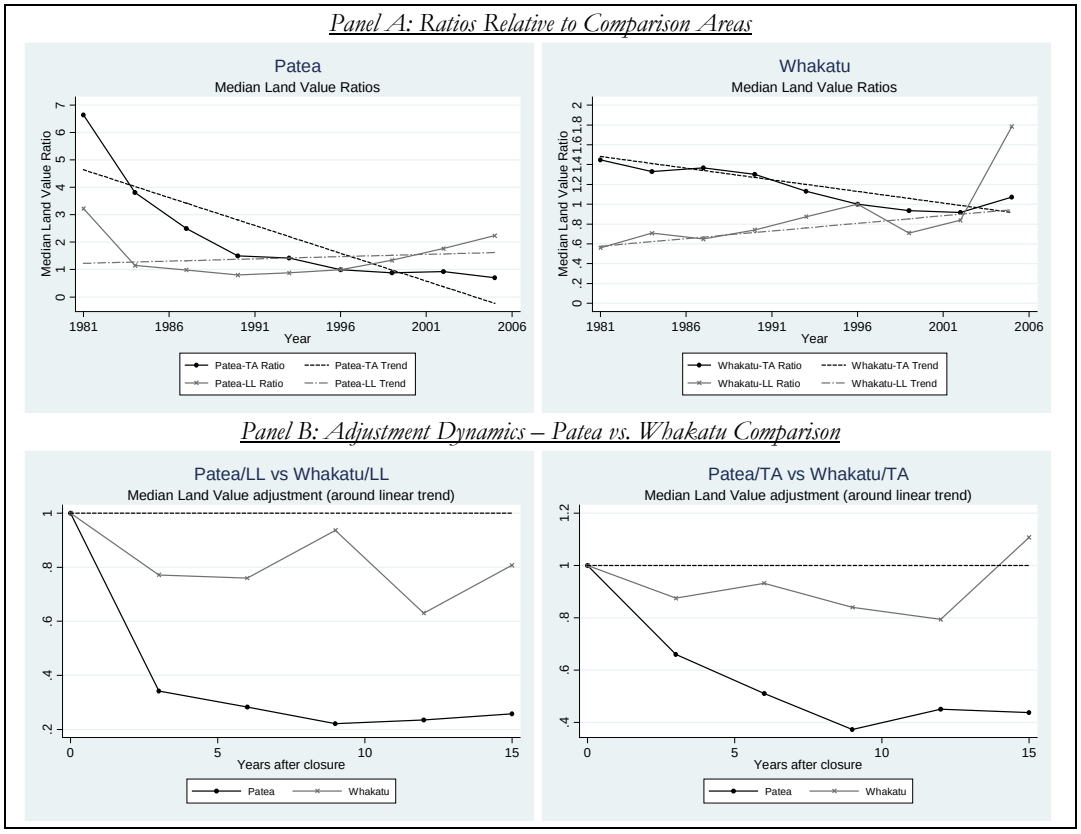
Figure 18: Median House Sale Prices: Ratios and Adjustment Dynamics



Note: See Notes from Figure 4

Nevertheless, Figure 19 which shows the behaviour of median residential land values (as assessed by QVNZ valuers) indicates that one element of the Glaeser and Gyourko findings is observed for our towns. In particular, the adjustment graphs indicate that in the period immediately following the closure of the Patea meat plant, there was a steep drop in residential land values. Whakatu on the other hand experienced no obvious impact from the closure of its meat works. The adjustment graphs for Whakatu fluctuate around a constant whereas there is a steep downward adjustment for Patea that remains below the trend (and initial) level for the full 15 years. Thus land values in Patea appear to have suffered severely from the loss of the local freezing works. Given the net migration out of the town, there was little to support the revival of land values in Patea. Whakatu, by contrast, experienced only a temporary population shock and had a nearby urban area so remaining attractive to potential residents, supporting its land values.

Figure 19: Median Land Values: Ratios and Adjustment Dynamics



Note: See Notes from Figure 4

The house sales price and residential land value findings for Whakatu are consistent with one another, but the Patea findings across the two variables are inconsistent. (Initial land values in Patea represented only a small proportion of

capital values, so arithmetically it is possible to have a large fall in residential land values with very little effect on house sales prices.) One potential weakness of the land value data is that they rely on valuers' estimates, and so the inconsistency may conceivably be due to changing measurement practices for land values in Patea across time. However land valuations are informed by sales of vacant lots (sections) in the local area; and there is no reason to believe that there was a change in practices for Patea (as opposed to Whakatu) at this time.

Taking the data at face value, we hypothesise that vacant land within Patea was formerly valued as being capable of conversion to residential purposes in order to meet a possible increase in the town's population. Thus it will have had a positive option value attached to it, resulting in it being priced above neighbouring agricultural land. This option value will have virtually disappeared once the works closed since now there was little likelihood of demand for new housing stock. Sales prices of existing houses, by contrast, may have been supported by the ability of out-of-town retirees (and other inward migrants, potentially including working aged beneficiaries) to purchase a house or pay a rental within Patea that was still inexpensive relative to their existing place of residence. Thus while the housing stock was unlikely to expand (so removing the option value for land), a wider housing market worked to support the level of house prices in the town.

