

# **Shocking the Suburbs: Urban Location, Housing Debt and Oil Vulnerability in the Australian City**

**Jago Dodson and Neil Sipe**



**Urban Research Program**

**Research Paper 8  
July 2006**

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## Introduction

One of the most publicly discussed economic phenomena since early 2005 has been the dramatic rise in the global price of oil. The rising global oil price has been translated into rising domestic fuel costs. Given the heavy dependence of Australian cities on cheap fuel for urban transport the increasing oil price raises questions about their economic impact on urban households. In a previous paper (Dodson and Sipe 2005) we examined the socio-spatial distribution of 'oil vulnerability' in Australian cities. That paper received much attention from scholars, policy makers and the media. The earlier paper established a basic method for assessing oil vulnerability via a spatial index that measured a combination of car dependence and socio-economic status at the level of the Census Collection District. We termed our original index the 'vulnerability index for petroleum expense rises' (VIPER). A version of this paper is to be published in an international journal. Many questions still remain, however, about the impact of rising oil prices on cities.

Our continuing scholarly interest in this issue and increasing public and political concern about rising fuel costs has motivated us to extend our original VIPER assessment to take into account further aspects of urban socio-economic vulnerability to rising oil prices. One of the key emerging public concerns is the socio-economic risk to households arising from the combined impact of rising mortgage expenses, historically high petrol prices and inflationary pressures. To assess how the impact of these three factors is likely to be distributed across Australian cities we have created a new index, the 'vulnerability assessment for mortgage, petrol and inflation risks and expenditure' (VAMPIRE). This paper reports the results of our analysis of the VAMPIRE for six Australian cities and the implications these have for various aspects of public policy. Our findings suggest that households with mortgages residing in outer-suburban locations in Australian cities will be the most adversely affected by rising fuel costs, in large part because of their exposure to housing debt and the poor quality of alternative travel modes to the private car. In contrast, wealthier inner-urban and middle-ring localities appear less likely to be vulnerable to increasing petrol prices, due to relatively higher incomes and greater availability of public transport. The personal taxation changes announced in the 2006 Australian government budget also appear likely to favour the wealthy areas of Australian cities over less affluent localities in terms of mortgage and oil vulnerability. We hope that the analysis and discussion we present in this paper will assist to inform scholarly, policy and broader public debate about the impact of rising oil prices on Australia's urban social fabric.

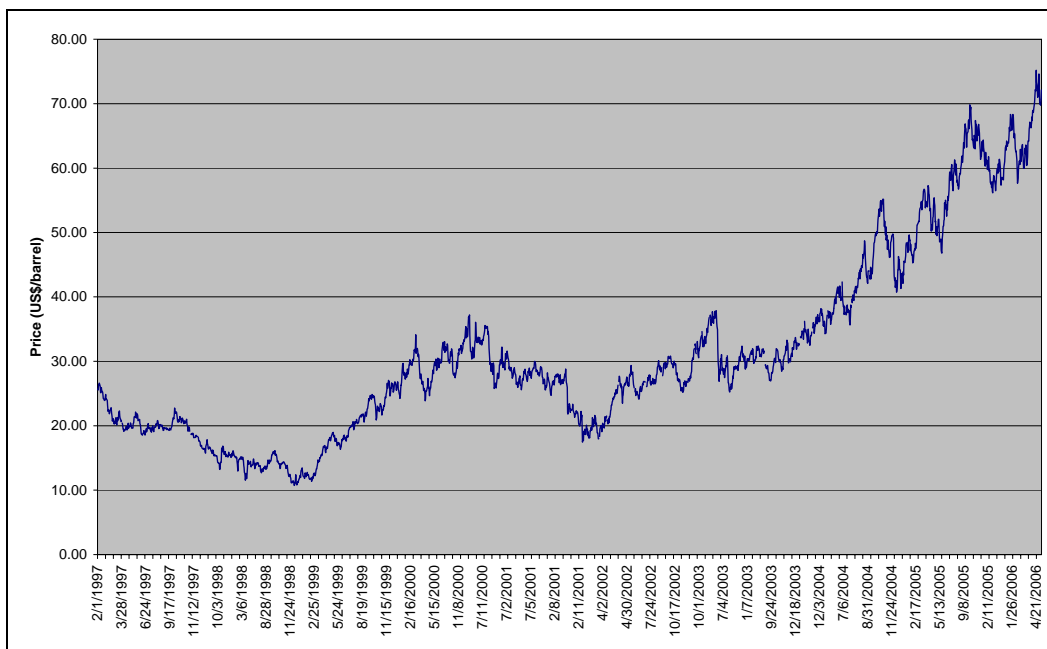
The paper is structured in four parts. The first outlines recent oil price patterns and the way commentators and politicians have comprehended the current financial and economic environment. The next section examines underlying spatial patterns of vulnerability in the Australian city, in terms of the spatial distribution of income, mortgage tenure, car dependence and public transport services. Section Three introduces the VAMPIRE index, the methodology underlying the analysis and the results for Brisbane, Gold Coast, Sydney, Melbourne and Perth. The final section contains the conclusions arising from the analysis and the policy implications for ongoing oil price and interest rate uncertainty.



## Part One - Oil bites

### Oil Prices

The price of oil has increased markedly in the past year (Figure 1). By early May 2006 the price of oil was around US\$70 per barrel, which represents an increase of approximately 40 per cent from the May 2005 price of around US\$50 per barrel. The current high prices appear to be the second 'spike' since mid-2005. Following the impact of Hurricane Katrina on US oil production in August 2005 oil prices briefly touched US\$70 per barrel. This spike was followed by a lull in late-2005 during which oil prices fell below US\$60 per barrel, but since January 2006 the pattern has been for oil prices to persist above this level.



Source: Energy Information Administration (2006, Contract 1).

**Figure 1 Price of NYMEX Light Sweet Crude Oil, 1997-2006**

A number of factors appear to be underlying these marked increases in the price of oil. We discussed these factors in some detail in our earlier paper (Dodson and Sipe 2005) including the implications for cities, and will not address the broader issues extensively here. Some developments since the earlier paper deserve mention however. Whereas the September 2005 oil price spike was apparently driven by the effect of meteorological events on global oil production capacity, current international commentary suggests that the early-2006 spike is the result of fears about the security of Nigerian oil production and cooling relations between Iran and some Western nations. Global oil demand continues to exert upward pressure on oil prices and there is little spare capacity should any further adverse events affect global oil production. There are also concerns about the ability of global production capacity to accommodate the anticipated medium-term demand. The level of oil extraction

and refinement investment necessary to meet this anticipated demand growth is estimated to be \$US 3-4 trillion over a number of years and this investment does not appear to be forthcoming (Klare 2005; Miller 2006).

A growing body of 'peak oil' literature suggests that future constraints on oil supply may already be influencing oil prices. The future oil outlook remains unclear. However the pattern over the past two years has been towards greater insecurity in the global oil market. The Chevron petroleum company (2005) has suggested that 'the era of easy oil is over'. By implication we now dwell in an age of 'uneasy oil'. We need to comprehend how uneasy oil will impact on our cities and how the impacts will be distributed.

### **Bite causes pain**

The rise in the global price of oil has been translated into similar increases in the cost of petrol in Australian cities. In Sydney during late April the price of unleaded petrol fluctuated between AU\$1.27/L and AU\$1.38/L (Motormouth 2006). These prices equate to an increase in the cost of petrol in Sydney of approximately 40 per cent since the same period in 2005. Similar patterns are found in other cities. Even in Brisbane where petrol purchasers receive a state government subsidy of 8 cents/L, retail petrol prices ranged between AU\$1.19/L and \$1.34/L during late April.

The rise in fuel costs has received growing attention and concern from politicians, policy makers and the media, as well as the wider public. The Australian Treasurer Peter Costello has suggested that the global economy is experiencing a third 'oil shock' and has begged businesses not to pass on rising fuel costs to consumers through increased prices (appearance on ABC Lateline 2006; Uren 2006). Prime Minister John Howard has suggested that it is unlikely that Australian petrol prices will ever drop below \$1.00/L (Howard 2005). Opposition Leader Kim Beazley (appearance on ABC Lateline 2006) anticipates oil prices will remain high " 'til hell freezes over".

A growing number of media stories have observed rising fuel prices 'biting' motorists (Brown 2006; Gordon and Smith 2006; McMahon 2006) causing 'pain at the pump' (Fishman 2006; Gittens 2006; Smith 2006) that spreads to household financial circumstances. Many reports describe the swelling pressure on household budgets due to rising fuel costs. Buttler (2006), for example, suggests that with petrol at \$1.40/L the average family is paying more than \$1,500 per year for petrol than was the case two years previously. The theme of struggling families facing a new unpleasant socio-economic reality of rising fuel costs is also a prominent motif in such reports. In Melbourne for example:

Families in the outer suburbs are feeling the pinch as interest-rate rises add to their petrol price woes. Residents in a typical suburban street -- Anna Court, Werribee -- are slashing spending in a bid to make ends meet. Holidays, private health insurance, dining out, entertainment, new household appliances and new clothes are already on the scrap heap. Fedele Franzoni has taken a second job to keep his family budget on track... .."It's just getting so hard. They say we live in the lucky country, but I say that's crap when people have to live like this," Mr Franzoni said... (Walliker *et al.* 2006)

For one Sydney reporter the biting appears to be voracious:

Sydneysiders' living standards have fallen over the past year, eaten away by higher petrol prices and falling home affordability. (Burrell 2006)

Rising fuel prices directly are now viewed as altering household financial and consumption patterns. Public, policy and political concern reflects further anxieties about the implications of indirect inflationary impacts from rising fuel costs on households as increased business production and transport costs are translated into the prices for goods and services.

### **Fuelling inflation**

The broader inflationary impact of recent rising oil costs appears to have been muted until late 2005. By May 2006 however the inflationary effect of rising fuel costs was strengthening and the official inflation rate had accelerated. Headline inflation is currently approximately 3.0 per cent while 'underlying' inflation is approximately 2.5 per cent (RBA 2006). The Reserve Bank of Australia (RBA) reports that over the past year the largest contributors to inflation were fuel, house purchase, and food prices. Of these, petrol prices specifically had 'contributed significantly' to annual inflation growth (RBA 2006, p.3).

While it has not yet displayed a great deal of concern about the extent of observed inflation, the RBA appears cautious about the medium term outlook and anticipates that the pattern of fuel price inflation will continue to place pressure on overall prices over the coming few years. The RBA Board considered that the recent inflation rises had 'increased sufficiently' (RBA 2006) to warrant an increase in the official interest rate and responded by raising official interest rates by 0.25 per cent, the first rise for fourteen months.

Prior to the recent official interest rate rise many observers had suggested that the rising cost of fuel was already threatening economic expansion in Australia through effects on both household and business consumption (Gordon 2006). This effect, it was argued would result in the Reserve Bank Board deciding not to raise official interest rates (Russell 2006). That the influence exerted on the Australian economy by the rising oil price could be seen as comparable to the official interest rate suggests that we may be entering a new era of economic management.

The new sensitivity to inflation has translated into a direct political response via the 2006 Federal Budget. The 2006 Budget has delivered substantial cuts to taxation rates and thresholds that will reduce the household tax burden by thousands of dollars in some cases, particularly for those on very high incomes. Prime Minister John Howard has emphasised repeatedly that rising petrol costs were the overriding political consideration underlying the taxation changes announced in the Budget:

People are paying a lot more for petrol and one of the best ways to help people with the high petrol prices is to put money in their pockets... .The answer is to put more money into people's pockets because the high price of petrol is having a depressing effect on people's livelihoods, people's incomes. (John Howard, quoted in Tingle 2006)

At least part of the motivation was to shore up household consumption confidence, as the Treasury admitted:

Consumption may also be more vulnerable to adverse movements in external factors such as a further increase in oil prices or even a shock that affects confidence...  
(Treasury 2006, p.6)

The Budget tax cuts appear to have temporarily distracted or diverted some of the gathering political consternation and public anxiety associated with Australian households' financial exposure to rising petrol prices. This effect would likely be only temporary if fuel prices were to increase beyond their recent high levels. An understanding of the underlying relationship between housing markets, transport systems and household incomes reveals a continuing risk to households from fuel price inflation. Our spatial analysis of these patterns suggests that tax cuts may not be a sustainable policy response to further pressure from further fuel price rises, higher general price inflation or increased interest rates. Mortgage interest rates appear to be a particular area of sensitivity.

### **Mortgaged to oil**

Australian households are currently highly indebted largely via mortgages for house purchase. Many of these mortgages have been obtained during a marked period of house price inflation which has only recently and unevenly abated (Berry and Dalton 2004). The high prices paid for recent house purchases and the level of gearing to which some households are now exposed raises questions about the impact of future increases in petrol prices or interest rates. The relationship between the increasing price of petrol and interest rate rises has been officially established by the Reserve Bank Board and is now accepted by many commentators. Most commentators believe the combined impact of interest rates and fuel costs on household finances will be negative, although Gittens (2006) views the broader effect on consumption and demand patterns as potentially positive. Although citing no evidence for this observation, Millnow (2006) described the problem succinctly:

In a [sic] space of a few months, the average Australian family, on a \$240,000 mortgage, has now to find an extra \$100 a month to service the loan and fill the petrol tank.

Brisbane's *Courier Mail* newspaper has claimed that an increase in mortgage refinancing during the first quarter of 2006 indicates one household response to the pressures of rising petrol prices and interest costs (Lion 2006). The official figures more likely reflect seasonal trends rather than a new household response, but some may be trading off higher fuel and interest costs for longer repayment times. This will likely result in higher interest repayments over the mortgage period. Financial responses of this type are thus only feasible over the short or medium term. The evidence does not yet suggest any extensive shift to re-financing but any further interest rate or petrol price rise could increase such responses. As with taxation changes, there is a limit to the medium or longer term sustainability of mortgage re-financing responses to higher interest rates or petrol prices.

There is inevitably a spatial dimension to these impacts which we examine in detail in the empirical section of the paper. The possibilities for behavioural change in response to rising petrol and interest rate rises depends in part on the spatial context in which households are distributed. We discuss this underlying context in detail below. Some indications of the types of behavioural change that may be observed are provided by some recent reports.

## **Travelling light**

The question of whether rising fuel costs have produced shifts in household travel patterns is an important issue for urban policy makers and politicians. Anecdotal reports suggest that households are cutting back on expenditures for non-essential items and trying to use their motor vehicles less. To date, however, there have been few official reports documenting the type or extent of transport behaviour change. However, some private research reports deserve mention simply because of the importance of the behavioural change they appear to report.

The Commonwealth Bank research unit (2006, p.1) reported that Australian petrol consumption fell by 8 per cent in 2005, which it claimed is the sharpest reduction in twenty years. Had such a decline occurred during an economic downturn it would be unremarkable but given that Australia continues to experience strong overall economic growth such a drop in petrol consumption suggests a significant change in business and household transport activity. The Commonwealth Bank report suggests that while rising fuel costs had impacted on petrol consumption this had not yet translated into broader changes to household consumption patterns.

A report by the market research company AC Nielsen (2006) appears to confirm that reductions in household fuel consumption are being achieved through reduced automobile use. They conducted a survey following the September 2005 oil price spike to assess the impacts of rising fuel costs on travel behaviour. The company reported that 84 per cent of respondents were affected by rising fuel prices and were changing their behaviour. Of these, 61 per cent were trying to use their car less and 59 per cent were trying to combine trips to save on fuel (AC Nielsen 2006, p.6). A further 29 per cent were cutting back on non-essential living expenses while 19 per cent were using public transport more. Few households were changing the motor vehicle they operated. Only 8 per cent of respondents had bought a more fuel efficient vehicle and only 2 per cent said they were switching to a motorbike, scooter or bicycle.

Similar, although less pronounced behavioural shifts were reported by market research firm Sensis in the company's December 2005 consumer attitudes report. Sensis (2005) reported that 40 per cent of Australian consumers had cut their expenditure due to increased petrol prices. The main expenditure reductions were on entertainment and 'going out' as well as travel, holidays and luxury foods. Sensis reported that 21 per cent of respondents had reacted by using their car less (2005, p.10). Overall the Sensis survey respondents rated petrol prices as their greatest concern. Importantly for the present discussion, Sensis noted that households on lower incomes were more likely to be concerned about rising fuel costs than other households. While the Sensis and AC Nielsen findings differ in the extent of behavioural shifts, they are in agreement as to the general trend towards reductions in motor vehicle use and altered household consumption patterns as a response to increased fuel costs.

The AC Nielsen and Sensis surveys were conducted in November 2005. Since then oil prices have exceeded the levels reached in September 2005 and have sustained these prices

for a longer period. If by November 2005 Australian households were already responding to the September fuel price spike, it is likely that this behavioural shift have continued during the current high fuel price phase. This effect is reflected in a further Sensis report (Sensis 2006) released at the time of writing which revealed declining confidence in households' financial prospects. Rising fuel prices, the cost of living, interest rates and inflation identified as the main causes of concern. Of those surveyed 33 percent per cent were reducing entertainment spending in response to rising fuel prices, while 19 per cent were using their car less (Sensis 2006, p.10). Further reports have revealed declines in purchases of four-wheel drive vehicles and declining consumer use of private toll roads in Sydney that were interpreted as resulting from fuel price pressures (Garnaut and Baker 2006). Traffic on motorways is a poor indicator of overall decline in car use as the relative ease of travel on such roads means these are likely to be the last to experience the effect of any overall decline.

Further behavioural change in response to rising fuel costs is becoming apparent in public transport patronage growth in Australian cities. Official reports are sparse, but a number of media stories suggest that substantial patronage gains are occurring, especially on bus services, which tend to be more locally connected than regional rail systems. In Brisbane many bus routes, particularly those operating at high frequency on arterial roads have experienced strong patronage gains in the past year and overcrowding is now chronic leaving many passengers unable to board services (Kennedy 2006). Overall Brisbane's buses experienced patronage growth of 12.4 per cent between March 2005 and March 2006 (Corkhill 2006) and total patronage is now higher than at any time since petrol rationing was abolished in 1950. Sydney is reported to have gained a further 100,000 daily bus passengers between February and May, stretching bus company capacities and resulting in passenger roadside strandings (Aston 2006). Adelaide has reported annual patronage gains of over 8.5 per cent to March this year (The Advertiser 2006). Comparable gains in other Australian cities have also been attributed to petrol price rises (Lam 2005; Russell 2005). Such remarkable increases in public transport use in Australian signify a departure from historic public transport patronage trends and suggest that the patterns of household travel demand are being reconfigured in response to rising urban fuel costs.

Opportunities for travel behavioural changes are geographically uneven however due to local and sub-regional differentiation in dependency on motor vehicles for urban travel and are conversely mediated by the spatial supply of public transport as well as walking and cycling facilities. Household income constraints or existing financial commitments may also limit behavioural consumption responses. The availability of alternative travel modes and household capacity to absorb rising mortgage costs are unevenly distributed in Australian cities. How the patterns of the transport system and housing market contribute to differential spatial risks and opportunities is critical to understanding patterns of mortgage and oil vulnerability.

## Part Two – The exposure of the city

Two basic urban socio-spatial patterns must be addressed when comprehending the newly recognised relationship between mortgage costs and petrol prices. These are the distribution of car-dependence and the distribution of households purchasing housing. These patterns were covered extensively in our previous paper (Dodson and Sipe 2005). However some merit rehearsing here as they have a number of implications for any policy responses that may arise from an appreciation of the VAMPIRE results presented in Part Three.

### The distribution of car dependence in Australian cities

Australian cities are highly car dependent and thus highly oil dependent (Newman *et al.* 1985; Newman *et al.* 1990) when compared to many Canadian, UK or European cities. The private motor car is used for most trips, both for work and other purposes in Australian cities (Newman and Kenworthy 1999; Mees 2000b; Morris *et al.* 2002). In Sydney, 70 percent of all trips are undertaken by private motor vehicle (DIPNR 2003, p.2). This level of car dependence places Australia's major cities at a high risk of adverse social and economic impacts that may arise from rising oil prices (Fleay 1995; Dodson and Sipe 2005).

Car dependence is highly unevenly spatially distributed within Australian cities. In general households located close to central business districts (CBD) demonstrate less dependence on automobiles for urban travel than those in middle and outer locations (Newman *et al.* 1985). The case of Sydney is a good example of this general pattern as demonstrated by data describing the average level of individuals' 'vehicle kilometres travelled' (VKT).

**Table 1 Selected travel data for Sydney statistical division.**

Travel Indicator	Area								Total Sydney SD
	Inner/ East	North East	South East	Inner/ Central West	North West	South West	Outer West	Central Coast	
Average number of trips per person	3.85	4.01	3.81	3.42	3.36	3.31	3.99	4.16	3.74
Private vehicle mode share (all trips) (%)	48.7	67.9	72.3	64.6	80.1	78.7	79.7	77.3	70.0
Average trip length (km)	5.7	8.2	8.4	8.0	11.8	11.9	13.7	12.8	9.5
Daily VKT per person (km)	10.1	17.9	17.6	14.1	23.2	24.0	33.3	30.1	20.0
Change in VKT per person (%) 1991-2001	-9.9	0.3	9.1	6.0	4.7	23.6	22.8	19.0	11.6

Source: DIPNR (2003, p.2)

The Department of Infrastructure Planning and Natural Resources (DIPNR) (2003, p.2) reports that the average daily VKT for residents of eastern Sydney was 21.8 km in 2003, compared to 27.4 km for those in middle west areas and 54.6 km for those in the city's outer west. The spatial trends in VKT growth are also uneven. Daily per capita VKT declined

almost 10 per cent for residents of inner and eastern Sydney areas during the period 1991-2001 but increased by approximately 23.6 per cent and 22.8 per cent for those in Sydney's south and outer west, respectively (DIPNR 2003, p.2). The spatial divisions in car dependence are widening in Sydney and appear to be related to the distance from the CBD. Other Australian cities exhibit similar patterns (e.g. Newman *et al.* 1985; Morris *et al.* 2002) suggesting that car dependence retains its historic importance as a point of socio-spatial differentiation in Australian cities (Badcock 1984). These patterns would suggest that the costs of increasing fuel prices will be similarly (and unevenly) distributed throughout Australian cities and that those in outer and fringe areas are most exposed.

The converse of car dependence is the ability to choose and use other modes of transport for urban travel, especially public transport. The available data suggests that households in inner parts of Australian cities where public transport coverage is dense and frequent tend to use this mode more than those in middle and outer areas. In inner Sydney, for example, motor vehicles are used for only 49.2 per cent of work journeys, while the levels for south and outer west Sydney are 75.6 and 77.5 per cent, respectively (DIPNR 2003, p.2). Comparable patterns exist in other Australian cities (Morris *et al.* 2002).

The temporal and spatial availability of alternative methods of travel, particularly public transport, strongly influences transport choices. Public transport provision tends to be of highest quality in terms of spatial and temporal coverage, frequency and connectivity in inner urban locations compared to those on the fringe (Cheal 2003). This is in part due to the dominance of radial routes in most Australian public transport networks such that services are spatially most dense at and around the central point of convergence, typically in the city CBD but is also related to the failure of governments to invest in public transport beyond and between these radial links. This spatial difference in the provision of public transport appears to be inversely related to spatial differences in car dependence (Mees 2000b). Further, the gentrification of Australian inner cities in recent decades appears to have enabled higher income households to spatially 'capture' public transport services.

This spatial capture of high quality public transport by wealthier inner-urban groups is highlighted by the experience of the Malcolm Turnbull, the Federal Member for the Sydney electoral division of Wentworth. Mr Turnbull recently won the right to use parliamentary allowances for travel on public transport by arguing that public transport was "more efficient" for travel around his electorate than a car (Coorey 2006, p.3). Given that he is also one of Australia's richest citizens, it is remarkable that Mr Turnbull would deliberately choose Sydney's public transport as a travel mode over a private motor car. Mr Turnbull is fortunate however, to be able to afford to live in the 'transit rich' inner east of Sydney. Residents in Sydney's outer western suburbs where public transport services are poor (Mees 2000a), and those in the poorly served areas of other Australian cities (Cheal 2003; Johnson and Herath 2004) do not have the option of making 'Turnbull's choice'.

Spatial differences in car dependence and public transport service quality in Australian cities derive from the strategic planning and transport policy approaches adopted by metropolitan planners and their state government masters, over many decades. Since the 1950s policy makers have planned new suburban development on the assumption that the primary mode of travel will be the private motor car. The provision of high quality public transport services in Australian cities has not generally been spatially matched to population growth



and urban expansion. Successive state governments in most capital cities have failed to invest sufficiently in new public transport infrastructure and services in new growth areas to provide a convenient alternative to motor vehicle travel (Mees 2000b). Institutional intransigence and privatisation have weakened Australian public transport systems by reducing management accountability and limiting capacity for service integration (Mees 2005).

The lack of public transport investment stands in contrast to the high levels of road investment undertaken in Australian cities in recent decades. Many Australian cities have preferred to undertake investment in large private toll freeway projects, rather than invest in public transport, with Sydney and Melbourne two extreme examples. Such decisions have done little to improve public transport or reduce car dependence. Indeed there is growing evidence that these road projects may have weakened public transport while simultaneously exacerbating car dependence (Zeibots 2005). The opportunity cost of road investment over public transport magnifies this problem – government monies expended on roads are therefore unavailable for public transport.

Planned car dependence is not universal in Australian cities. Perth's post-1980s program of rail investment, for example, demonstrates the capacity of state government to successfully redress car dependent urban planning through coherent and consistent long term infrastructure and service planning (Newman and Kenworthy 1999). The funding for Perth's rail program has in part been obtained through the postponement of some major road projects. This reprioritisation appears to be reducing car dependence in Perth (Newman and Kenworthy 1999, p.237; Carleton n.d.). Other Australian cities are yet to learn from the costs and opportunities of recent investment experience. The Brisbane City Council, for example, is currently proposing to invest \$3 billion on the North South Bypass Tunnel and is contemplating building several others (Allen 2006).

The empirical analysis presented below illuminates the link between urban location, car dependence and mortgage vulnerability. To appreciate the spatial dimensions of this issue however, some understanding of the housing market and residential patterns underlying this vulnerability is needed.

### **The distribution of home purchasers within Australian cities**

Spatial housing markets influence the distribution of households purchasing housing in Australian cities, while labour and financial markets influence their exposure to housing debt. These factors deserve consideration when assessing the spatial, transport and financial risks Australia's urban households face from fuel or interest cost increases.

Home purchase location in Australian cities is closely associated with dwelling availability and price. New dwellings for sale are typically concentrated in new fringe areas. Also, median house prices for Australian suburbs follow a reasonably consistent spatial 'price decay gradient' whereby house prices decline as distance from the CBD increases (Burnley 1980). There is evidence that these price gradients have become more marked in recent years (Burke and Hayward 2000; Productivity Commission 2004). Data presented by the Productivity Commission suggests that price decay gradients in Sydney and Melbourne have

steepened as recent house price inflation accelerated to a greater extent in inner city locations compared to those further out (Productivity Commission 2004, p.126, figure 6.2).