5 Conclusions and Future Work

During the early to mid 1980s, the closures of freezing works at Patea and Whakatu had significant impacts on these rural towns. The similarities and differences between the two towns' adjustment experiences have implications for our understanding of the impacts of major rural processing infrastructure, the role of urban versus rural labour markets and the effects of homeownership on migration patterns following local shocks. These adjustment responses provide insights that may assist in the formulation of regional development policies.

We make use of descriptive evidence over a range of variables to extract the initial and longer term impacts that each closure had on the town in which it was located. The data enable us to compare the adjustment dynamics across the two towns given their differences in location relative to urban areas. Both towns suffered net outward migration immediately following the closures. This outcome is

consistent with results of other studies. One exception is the study of Glaeser and Gyourko (2005), which found that a negative shock should result in a relatively small impact on population (but a large negative impact on house prices).

One feature that sets our study apart from many others is that we subdivide the population into a number of different age-bands. We find that the majority of the population movement arises from migration of the younger working age population (25-44 years), youths (15-24 years) and children; out-migration of youths and children is common to both towns, while Whakatu has less out-migration than Patea of those aged between 25 and 44. The older working population (those aged 45 to 64 years) showed few signs of outward movement following the closures, while both towns experienced an increase in the number of people aged 65 and older. Population movements in Whakatu were comparatively temporary, with inward migration following the initial outward flows, while population loss was permanent in Patea.

The closures of both meat-processing plants created substantial reductions in total employment figures for both towns. Given that Whakatu is located near the urban area of Hastings (and also Napier), some of those made redundant could find work there, so the negative employment shock for Whakatu residents had only temporary effects. Patea, not being located near any larger agglomeration, suffered a more permanent employment shock. An unexpected outcome resulting from the closures was that both towns experienced falls in their unemployment figures five years after the closure. One possible explanation for these falls is that many of those who were previously unemployed removed themselves from the workforce following the closures since they now considered there to be little point in searching for work within the locality. Accordingly, the number of those not in the labour force increased. Another (consistent) explanation is that a number of those already unemployed were among the population who migrated since they now had to relocate in order to give themselves a reasonable probability of finding work, whereas formerly they could hold out hope of a job at the local meat works.

The number of occupied dwellings in each town, along with the average household size, decreased after the closures. As a result of the relatively temporary out-migration in Whakatu, the total number of occupied dwellings only dipped for a short time, with inward migration filling properties that had initially been left

unoccupied. Given the more permanent migration from Patea, it did not see a full recovery in the number of occupied dwellings. Average household size for both towns decreased initially, but then showed signs of growing, possibly due to those remaining starting families or, in the Whakatu case, to new residents settling in the town.

Considering the changes in population and the results of Glaeser and Gyourko for the US rust-belt, one could expect housing demand to fall in the affected towns (especially Patea), and therefore to see house prices fall (in the face of unchanging house supply). However, consistent with the findings of Grimes et al (forthcoming), we find no material impacts on the median sales price of houses in either town following the employment shocks.

The house price and land value results for Whakatu are consistent with that locality being part of a larger housing and labour market; thus arbitrage within that market would mitigate the potential for a marked downward shift in residential prices. Patea is unlikely to be part of a larger labour market due to travel distances and times to nearby urban areas. However, it is possible that it is part of a larger housing market, in a particular sense. Certain population groups that are faced with financial stringency may be open to migration to cheap housing areas with vacant houses. Such population groups may include retirees and others on social assistance benefits. While we have no evidence concerning the latter group's migration patterns, we do find evidence of a marked increase in (absolute numbers of) those aged over 65 years in Patea for each of the five yearly observations following the closure. While not placing pressure for additions to the dwelling stock, the actual and incipient inflow of this group may have supported house sale prices in the town. Nevertheless, the option value for developing vacant lots into new housing falls sharply following the works closure, so land values dropped at the same time as house prices remained broadly stable (relative to comparators). The land value result is consistent with the Glaeser and Gyourko findings while the house price results more closely mirror those of Grimes et al.

Our results have implications for the formulation of regional development policies in relation to major infrastructure investments. The paper has analysed the impacts of *closure* of two major plants in order to avoid the methodological problems that would occur with new plant openings where a new plant is located in an already

expanding area. Both closures studied here came as surprises to the local community and, at least in part, were an end product of exogenous changes in central government licensing rules. Thus we can reasonably treat their effects as being the outcome of a natural experiment. While the timing of impacts may differ between an opening and closing of such an infrastructure asset, it is reasonable to consider that many of the longer term effects, especially in terms of employment and working aged population, will be similar. Our findings lead us to conclude that policy makers involved in deciding where to locate major rural processing infrastructure should consider locating such facilities in towns which are close to cities or other urban areas. This avoids the potentially dislocative impacts and greater long-run investment risks, which could occur to the local community if the infrastructure were to be lost. Also, policy developers need to take care in assessing where the benefits of the infrastructure investments accrue; whether current residents receive the majority of the benefit or whether the benefits are captured by new migrants to the areas.

Given the contradictory findings of our case studies relative to some other studies with regard to the relationship between migration and house prices, further research into this relationship is warranted. Our findings indicate that it will be important in future work to examine age differences and homeownership influences when considering responses to shocks. The analysis here indicates that certain age-groups are more mobile than others and that homeowners may be less mobile in response to local employment downturns. This latter feature, in particular, mirrors similar findings in the UK and US and is a factor that needs to be incorporated into policy considerations when programmes to promote homeownership, especially in rural regions, are being assessed.

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