Price gradients demonstrate that house prices in outer urban and fringe areas are often lower when compared to middle and inner locations. These relatively cheaper prices have historically made outer urban and fringe areas more affordable for many households purchasing housing, particularly those on modest or low incomes who cannot afford housing in the middle or inner areas. The popular perception of outer suburban areas of Australian cities as 'mortgage belts' is, in part, based on this phenomenon. The Productivity Commission (2004) has reported that a large proportion of 'first home owners' purchase dwellings in outer and fringe areas. For example, 47 per cent of recent first home buyers in Sydney and 49 per cent in Melbourne purchased homes in outer or fringe areas (Productivity Commission 2004, p.255). This pattern is accelerating in some Australian cities. In Melbourne, for example, the proportion of first home owner households locating in outer and fringe areas increased by almost ten per cent between 1991 and 2003 (Productivity Commission 2004, p.244 figure B.6).

Given that house prices are typically lower in outer urban areas it is likely that these areas receive a higher proportion of modest income home purchasers than middle or inner areas. Social atlases for Australian capital cities demonstrate this pattern with localities containing the highest proportions of low-income households being generally, although not exclusively, located in middle or outer-suburban locations (eg ABS (2002)). This pattern is however highly varied. Since the late-1990s outer and fringe suburban areas have experienced a greater incidence of second and third home purchasers who have moved to new master-planned residential estates (Gleeson and Randolph 2001; Dodson and Berry 2003; Randolph and Holloway 2003).

The availability of residential land in fringe areas has historically not been consistently matched by the extensive or comprehensive provision of employment and public services. Despite some moves to improve full 'self-containment' in new residential estates via early services provision, many outer estates continue to lack good access to high quality social or community services, including public transport (Gleeson 2006). The result can be 'locational disadvantage' whereby modest income households seeking home ownership experience a lower quality of access to employment and services as a result of their financial constraints and locational opportunities than the metropolitan residents generally. This problem of 'locational disadvantage' was the subject of much scholarly research in the early-1990s and deserves some revisiting here.

Maher *et al* (1992) argued that locationally disadvantaged areas are deficient in terms of the facilities and resources necessary to enable a 'satisfactory life' or which require residents to undertake long journeys to access such resources. The transport network and transport services are among the 'resources' available to households, and thus transport can be seen as a key element of locational disadvantage. The Australian Government's National Housing Strategy (1992, p.76) drew on Maher *et al*'s study of locational disadvantage arguing:

People without private transport, especially where public transport is not readily available are likely to be disadvantaged. In particular older people, young people and members of a car-owning household who cannot use the car, are more likely to have problems and/or longer travel times to services and jobs.

A major study of relocation decisions to fringe areas in Sydney by Burnley, Murphy and Jenner (1997) reported similar findings to that of Maher *et al* (1992). Burnley *et al* (1997, p.1125) argued that the uneven spatial provision of services and the differentiation of housing markets produced unfair outcomes for modest income groups:

To the extent that people move to outer suburbia to obtain affordable housing, such pricing trends may be socially inequitable unless strong policies to relocate employment and to develop public transport are pursued in tandem.

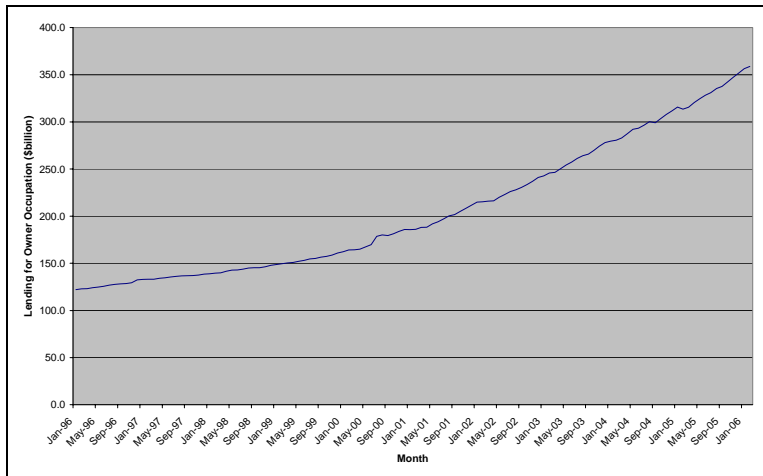
Such conclusions support the view that transport systems play a critical role in shaping household socio-economic opportunity in Australian cities. Given these spatial constraints, households on modest incomes may be prevented from expressing genuine choice of housing type, location or quality (Gleeson 2006).

The failure of metropolitan planning policy to provide high quality public transport services in new suburban areas is now exposing households in these areas to greater social and financial risk from rising fuel costs when compared to households that are better serviced and more centrally located. This problem is compounded by the emerging link between household mortgage costs and petrol prices.

### **Household debt and mortgage exposure**

A final dimension of household vulnerability to rising oil prices is the burden of housing debt. The cost of debt in Australia has remained historically low since the mid-1990s. During the past decade Australia has experienced the associated phenomenon of a sustained expansion in the levels of owner-occupied household loans (Figure 2) and a sustained increase in median house prices. These debt levels deserve note in any attempt to understand the present level of mortgage and oil vulnerability experienced by households in Australian cities.

Given the spatial patterns of car dependence and mortgage ownership described above, it seems relevant to understand the combined impact of rising mortgage and fuel costs on household financial vulnerability. Before presenting our mortgage vulnerability assessment, it is worth reviewing some existing patterns to identify the relationships these suggest. Unfortunately there is limited information available that depicts the levels of household debt relative to household income and urban location at a statistically comprehensive and detailed scale. Some patterns can be discerned however and these provide an indication of the potential risk to which Australian urban households are exposed from rising mortgage and fuel prices.

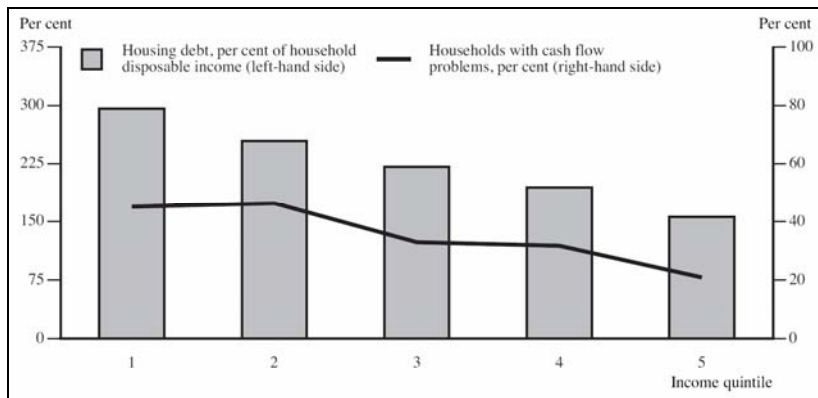


Source: Reserve Bank of Australia (2006, table D05)

**Figure 2 Lending for owner occupied house purchase in Australia, 1996-2006.**

A relative minority of Australian households are currently purchasing housing. In Australia in 2001 only 27.8 per cent of households were purchasing their dwelling while 41.7 per cent owned their home outright and 27.6 per cent were renting (Kennedy and Robertson 2003). These aggregate proportions, however mask some important dimensions. The spatial distribution of household mortgage debt burdens relative to household income levels is not well documented – a curious scholarly and policy oversight in a society that celebrates mortgage funded home ownership. There is a strong probability that while home purchasers constitute a minor proportion of households overall they may nonetheless comprise a higher proportion of households in certain urban sub-regions. This in turn implies that the socio-economic effects of rising fuel costs on home purchasers will also be unevenly distributed across Australian suburbs. Income differences also play a role in this spatially uneven distribution.

The distributional impact of mortgage pressures varies across Australian households. The RBA (2003) and La Cava and Simon (2005) have each reported that lower income households who are purchasing owner occupied housing tend to have higher levels of debt as a proportion of their income than higher income households (Figure 3). Average household housing debt as a proportion of income ranged between 200 per cent and 300 per cent for households in the lowest income quintiles in 2001 (2003). By comparison housing debt for households in the highest income quintiles was less than 200 per cent of household income. Of households with housing debt, those on lower incomes were also more likely to have financial difficulties than those on higher incomes (Figure 3). The data used in the RBA (2003) and La Cava and Simon (2005) studies is now dated. The relationships between household debt and income that these studies report may have shifted since the data were collected in 2001 and given marked subsequent house price inflation the trend is towards greater levels of household debt (Figure 2) and thus greater levels of exposure to mortgage and oil risks. This in turn has consequences for the mortgage and oil vulnerability of Australian cities.



Source: La Cava and Simon (2005, p.45).

**Figure 3 Housing debt as a proportion of household income for debtor households, 2001.**

Lower income households are, in general, more likely to obtain housing in lower cost outer and fringe areas than those on higher incomes. First home purchasers on modest incomes are consequently also more likely to locate in outer and fringe areas (Burnley *et al.* 1997) than higher income first home purchasers. These households are also likely to suffer high levels of car dependence that places them at higher financial risk from rising fuel prices.

The new policy relationship that is being drawn between rising fuel prices, interest rates and mortgage costs (RBA 2006) has significant implications for the socio-economic and financial circumstances of households within Australian cities. These implications are likely to be most pronounced for those most dependent on cheap fuel and who have the least disposable income with which to absorb rising petrol and debt servicing costs. Despite the discussion provided above we currently know little about the twin combination of car dependence and mortgage vulnerability and the socio-economic profile of households at the local scale. The specific distribution of oil and mortgage interest rise impacts is currently poorly understood beyond the broad spatially aggregated contours. If policy makers are to respond to address this exposure there is need for detailed empirical data that can illuminate the extent of this vulnerability. Given that the problems are inevitably also spatially expressed, it is essential that spatial analysis be undertaken to assess the distribution of such risks.

Part Three of this paper presents a new method for assessing household vulnerability to rising mortgage and petrol costs via an assessment methodology that we term the ‘vulnerability assessment for mortgage, petrol and inflation risks and expenditure’ (VAMPIRE). The following section sets out the basis for the VAMPIRE and presents our analysis and results.

## **Part Three – The VAMPIRE in the Australian city**

### **The VAMPIRE**

Our previous study (Dodson and Sipe 2005) sought to intervene in the growing public debate over petrol price rises by assessing socio-economic vulnerability to rising fuel costs. The VIPER index that we created in that study combined a basic indicator of car dependence with the ABS Socio-Economic Index For Areas (SEIFA) rating to create a combined socio-economic oil vulnerability index at the Census Collection District (CD) scale. This measure was not sensitive to either home purchase or income except to the extent that these factors are incorporated into SEIFA. For this analysis we have developed a similarly simple but comprehensive assessment method to look at household vulnerability to mortgage interest rate and oil price rises.

To assess the spatial vulnerability of households to the combined impact of increasing mortgage and petrol costs we have developed the ‘Vulnerability Assessment for Mortgage, Petrol and Inflation Risks and Expenditure’ (VAMPIRE). This method combines the car dependence indicator developed in the VIPER with income and mortgage data. The resulting spatial index identifies the exposure of urban localities to rising mortgage and petrol expenses. The VAMPIRE is a simple and easily constructed method of assessing spatial mortgage and oil vulnerability at a fine level of spatial resolution. We are not aware of any other statistical dataset that can provide this level of spatial resolution on this issue. While the reliance on 2001 data is a limitation, our assumption is that the spatial patterns of car dependence and mortgage tenure have not significantly shifted over the past five years. Although car dependence and household housing debt trends described in Part Two of this paper may have become more extreme during this period.

### **Constructing the VAMPIRE index**

The VAMPIRE index is constructed from four indicator variables obtained from the 2001 ABS Census that are combined to provide a composite mortgage vulnerability index that can be mapped at the geographic level of the Collection District (CD). The VAMPIRE therefore assesses the average vulnerability of households within the CD rather than indicating the specific vulnerability of particular households. The variables used are:

Car dependence:

- Proportion of those working who undertook a journey to work (JTW) by car (either as a driver or passenger)
- Proportion of households with 2 or more cars

Income level:


- Median weekly household income

Mortgages:

- Proportion of dwelling units that are being purchased (either through a mortgage or a rent/buy scheme)

The use of these variables merits some explanation. The first two variables indicate the extent of car dependence for urban travel as used in our VIPER study (Dodson and Sipe 2005). The JTW (journey to work) figure provides a basic indicator of demand for automobile travel while the proportion of motor vehicles per household indicates the extent of household investment, and thus dependence, on motor vehicle travel. Together these variables provide an indicator of the extent to which households are exposed to rising costs of urban travel.

The mortgage variable represents the prevalence of mortgage tenure and accordingly household exposure to interest rate rises within a locality. The income variable is used to measure the financial capacity of the locality to absorb fuel and general price increases. Together these four variables provide a basic but comprehensive spatial representation of household mortgage and oil vulnerability.

The VAMPIRE index was constructed by combining the four variables in the following way. As with VIPER we have weighted the variable combinations according to car dependence, income and mortgage by assigning an index score according to the percentiles shown in Table 3. High levels of car ownership, JTW by car and mortgage tenure received high index values while low levels of household incomes received lower scores. Thus a CD with high levels of car ownership, JTW by car, income and mortgages would receive a score of 15 (5+5+0+5) as shown in Table .

The four variables we have selected are not equal in their contribution to VAMPIRE. The variables have been weighted according to their proportional contribution to the overall VAMPIRE score (table 3). Thus of a total possible VAMPIRE score of 30, five points are provided by each of the car ownership and JTW variables while ten points each are provided by the income and mortgage scores.

**Table 2: Value assignment relative to Census District percentile for VAMPIRE.**

Percentile	Value Assigned			
	<i>Car own <math>\geq 2</math></i>	<i>JTW by car</i>	<i>Income</i>	<i>Mortgage</i>
<b>100</b>	5	5	0	5
<b>90</b>	4	4	1	4
<b>75</b>	3	3	2	3
<b>50</b>	2	2	3	2
<b>25</b>	1	1	4	1
<b>10</b>	0	0	5	0

Thematic maps were then created for five major Australian cities (Brisbane, Gold Coast, Sydney, Melbourne and Perth) based on the ABS definition of the urban area and shaded for consistency in terms of VAMPIRE categories (Table 4). The results of the mapping are presented in Figures 4 to 8 below.

**Table 3: Variable weighting for VAMPIRE**

Indicator	Proportion of households with $\geq$ two cars	Proportion of work trips by car	Income level	Proportion of households with a mortgage
Potential points:	5	5	10	10
Weighting:	33.3%		33.3%	33.3%

**Table 4: Assignment of VAMPIRE ratings to map shadings.**

VAMPIRE value:	1 to <10	10 to <15	15 to <17	17 to <19	19 to $\leq$ 22
Shading:					

## The results of the VAMPIRE

### *Brisbane*

The geography of the greater Brisbane urban area is comprised of a large core area from which four broad growth corridors extend north, west, south and east. The VAMPIRE results for Brisbane (Figure 4) demonstrate a wide variation in mortgage oil vulnerability levels between CDs within the metropolitan region. The central area of Brisbane immediately surrounding the CBD exhibits the highest concentration of low vulnerability localities within the metropolitan area. Suburbs within this area, such as Toowong, Paddington, Spring Hill, New Farm, West End and parts of Kangaroo Point and Woolloongabba received comparatively low or moderate VAMPIRE scores of between 1 and 15. Other areas with low or moderate VAMPIRE scores were dispersed throughout the middle suburbs mostly within 15 km of the CBD. The middle suburbs of Brisbane also display some variation in vulnerability with a mix of moderate scores in such areas as Cannon Hill, Carindale, Holland Park, and Moorooka.

High mortgage and oil vulnerability scores were found in many middle, outer and fringe suburban localities. The highest VAMPIRE levels were found predominantly in the outer growth corridors – towards Caboolture to the north, Ipswich to the west, Beenleigh to the south and Cleveland to the east. Each of these corridors contains many CDs with VAMPIRE scores above 17, indicating high levels of mortgage and oil vulnerability. Particularly high concentrations of high vulnerability localities exist in the eastern Caboolture corridor, around Capalaba in the east, Beenleigh and Parkinson in the south. The overall picture is of broad tracts of outer suburban locations exhibiting high levels of mortgage and oil vulnerability. There are some very small pockets of moderate mortgage and oil vulnerability in outer areas at Redcliffe in the north east, at Cleveland in the south and near central Ipswich. These however are rare relative to the broad tracts of highly vulnerable densely mortgaged residential areas within the growth corridors.



Can any relationship to travel modes be discerned, beyond the car dependence variables contained within VAMPIRE? It appears that the availability of public transport is a moderate guarantor of lower mortgage oil vulnerability. Middle-suburban localities within 15 km of the CBD demonstrate lower mortgage and oil vulnerability than those further out. These areas of the Brisbane metropolitan area exhibit the best public transport services, in particular the bus services operated by Brisbane City Council. Some specific outer suburban moderate vulnerability areas are also located close to good public transport, such as parts of the Ipswich, Beenleigh and Cleveland. The overall picture provided by Brisbane is of a graduated spatial divide between the inner and middle areas with higher quality public transport exhibiting lower mortgage and oil vulnerability than those in the more dispersed and poorly served outer suburban locations. Outer suburban and fringe areas where public transport is poor are clearly most vulnerable to the impacts of rising fuel and mortgage costs.

### *Gold Coast*

The urban geography of the Gold Coast is broadly linear, with a relatively dense strip of activities stretching north-south along the coastline. The Gold Coast is highly dispersed and does not contain a well-defined CBD. The densest concentration of employment is at Surfers Paradise situated at the mid northeast of the coastal strip. While there are some further, although weaker, concentrations of activity at Southport, Burleigh, Nerang and Robina, much of the Gold Coast displays a dispersed urban form and activity structure.

Mortgage and oil vulnerability is clearly spatially patterned within the Gold Coast (Figure 5). The clearest pattern is for lower vulnerability to be distributed along the eastern coastal strip with concentrations at Southport, Surfers Paradise and Broadbeach, while highest vulnerability is predominantly distributed to the west of the Pacific Highway and rail line, particularly at Coomera in the northwest, Nerang and Mudgeeraba in the west and Tugun in the south. Some pockets of low vulnerability are apparent in the middle suburban strip of the Gold Coast, in such localities as Robina and Clear Island although these areas also exhibit concentrations of high mortgage oil vulnerability, such as at Varsity Lakes and Mermaid Waters.

As in the other Australian cities we have examined, the distribution of mortgage and oil vulnerability on the Gold Coast appears to be closely linked to the land market and to the quality of the public transport system. The lowest vulnerability areas are concentrated around the highest quality public transport services on the Gold Coast which ply the Gold Coast Highway adjacent to the eastern seaboard. The quality of these services appears to be reducing oil vulnerability between Southport and Burleigh and even to Coollangatta. Conversely, those areas with poor public transport and relatively higher concentrations of mortgagee households are predominantly located in new growth areas west of the Pacific Highway, particularly at Coomera and Nerang. These areas display high levels of mortgage and oil vulnerability. Mortgage and oil vulnerability is clearly spatially differentiated on the Gold Coast with 'outer' western areas most at risk from the combined impact of rising fuel and mortgage costs.

## *Sydney*

Sydney is structured around a central business district that is situated to the mid-south of the Sydney harbour. The urban area surrounding the CBD is extensive, and extends far to the north, west and south. Two urban corridors extend northwest and southwest. As with Brisbane, Sydney's urban geography is strongly patterned in terms of mortgage and oil vulnerability, as revealed by our analysis (Figure 6). Two broad areas display low or moderate levels of vulnerability. These include an area broadly described as inner northern Sydney that extends from the harbour mouth in the inner northeast to a broad area from north of the CBD to Hornsby in the north. A further area of low vulnerability is apparent around and to the east of the Sydney CBD and this area also extends through the suburbs approximately 15 km south and west of the CBD. The highest concentration of low vulnerability is immediately around the Sydney CBD and North Sydney.

Higher levels of mortgage and oil vulnerability are found in areas beyond 20 km from the Sydney CBD to the north, south and in particular to the west. This effect is particularly pronounced in the greater western Sydney region, from Baulkham Hills in the north of this region to Sutherland in the south, Camden in the southwest and Glenmore in the north western corridor. Sydney's most concentrated areas of mortgage and oil vulnerability are located in the outer western region and include Rouse Hill in the north, Glenmore Park and Erskine Park in the northwest corridor, Horningsea Park in the mid west and Narrelen and Harrington Park in the southwest. A higher proportion of households in these locations are likely to be at high social and financial risk from fuel and mortgage and price increases than elsewhere in the Sydney region.

Some particular patterns of mortgage and oil vulnerability in Sydney deserve mention in relation to the public transport network. The heavy rail system appears to confer some advantage to a number of areas within Sydney. This includes a broad swathe of suburbs along the northern Sydney rail line from north Sydney to Hornsby. Even within the generally vulnerable western Sydney region some relatively low vulnerability localities can be discerned. These appear to be clustered around major rail nodes, including Parramatta, Fairfield, Cabramatta and Liverpool, but also to some extent Blacktown, Penrith and Campbelltown (Figure 6). Similar effects are apparent in the middle-western localities of Bankstown, Regents Park and Auburn. While we have not directly calculated the role of public transport in this study, and tenure effects may be implicated in this pattern, a preliminary assessment suggests that proximity to a major rail node seems to offer western and outer Sydney suburbs some protection from the social and financial risk associated with rising fuel and mortgage costs.

## *Melbourne*

Melbourne's urban geography is generally structured as an extensive urban area from which a number of weakly defined urban corridors extend outwards. The VAMPIRE for Melbourne demonstrates the metropolitan area is spatially variegated in terms of mortgage and oil vulnerability (Figure 7). Localities that score the lowest on the VAMPIRE are concentrated in close proximity to the Melbourne CBD and extend to the east and north of

this area, such as in Fitzroy, Carlton, Kew, Hawthorn and Toorak. Areas of highest mortgage and oil vulnerability in Melbourne are concentrated in outer and fringe suburban areas and are distributed around almost the entire perimeter of the metropolitan area. A number of highly vulnerable areas appear to be associated with Melbourne's outer urban growth corridors. These include Werribee in the southwest, Melton East and Hume in the northwest, and South Morang in the north. In the northeast and southeast these areas include Ringwood and Lilydale, Knox, Rowville, Casey, Berwick and Frankston. Some areas scored particularly highly on VAMPIRE. These include many new housing estates, such as Caroline Springs and Hillside in the Melton East growth corridor and areas such as Narre Warren and Berwick in the Casey growth corridor.

The middle areas between the Melbourne's inner city and the outer suburbs demonstrate considerable VAMPIRE variation although some patterns can be discerned within these areas. The influence of the major rail lines is apparent in Melbourne's middle-outer east, with lower vulnerability localities strung along the Lilydale, Glen Waverly, Dandenong and Frankston rail lines. Similar patterns are present along the Sydenham, Broadmeadows and Upfield rail lines in the outer west. The clearest examples of this pattern are observed at Dandenong, Springvale and Clayton which exhibit large clusters of low mortgage and oil vulnerability localities. Income and tenure effects are no doubt playing a role here, but it is notable that the public transport system appears to be contributing to higher mortgage and oil resilience in those immediate areas where it is of higher quality. In the inner eastern suburbs, it seems that the high density of rail, tram and bus routes in this area is placing these areas at relatively lower mortgage and oil risk when compared to outer and fringe areas. As with Sydney and Brisbane, public transport systems appear to be playing a critical role in ameliorating mortgage and oil vulnerability in Melbourne.

### *Perth*

Perth's urban geography is structured around a CBD surrounded by an extensive urban area from which a number of growth corridors extend to the north, east and south. As with other Australian cities, mortgage and oil vulnerability as measured by the VAMPIRE is unevenly distributed throughout the Perth metropolitan area. Areas of lowest vulnerability are concentrated immediately adjacent to the Perth CBD and this concentration extends eastwards through Subiaco to Mount Claremont. The middle-ring suburbs of Perth which extend in a broad arc from Fremantle in the southeast to Cloverdale in the east and to Scarborough in the northwest display a mix of mortgage and oil vulnerability levels. Within this area a number of localities received moderately low VAMPIRE scores, but a comparable, and marginally greater number received moderately high scores. These areas include the localities of Scarborough, Bedford and Lynwood.

The areas of Perth that demonstrated the highest concentration of high VAMPIRE scores were found in a broad arc of outer and fringe areas including most of the growth corridors. Within this arc of generally high mortgage and oil vulnerability were concentrations that deserve mention. These include Merriwa, Kinross, Joondalup, and Wannaroo in the north, Marangaroo and Beechbro in the north-east, Janebrook, Greenmount, High Wycombe, Forest Field in the east and Armadale, Huntingdale, Success, Munster and Yangebup in the southeast and south.

While the influence of public transport on the levels of mortgage and oil vulnerability in Perth are difficult to discern, there does appear to be some effect arising from the availability of public transport services. The best example of this phenomenon is the corridor between the CBD and Janebrook-Greenmount where a number of low mortgage and oil vulnerability localities are observed. Such an effect is also apparent, although less marked in the Armadale and Joondalup corridors. The greater availability of public transport in the middle suburban areas is also likely contributing to relatively lower, albeit uneven, levels of mortgage and oil vulnerability in these localities. This may be due to the greater capacity for circumferential work journeys provided by public transport services in these areas..

## **Population distribution of VAMPIRE**

This study has focused primarily on identifying the spatial distribution of mortgage and oil vulnerability within Australian cities. The maps we have generated provide a detailed depiction of this distribution. However they provide little indication of the population numbers at risk. Therefore, we have enumerated the number of persons residing within areas for each of the VAMPIRE index categories for Brisbane, Gold Coast, Sydney, Melbourne and Perth (Figures 8 to 10). These figures provide greater appreciation of the scale of impact in terms of the numbers of urban residents who may be affected by mortgage and oil vulnerability and the degree of impact increased fuel costs will have for these groups. It should be noted that the figures cannot be used for inter-city comparisons – VAMPIRE measures relative, not absolute mortgage vulnerability meaning it can be used for comparative assessments of localities within, but not between cities.

The enumeration includes all residents of a given CD and many households may not be exposed to specifically mortgage vulnerability. A higher VAMPIRE rating indicates a higher proportion of households with mortgages, so there is greater likelihood of a resident of a high VAMPIRE CD being a member of a household with a mortgage. The higher VAMPIRE ratings therefore are likely to have greater indicative power than lower ratings.

### *Brisbane*

Brisbane's population is normally distributed among the VAMPIRE categories and presents a clear 'bell curve'. The highest proportion (25 per cent) of Brisbane's population resided in VAMPIRE category 17. The two next lowest VAMPIRE categories contained a further third (33.3 per cent) of Brisbane's population while VAMPIRE categories 18 and 19 contained 22.6 per cent. Together these five categories accounted for eighty per cent of Brisbane's population. The population of Brisbane is structured around the centre of the VAMPIRE scale. Very few of Brisbane's residents live in low or high mortgage and oil vulnerability localities. However a clear majority (84.5 per cent) reside within localities that recorded VAMPIRE scores of 15 or greater.

VAMPIRE reflects car dependence, income level and mortgage exposure of localities. While it is not possible to link higher VAMPIRE levels to a direct impact on households'

circumstances, the results for Brisbane suggest a substantial proportion of the population may be affected by mortgage and oil vulnerability.

### *Gold Coast*

The VAMPIRE rating within which the highest proportion of Gold Coast residents reside is 18 which equates to 18.8 per cent or 70,749 persons. While this is to the higher end of the VAMPIRE scale, very few people are located in areas with a higher rating. Only 3.1 per cent of the Gold Coast population lived in areas with a VAMPIRE score of 19 or more. Many, however, were located in moderate VAMPIRE categories. Thus 48 per cent were located in areas rated between 16 and 18. A bare majority were located in areas rated 15 or less on the VAMPIRE scale, equal to 194,773 persons. This majority was clustered around the low moderate VAMPIRE scores, with only 6.7 per cent of the total population located in areas with a rating of 10 or less. Mortgage vulnerability on the Gold Coast is thus distributed unevenly among the population while the majority of the population is located in areas with moderate mortgage vulnerability.

### *Sydney*

Sydney's population exhibits a normal distribution although this is somewhat uneven. The modal VAMPIRE category for Sydney is 15, representing 18.1 per cent of the city's population or 633,332 persons in 2001. The two next highest population VAMPIRE categories (13 and 14) are lower than this level and together contain 18.3 per cent of the Sydney population, or 991,578 persons. The total proportion of Sydney's population living in VAMPIRE categories of 15 or below is 58 per cent. The majority of Sydney's population is therefore overwhelmingly located in moderate or low VAMPIRE categories.

The majority of those within high VAMPIRE rating locations are situated in the categories of 15 to 17. The population in these areas comprise 37.3 per cent of Sydney's total population, equivalent to 1.3 million persons, whereas those in categories 18-30 make up only 4.8 per cent of the total population, which is just under 167,000 residents. There were also few households in either the very low or very high VAMPIRE categories for Sydney. Only 12 per cent of Sydney's population resided in VAMPIRE categories of 1-10 or 20-30. Overall Sydney's population tends toward the low-moderate level of mortgage and oil vulnerability.

### *Melbourne*

Melbourne's VAMPIRE distribution also follows a generally normal distribution that is centred on the middle of the VAMPIRE scale. The highest proportion of the Melbourne population in a single VAMPIRE category was the 19.8 per cent of residents (636,548 persons) whose locality received a mortgage and oil vulnerability rating of 15. Melbourne's population was marginally more likely to be situated in a locality with a low-moderate

VAMPIRE rating of between 0 and 15 (52.7 percent) than in a moderate-high VAMPIRE locality of 16 to 30 (47.3 percent).

### *Perth*

The distribution of Perth's population between VAMPIRE categories is comparable to that for Brisbane and to some extent Melbourne, although the total population numbers differ. The VAMPIRE category within which the most Perth residents were located was 17, equating to 243,209 persons. Perth residents were more likely to be located in a locality that scored a high VAMPIRE rating with 68.6 per cent situated in categories 16 or above, equating to 806,898 persons. Of Perth's total population of 1,176,541 only 31.4 per cent or 369,643 were situated in VAMPIRE categories 15 or less.

### **Comparison with VIPER results**

In our previous paper we examined the distribution of spatial socio-economic oil vulnerability to rising fuel prices (Dodson and Sipe 2005). The VIPER index constructed for that study emphasised socio-economic status in combination with car dependence to assess oil vulnerability. The current study focuses specifically on the spatial distribution of mortgage and oil vulnerability which is based on income and mortgage tenure rather than socio-economic status. It is worth briefly revisiting the earlier study to identify how the patterns of mortgage and oil vulnerability differ from socio-economic oil vulnerability in Australian cities.

The VIPER study examined only Brisbane, Sydney and Melbourne. In Brisbane, high VIPER ratings were recorded in the outer and fringe areas of the growth corridors. These were quite concentrated however such as around Deception Bay and Caboolture in the north, Logan in the south and parts of the Ipswich corridor in the west. Under VAMPIRE a much broader and deeper pattern of vulnerability is apparent when compared to the VIPER study. High VAMPIRE scores predominate across almost the entire northern, eastern, western and southern growth corridors of Brisbane and are apparent to a much greater extent in middle suburban localities within 15 km of the CBD. Clearly, the VAMPIRE represents a different, albeit more spatially extensive, phenomenon than VIPER.

Similar patterns are apparent in Sydney and Melbourne. While VIPER demonstrated concentrations of socio-economic vulnerability in western Sydney centres such as Penrith and around Liverpool, the VAMPIRE shows that mortgage vulnerability is more likely to be concentrated in fringe and growth corridor areas. In Melbourne, the VIPER identified concentrations of socio-economic in the outer-middle industrial areas such as Sunshine, Thomastown and Dandenong. Under VAMPIRE these areas appear less immediately vulnerable. In Melbourne it is the broad tract of peripheral new suburbs beyond the older established areas that are at greatest mortgage risk. That the VIPER and VAMPIRE display different patterns of vulnerability suggests that they are representing different socio-spatial phenomena.

One clear similarity between VIPER and VAMPIRE is the consistently low levels of socio-economic and mortgage vulnerability apparent in the inner and inner-middle suburban regions of Australian cities. In Brisbane, Sydney and Melbourne, the lowest vulnerability scores are concentrated around the CBD. While socio-economic status, mortgage tenure and car dependence vary across Australian metropolitan areas, it is in the CBD and immediately adjacent areas where the greatest extent of coincidence of high socio-economic status (including high incomes) and low car dependence are found. VIPER and VAMPIRE indicate that households that are situated in central and inner areas of Australian cities have the least socio-economic or mortgage risk. This observation should raise serious questions for urban policy makers about the equity of urban policies, given the potential for further increases in petrol prices.

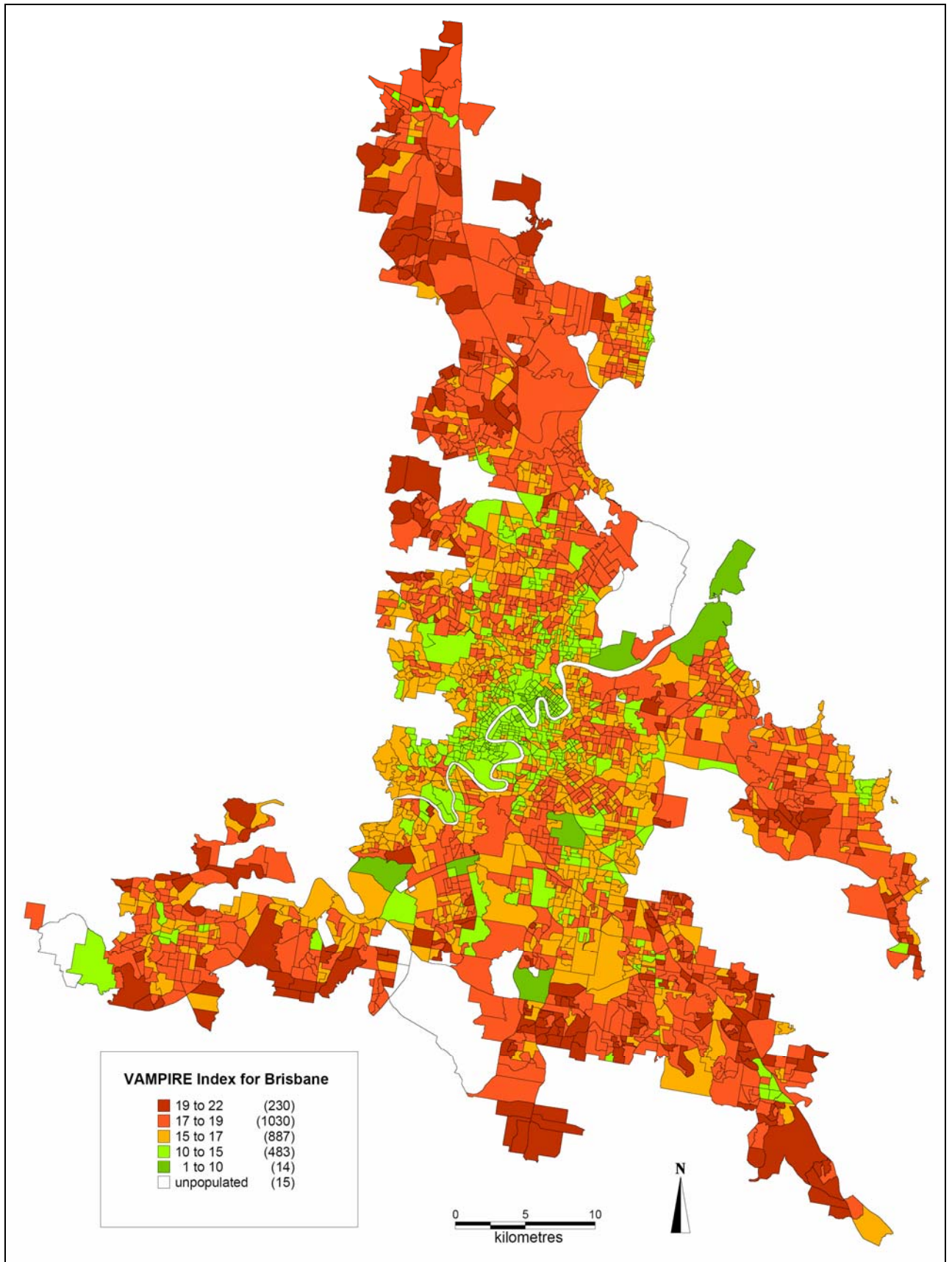


Figure 4 Mortgage and oil vulnerability in Brisbane



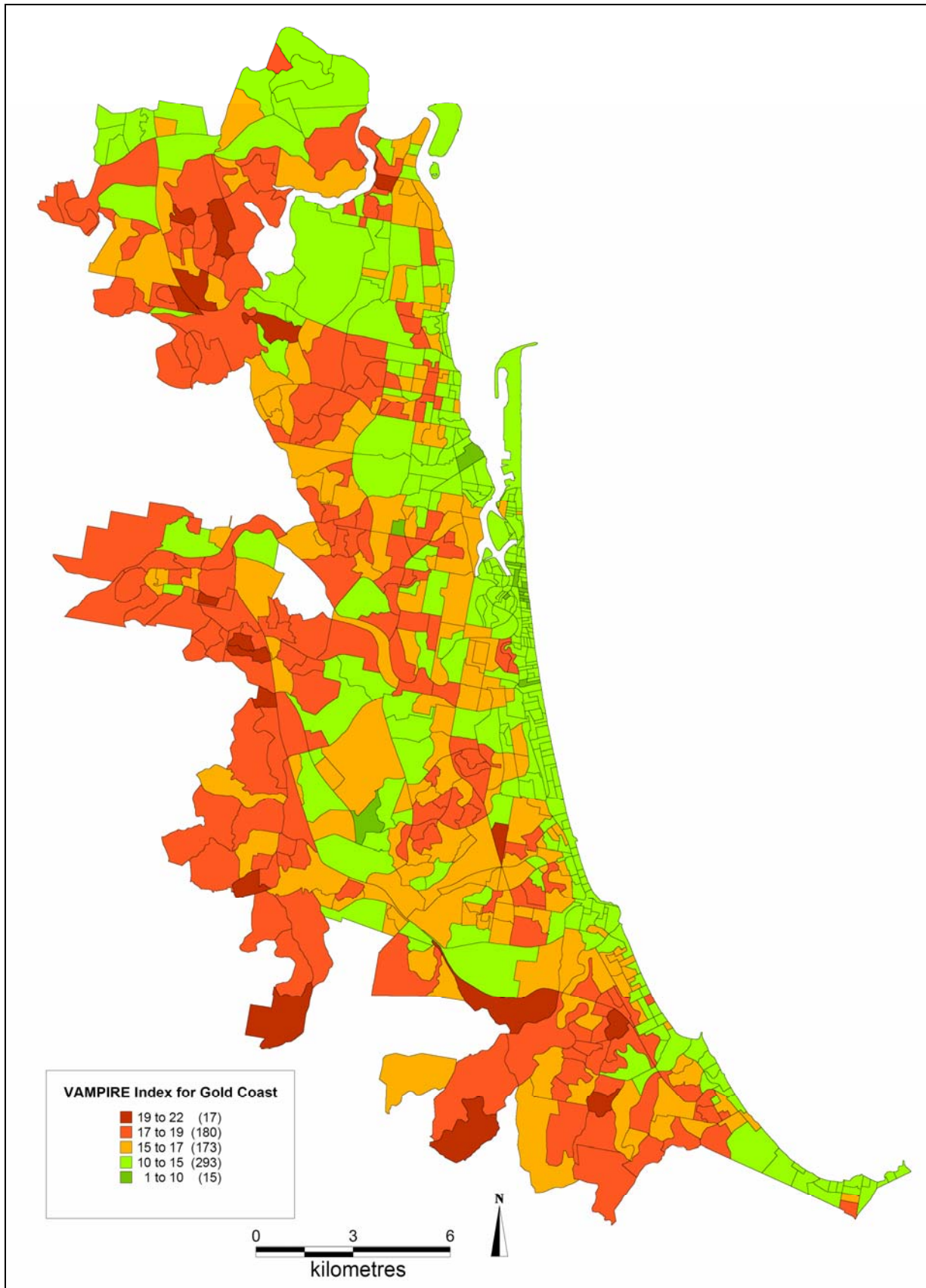


Figure 5 Mortgage and oil vulnerability in the Gold Coast

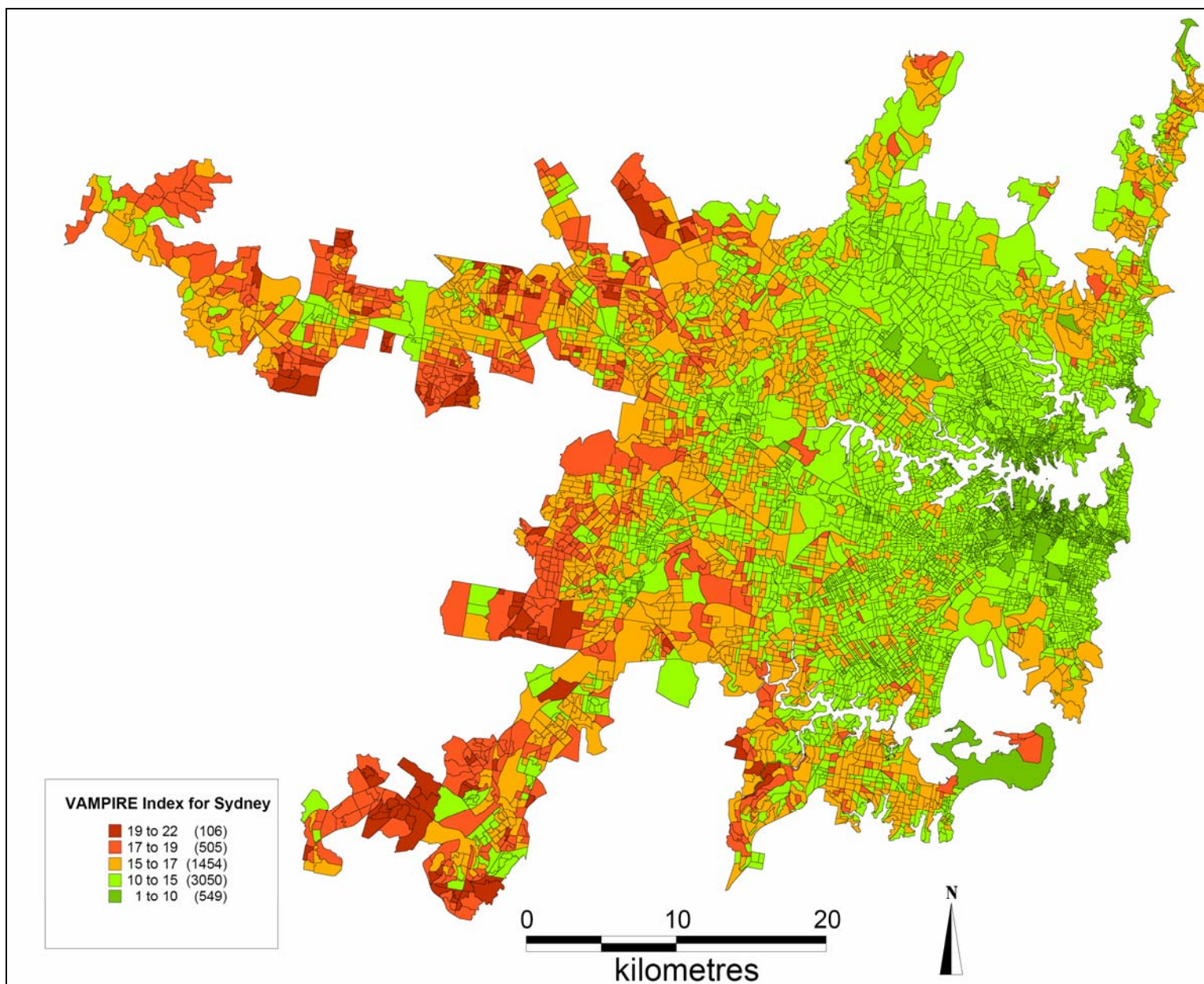


Figure 6 Mortgage and oil vulnerability in Sydney

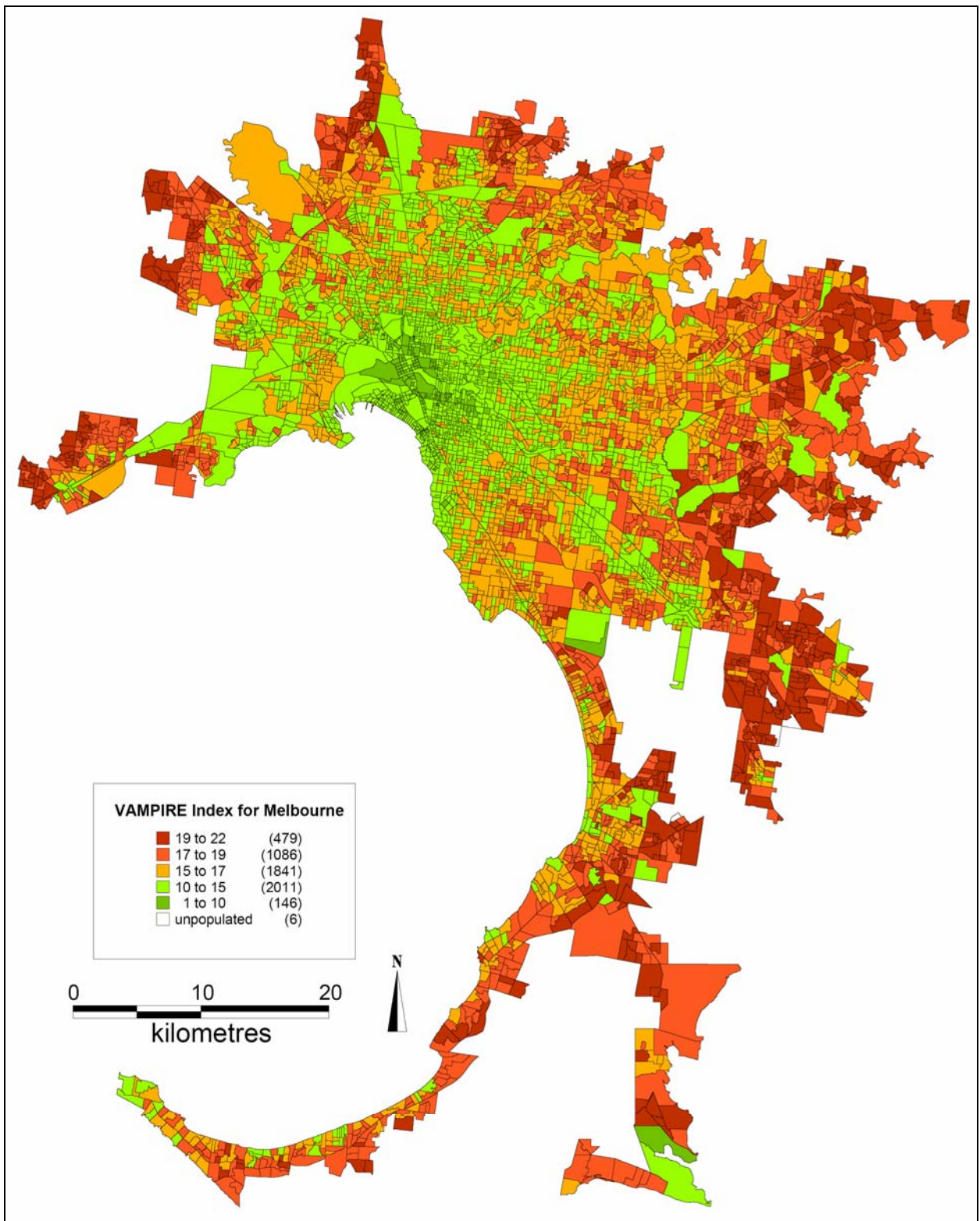


Figure 7 Mortgage and oil vulnerability in Melbourne



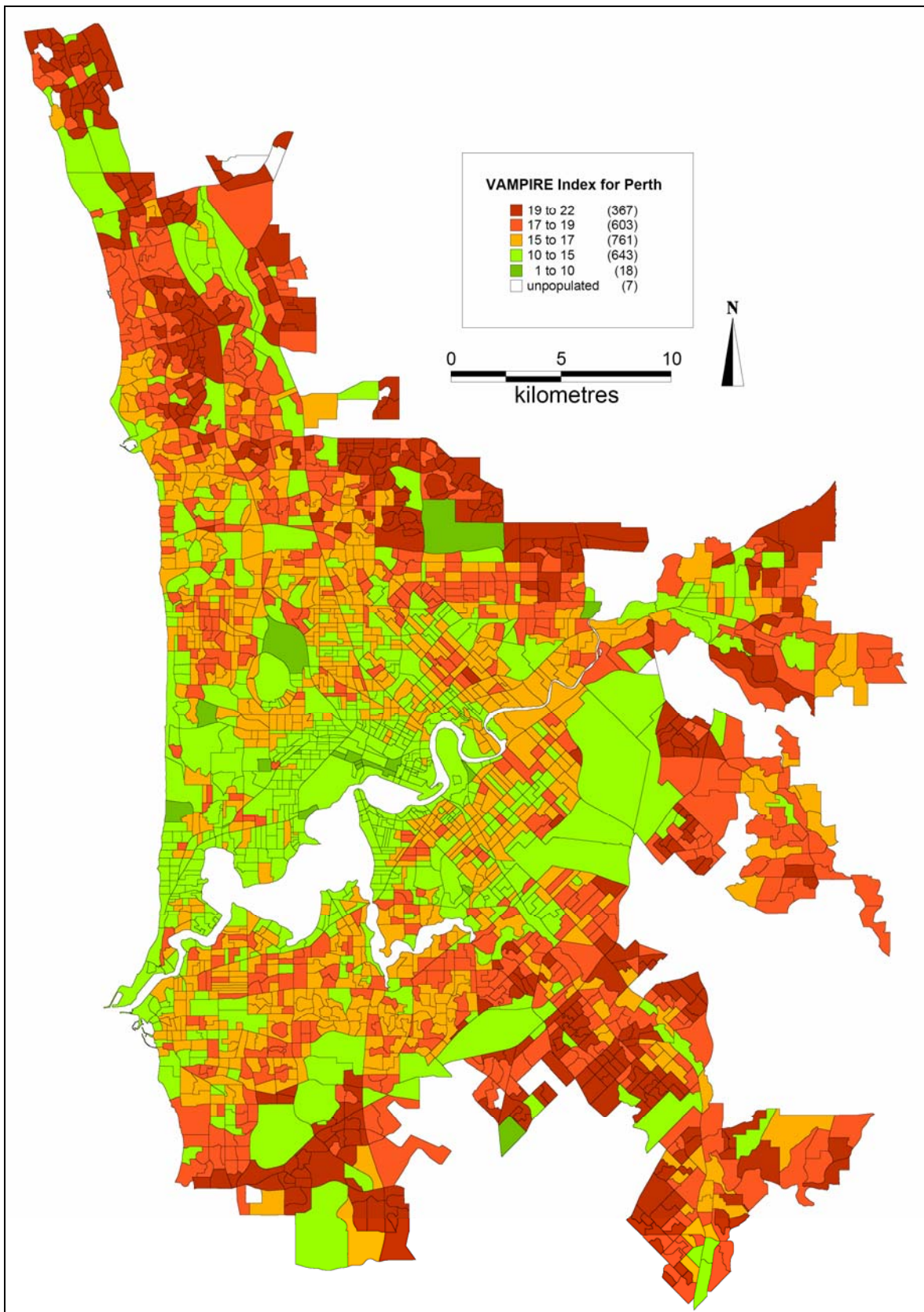


Figure 8 Mortgage and oil vulnerability in Perth

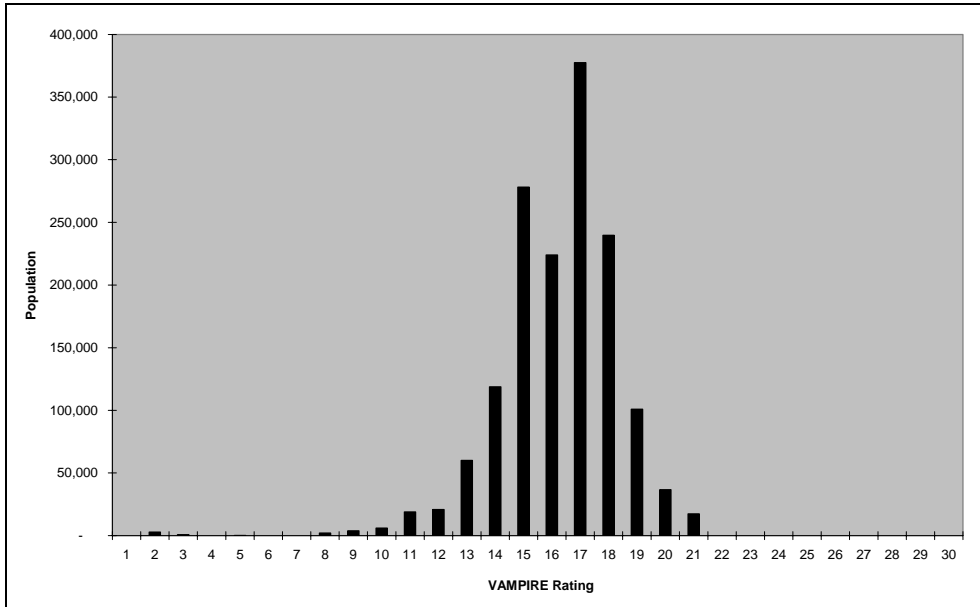


Figure 9: VAMPIRE distribution for Brisbane

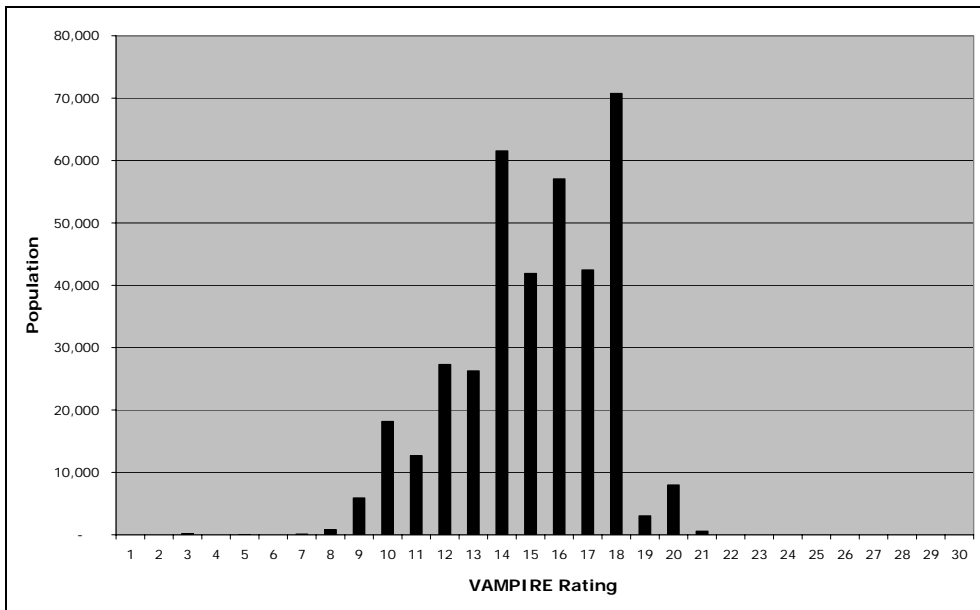


Figure 10: VAMPIRE rating for the Gold Coast

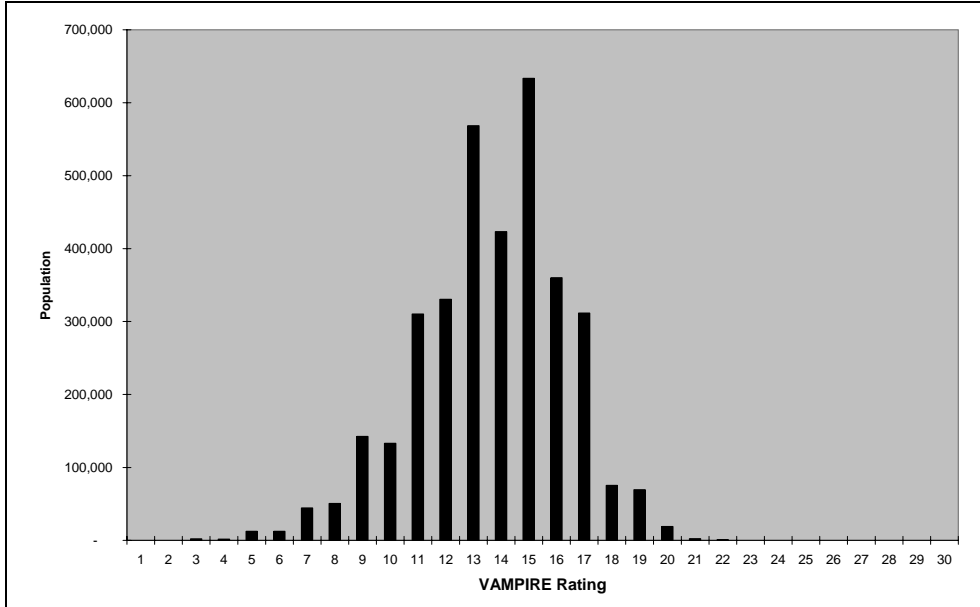


Figure 11: VAMPIRE rating for Sydney

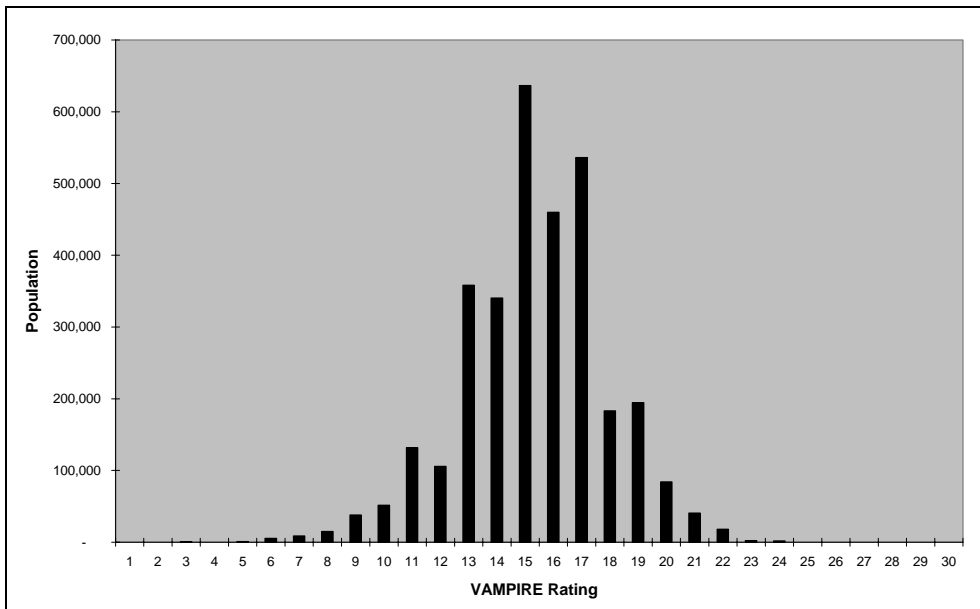
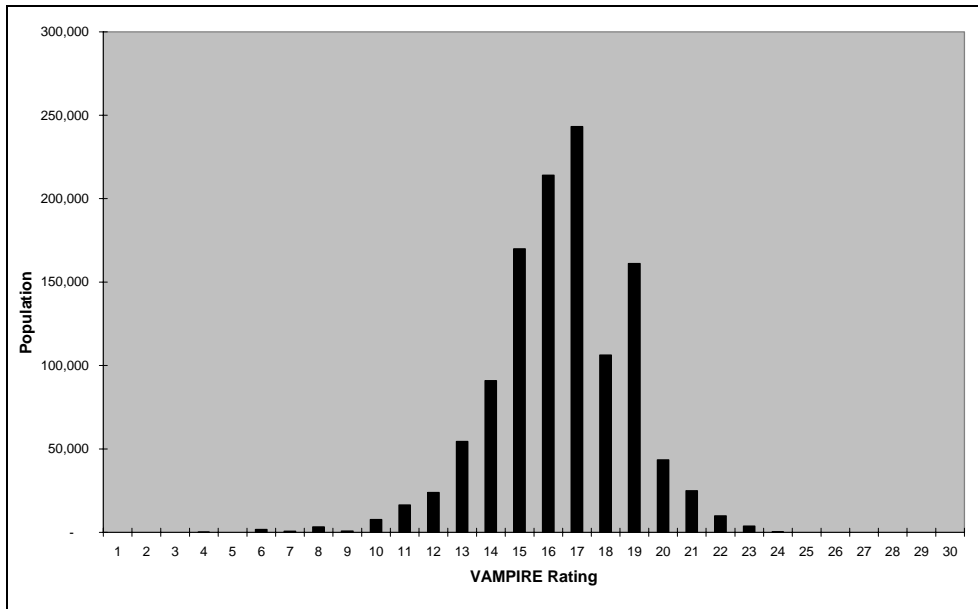


Figure 12: VAMPIRE rating for Melbourne



**Figure 13: VAMPIRE rating for Perth**

### **Opportunities for improving VAMPIRE**

As with the VIPER index created to assess socio-economic oil vulnerability in Australian cities (Dodson and Sipe 2005), the VAMPIRE index is a relative indicator of mortgage and oil vulnerability rather than providing a definitive evaluation of the specific impact that rising fuel and home purchase costs may herald for households in any given locality. It is possible that within any particular locality that those households with high car dependence are different from those households with mortgages. But as the proportions of households in each category increases within a given area, so too does the probability of households within that area experiencing combined high levels of these categories. For this reason the VAMPIRE provides a strong indicator of the likely extent of combined oil and mortgage dependency for localities in the cities examined. In the absence of a better dataset that can provide more detailed information on the costs of home purchase and private transport relative to income levels at the level of the individual household the VAMPIRE remains the best estimate currently available.

## **Part Four – Conclusions and policy responses**

Petrol prices have been gradually rising for almost two years and are now far above the levels to which households have been accustomed during recent decades. Policy makers are beginning to respond to the impacts on households that are arising from high petrol costs. The main Federal government response to date has been to raise interest rates to counter inflationary pressures due to rising fuel costs, combined with cuts to tax rates and thresholds to reduce the tax burden on household income. Neither of these policy directions is sustainable over the medium term if the current levels of economic growth and government services provision are to be maintained. Raising interest rates to counter fuel price inflation risks dampening business investment while raising the cost of home purchase and eroding household discretionary spending. Reducing tax during uncertain economic conditions may result in reduced government revenue and may threaten the sustained provision of government services. Clearly alternative policy strategies are required. Given the overwhelmingly spatial character of mortgage and oil vulnerability, any policy responses must have a deliberate spatial expression. The remainder of this paper discusses various policy alternatives and their potential to relieve mortgage and oil vulnerability. This section also advocates for greater attention to the spatial and service dimensions of mortgage and oil vulnerability in the formulation of responsive urban policy.

### **Tax cuts**

A number of commentators, including the Prime Minister, have suggested that cuts to Federal government taxes offer a method of providing suburban households with respite from the financial impacts of rising fuel prices. Fuel excise has received direct attention but as our discussion has noted the recent Budget reductions to personal tax rates and thresholds were also intended to indirectly reduce household budget pressures arising from increased fuel costs.

Reductions in fuel excise tax are considered to have some merit by observers because these are seen to directly affect the consumer price of petrol (Fielding 2006; McRann 2006). Reductions in the excise, it is argued, would produce reductions in the price of fuel at the pump. However in conditions of uneasy oil it seems appropriate to consider what the likely behavioural response to rising fuel costs may be and the extent to which the excise reduction could be targeted to households with the highest levels of car dependence. For those on very low incomes a reduction in the fuel excise might produce some financial respite. However for those on high incomes who are under less pressure from high fuel prices the reduction in fuel excise would be of limited benefit. Unless the excise cut was very large it would have marginal impact on lower income households budgets but would result in a substantial reduction in aggregate government revenue. Reductions in fuel excise would lead to a reduction in this revenue stream at a time when fuel consumption levels are already declining (Commonwealth Bank Research 2006). Signals to date suggest that the Federal Government considers this approach unfeasible with Prime Minister John Howard describing as “mickey mouse” (Howard 2006) such a mode of providing to fuel price relief.



At present, the Federal government considers cuts to personal tax rates as the preferred method of reducing the impact of high fuel prices on households. The Prime Minister has claimed that “the tax cuts are the best way of helping people cope with high petrol prices” (Howard 2006). The 2006 Budget provided for \$36.7 billion in personal tax cuts over four years comprising changes to tax rates and thresholds. The tax cuts are expected to provide annual tax savings of \$365 for those earning up to \$20,000, \$510 for those earning between \$40,000 and \$60,000 and \$2,700 for those earning \$100,000 (Franklin and Hays 2006). If these tax cuts are genuinely intended to relieve the pressure of fuel price increases on households’ budgets, it is worth contemplating their spatial distribution in terms of the social structure of our cities and relative to car dependence. Will the tax cuts tend to support highly car dependent households with low incomes and mortgages ahead of other groups? While we have not assessed this question directly, the VAMPIRE assists in identifying those areas that will gain the most from the 2006 Budget tax reductions and whether this will reduce mortgage and oil vulnerability.

The 2006 Budget tax cuts give the largest absolute tax savings to those on the highest incomes. But the VAMPIRE has demonstrated that those who have the highest incomes are generally located within areas of Australian cities that already exhibit low or modest levels of mortgage and oil vulnerability. By comparison, those on modest incomes in the most car dependent outer and fringe locations are likely to receive relatively minor personal tax savings. The tax cuts are thus likely to be highly spatially regressive when considered through the lens of the VAMPIRE. Accordingly, such tax cuts risk exacerbating the socio-spatial divisions that are emerging in the Australian cities as a result of mortgage and oil vulnerability. They are also unsustainable over the medium and longer term if petrol prices were to rise further. Unless a more spatially equitable model of tax changes could be constructed, personal tax cuts appear to be an inadequate means of responding to rising fuel costs and the pressures of mortgage tenure in Australian suburbs.

## **Magic fuels**

The main policy alternatives to direct manipulation of net household incomes so far have been linked to the transport energy sector. There has been some policy discussion of the imperative for research and analysis into the potential for combining alternative fuels with new technology for use in urban transport. Ethanol and hydrogen have been identified as potential substitutes for petroleum as a motor vehicle fuel. The Labor party’s ‘Australian Fuels Blueprint’ is an example of this type of policy proposal. More recently, Prime Minister Howard has established an inquiry into nuclear energy as a solution to nation’s energy supply problems.

There remains considerable uncertainty about the viability of these putative alternatives. What is certain is that considerable investment into research on alternative fuels would be required over a long period to realise any results. There is no guarantee that this effort would be rewarded with either cheap or useable fuels. Gambling on unproven fuels and technologies seems risky given that there are proven ‘old technology’ alternatives, such as public transport, presently available.

## **Building a way out**

Some urban transport policy responses to rising fuel costs that have been proposed by state governments and that have gained support from motoring agencies involve expanding road capacity (Garnaut and Baker 2006). It is difficult to comprehend how roads will reduce the cost of travel for outer suburban households resulting from rising fuel costs. One argument suggests that a reduction in road congestion will result in a reduction in fuel consumption, but this contention has been proven erroneous at the metropolitan scale (Newman and Kenworthy 1988). The claim that congestion can be reduced through road expansion is inaccurate and the proposition that constructing new roads will assist households to reduce their fuel consumption is fanciful.

Roads are expensive and carry a high opportunity cost in diverting scarce transport funds from other more effective policy responses especially in a time where official and anecdotal reports suggest demand for motor vehicle travel is declining. In addition, major roads are also spatially fixed and therefore likely produce concerns about inequitable social distribution of purported benefits. The most likely reason that major roads have been promoted as solutions to rising fuel costs is that they were already planned before the recent oil shocks and that the fuel saving rationale is being applied retrospectively in response to public clamour for government action. At best, road building is a poor response to the broader socio-economic impact of rising fuel prices.

## **Living densely**

Some scholars and policy observers have promoted higher urban residential and activity densities as a policy response to rising fuel prices (Newman and Kenworthy 1999). The wave of urban consolidation that has occurred during the past three decades was, in part, stimulated by the oil shocks of the 1970s and the perception that higher density living fosters more efficient transport energy use. It has, however, taken three decades of urban consolidation to achieve the current extent of increased urban density. The localities that have received the greatest density gains have typically been in middle and inner urban areas and the popularity of this policy has been mixed (Lewis 1999). Density increases are a slow and inefficient way of improving access to public transport, especially in outer and fringe suburban areas.

The use of higher densities as a mechanism for reducing transport energy demand is also complicated by the reliance on market processes for the supply of dwellings. Housing markets follow cyclical patterns meaning that there will be periodic downturns in the production of new housing. This means that the rate of consolidation experienced in Australian cities will also fluctuate as investors and developers react to changing demand signals and investment opportunities within other market sectors. The achievement of higher urban densities may thus be subject to processes that are disarticulated from shifts in energy markets. While it is conceivable that housing markets may over time be reconfigured to favour locations where the use of alternative modes to the motor car is relatively more supported, there remains considerable uncertainty whether market responses will be quick or effective in providing higher density urban form that reduces oil vulnerability. Indeed

should further increases in oil prices occur potentially adverse effects on confidence within financial and property markets may limit development driven urban consolidation. Such a scenario would render densification largely impotent in addressing urban mortgage and oil vulnerability.

The relationship between urban density and public transport use is secondary compared to government investment decisions. While higher densities contribute to the *potential* for greater patronage of public transport, only the *provision* of public transport services can realise this potential. Decisions about the rollout or withholding of improved outer suburban public transport services in recent decades appears more closely related to the fiscal concerns of state governments than with the concentration of local land-use and activity. Furthermore, while developers may be pleased to obtain relaxations on residential densities throughout urban areas, there is little likelihood of such regulatory changes having any significant impact on the mortgage and oil vulnerability of outer and fringe suburban households over the short, medium or long term. Newly coordinated bus services, linked to rail, can be easily rolled out on existing road networks. Service provision is therefore the critical factor in achieving outer suburban public transport use, not residential density.

### **Addressing suburban mortgage and oil vulnerability directly**

New technologies and road construction are inappropriate responses to the increase in household mortgage and oil vulnerability. Our analysis of household mortgage and oil vulnerability has demonstrated that this problem is spatially differentiated and is related to distance from the CBD and the coverage of public transport services. In particular, the spatial supply of public transport seems the most important contributing factor. Households with good access to high quality public transport already use this mode to a greater extent than those with poor access. Furthermore, households with good access to high quality public transport are more able and likely to switch modes in response to increased travel costs resulting from rising fuel prices.

Much Australian urban research has demonstrated that housing market restructuring has enabled higher income households to 'capture' the higher quality public transport services in the inner and middle suburban areas (O'Connor and Healy 2002). For these households the risk from rising fuel prices has been *socialised* as they have readily available alternatives for urban travel. Households beyond the high quality public transport zones of Australian cities however, are overwhelmingly dependent on the private motor car for urban travel. These outer and fringe suburban households face a far greater degree *privatised* socio-economic risk from rising urban travel costs compared to inner and middle suburban residents. This is a gross inequity in Australian cities that has existed for many decades (Morris 1981) but was obscured during conditions of 'easy oil'. The uneven socio-spatial distribution of the private risks of urban travel costs is increasingly apparent under conditions of 'uneasy oil'. Our mortgage and oil vulnerability analysis shows that households in outer and fringe areas shoulder a disproportionate level of socio-economic risk from rising fuel costs compared to those in inner areas. Partial socialisation of the cost of urban travel for outer metropolitan and urban fringe households through the provision of high quality integrated public transport in outer suburban locations is now an urgent imperative for state and federal governments.

This view receives further support from official and anecdotal reports over recent months that suggest that there has been a rise in public transport use during the past year. Households that are able are reducing their private transport costs by shifting to public transport. The recognition that households will switch to public transport if it is available at high quality and at a competitive price is not new and has been reported consistently by transport and urban planning scholars for over two decades (Newman and Kenworthy 1989; Mees 2000b). Public transport is 'old technology' with known capacities that requires no technical research to implement when compared to the uncertain new fuels or automobile engine designs. The potential for mode switching to public transport is however spatially differentiated. It seems that improvements to public transport, particularly in outer and fringe suburbs, offer substantial policy potential in reducing household mortgage and oil vulnerability.

The question of how governments can achieve improved outer and fringe suburban public transport services is a critical policy question in light of rising fuel prices and the potential impacts on households with mortgages in suburban locations. Some responses will provide superior and more effective outcomes than others. Australia is fortunate to have some of the world's foremost urban transport planning scholars who have prescribed a number of public transport policy responses that could be deployed in response to mortgage and oil vulnerability.

### **Transporting the suburbs**

Australian public transport systems have languished for many years due to institutional intransigence, fragmentation and privatisation. Problems have been exacerbated by limited funding and competition from road investment. These problems need to be quickly and effectively overcome if governments are to implement effective public transport responses to rising oil vulnerability. We have identified five key means through which Australian urban public transport systems could be improved through planning responses that would require limited capital expenditure.

The first measure that needs to be undertaken is for dedicated public transport authorities to be established with the objective of planning and coordinating public transport services. Mees (2000b) has demonstrated that comprehensive integrated service planning is crucial to the success of public transport systems. Some cities already have responsible public transport authorities, such as South East Queensland's Translink, or TransPerth. Translink has achieved successful patronage growth through the introduction of integrated ticketing. However this agency appears unable to coordinate rail and bus services and is currently promoting wasteful duplication and competition between bus and rail systems through busway construction that also creates a high opportunity cost arising from investment diversion despite controlling the rail network through the superordinate Queensland Transport department. Neither Sydney nor Melbourne has a public transport authority that is charged with public transport integration and coordination across the entire metropolitan area. This is a critical institutional weakness in the face of the rising socio-spatial risk imperatives that are emerging as a result of mortgage and oil vulnerability. The use of private

providers can also contribute to poor public transport integration, with Melbourne's privatised rail and tram networks offering perhaps the starkest recent example (Mees 2005).

A second critical factor in improving public transport services in Australian cities is the gross historical differences in spatial and temporal service coverage and network integration between inner/middle areas and outer/fringe areas (Morris 1981). There is a critical need for improved local suburban and circumferential public transport routes in the outer suburbs that can better link homes with workplaces and other activities. Buses coordinated with rail could provide for this type of travel. With the exception of the Gold Coast, the cities examined in this research paper all have extensive rail networks. There is currently only limited coordination between bus and rail in most of these cities. The enormous sunk capital in Australian urban rail systems and their current underutilisation suggests that these should form the backbone of revitalised suburban public transport systems. Urban public transport networks need to be reconfigured so that local suburban and circumferential bus services link to high frequency rail services throughout Australian metropolitan areas including outer and fringe suburban areas.

There is a relatively minor need for major new fixed public transport infrastructure. Many public transport improvements would not require major capital investment. The major costs of suburban bus upgrades would be in acquiring new buses and in establishing local bus stops. Indeed the humble suburban bus stop could become the most critical item of local neighbourhood transport infrastructure should fuel prices continue to rise. Some bus priority measures and minor improvements to bus-rail interchanges would be necessary but these could be undertaken at minimal expense with costs shared between local and state governments. New service integration should be accompanied by multi-modal ticket integration in cities where this has not yet occurred, such as Sydney.

The third policy response that should be pursued is the targeted extension of rail services to recently developed fringe estates. Many outer suburban locations have waited long periods for promised service extensions. A rail line extension to the high mortgage and oil vulnerability suburb of Rowville in Melbourne's outer east was proposed in 1969, but consistent state government postponement now suggests that further consideration of this extension will not commence until 2016 at the earliest (Department of Infrastructure 2006). Similar delays apply to the South Morang growth corridor in Melbourne's north (Department of Infrastructure 2006), the Redcliffe line in Brisbane's (Nightingale 2004) north and to other outer suburban localities across Australian cities. While not every highly car dependent outer urban housing estate can be provided with a new rail service, strategic outer suburban rail extensions could be combined with high quality sub-regional feeder and circumferential bus services to provide viable respite from mortgage and oil vulnerability

The fourth necessary response to the rising costs of suburban travel by motor vehicle is for governments to alter their financial allocations to favour public transport. With state and federal governments posting large budget surpluses, there are large sums available to policy makers and politicians to respond to rising fuel costs. The federal government has forgone over \$36 billion in tax revenue to partly compensate households for the rising costs of private urban travel. Many hundreds of millions of Federal assistance is used to compensate businesses for the costs of motor vehicle travel through fringe benefit tax exemptions. State governments have many billions allocated to urban road projects in their metropolitan

transport plans while public transport receives a minority share, with the exception of Western Australia. Many of these major road projects, such as Brisbane's North South Bypass and Airport Link tunnels serve the central city, but provide little advantage for those travelling between outer suburban areas. The cost of such tunnel projects will constrain government's fiscal capacity to improve public transport.

A fifth approach to supporting public transport systems would be to improve the quality of local access to these services for pedestrians and cyclists and to support the revitalisation of local suburban shopping strips. Walking and cycling have been neglected for decades by urban transport planners as viable modes of travel. While there is little immediate evidence of any substantial shift towards greater pedestrian or bicycle travel in response to rising fuel costs, it is likely these travel modes will become more prominent. A rising fuel prices increasing the cost of transport to dispersed retail centres, local shops within walking or cycling distance from local neighbourhoods are viewed as likely experiencing growth in demand (Young, quoted in Baker 2006). Most users of public transport access these services by walking or cycling. Local footpath, cycleway and streetscape improvements could markedly improve the quality of the pedestrian and cycling experience and support access to public transport. Complementary support for the revitalisation of small suburban shopping centres through directive local government planning of service mix and through streetscape improvement schemes would support local walking and cycling access and provide a focal point for local public transport. Together these measures could provide significant local scale reductions in the impact of mortgage and oil vulnerability in Australian suburbs. This is clearly another avenue of policy development and infrastructure investment to relieve financial pressures on households arising from increased fuel costs.

Ample funds for comprehensive upgrades to outer and fringe suburban public transport services and for local centre improvement could be easily obtained by postponing investment in major road projects and redeploying the funds for public transport and suburban revitalisation. This would have the advantage of imposing little net impact on governments' fiscal positions. In the unlikely event that fuel prices were to ease, the deployment of these monies could be reconsidered.

### **Further research**

The VAMPIRE index and the prior VIPER effort can only provide a preliminary albeit comprehensive depiction of various dimensions of oil vulnerability in Australian cities. There are many more questions that deserve attention from scholars and policy makers. The links between household income, housing costs and travel behaviour deserve far more attention than they have previously received. To our knowledge, we are the only research team that is examining the issue of 'oil vulnerability' in Australian cities from a socio-economic perspective. This rarity seems curious, given the centrality of car dependence and mortgage tenure to the social, cultural and economic practices of Australian urbanism. More research needs to be undertaken to fully comprehend the socio-spatial dynamics of car dependence, mortgage tenure and rising fuel costs.

There is a crucial need to generate better datasets that can illuminate mortgage and oil vulnerability at the local scale. There are no datasets that provide detailed information on

household income, housing expenses, travel behaviour and expenditure by location at the suburb or neighbourhood level. This seems to be a major governmental and scholarly failure given the imperative to understand these emerging issues. It seems astonishing that a society in which seventy per cent of all urban travel is undertaken by motor vehicle and in which a similar proportion of households will undertake house purchase at some stage, that we have such limited, partial and fragmented data with which to comprehend the social relationships and vulnerabilities associated with this car use. Better data collection is critical to comprehending how urban policy can better respond to the pressures of urban oil vulnerability in Australia.

### **Concluding remarks**

The past few decades have seen Australian cities grow and expand. This process has produced extensive suburban realms where the majority of Australians now live. The development of dispersed suburban residential areas has permitted the achievement of a high quality of life. The opening up of new suburban land permits households to access new housing. For many years critics of suburban development have pointed to the car dependence upon which suburbia is predicated as a critical weakness in the sustainability and viability of this development mode. Under conditions of 'uneasy oil' it seems that suburban areas are increasingly socio-economically and financially vulnerable.

The critical weakness in the suburban model is the dependence upon automobiles for urban travel. The patterns of automobile dependence demonstrate that where high quality public transport is available many will use it. Under conditions of high and rising fuel prices the imperative to redress the spatial imbalance in access to high quality public transport seems even more pressing than ever. The risks associated with rising fuel costs and high household debt could be substantially reduced if the direct exposure of households to these expenditure areas could be diminished. A large and sustained program of comprehensive public transport investment is now required to socialise suburban transport costs and protect outer and fringe suburban areas from the expense of operating motor vehicles.

The risks associated with oil vulnerability in Australian cities are great. But a comparable risk is that governments and policy makers will be distracted in their efforts to redress this risk through pursuit of untested and questionable technologies, indirect policy instruments and rigid institutional arrangements. The methods and models for redressing suburban mortgage and oil vulnerability are apparent. A reinvigorated pursuit of their implementation is now essential to prevent further oil price rises from shocking the suburbs.

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