Horizontal and Vertical Equity in the New Zealand Tax-Transfer System: 1988-2013

Matt Nolan

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Further enquiries to:
The Administrator
Chair in Public Finance
Victoria University of Wellington
PO Box 600
Wellington 6041
New Zealand

Phone: +64-4-463-9656
Email: cpf-info@vuw.ac.nz

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Abstract

Between 1988 and 2013 New Zealand's tax and welfare systems have experienced a significant period of change, with real benefit payments and tax rates both declining. When evaluating the perceived fairness of these reforms the focus has predominantly fallen on how average economic activity and income inequality changed. However, such evaluation is partial at best. In this paper I intend to extend the evaluation of tax-transfer policy change during this period by reframing the adjustment in the distribution of income (as proxied by the Gini coefficient) due to policy into "horizontal equity", "vertical equity", and "reranking" effects. This decomposition is achieved by applying the observed tax-transfers systems to two sets of pooled years of HES data (1988-1991 and 2011-2013), and then constructing appropriate concentration coefficients to analyse how the tax system transformed pre-tax and transfer family income into disposable family income. Such a decomposition allows us to discuss how the observed changes could be consistent with a change in perceptions of what is fair (eg the importance of treating equals the same vs the importance of redistributing income).

Statistics New Zealand disclaimer

Access to the data used in this study was provided by Statistics New Zealand under conditions designed to give effect to the security and confidentiality provisions of the Statistics Act 1975. The results presented in this study are the work of the author, not Statistics NZ.

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1 Introduction and motivation

This paper investigates how measures of redistribution, vertical equity, and horizontal inequity of the tax and transfer system changed between 1988 and 2013. The purpose of such an analysis is to evaluate the consequences of policy changes through the lens of equity, and to understand how adjustments in tax-transfer settings influence New Zealand equity measures.

With the election of the Fourth Labour government in 1984 New Zealand underwent significant economic reforms. In the decade that followed New Zealand went through a drastic period of liberalisation with trade protectionism reduced (Massey 1995), government institutions redesigned (Evans et al. 1996, Brash 1998), the benefit system changed (McClure 1996), and the tax system adjusted (Treasury 2001*a*, Stephens 1987).

As part of these reforms income tax and transfer policies changed. The goal of this paper is to ascertain how the observed change in the structure of the income tax-transfer system post-1988 met principles of vertical and horizontal equity using a decomposition of the Gini coefficient. As such this analysis is not a review of the equity principles satisfied by the reforms in their entirety, or a narrow analysis of the equity principles satisfied by a single policy. Instead, the focus of this paper is on the equity effects of the package of tax and transfer policies introduced from 1988 onwards.

A decomposition approach to this question allows for a quantitative evaluation of the equity characteristics of tax-transfer policies changes during this period. Furthermore, as it is conceivable policy makers may be more interested in adjusting tax settings rather than adjusting other policies that were introduced during the reforms, it gives guidance regarding the equity effect of changes in tax-transfer settings.

Stephens (1987) noted that, during Labour's first term the government explicitly aimed to maintain levels of vertical equity even with allocative efficiency and horizontal equity as primary concerns. However, Stephens (2003) indicates that, by the second term, there was an increasing willingness to ignore vertical equity concerns. Furthermore, the growing focus on efficiency was seen as consistent with horizontal equity - which had been a guiding principle for the initial broadening of the tax base with the introduction of Goods and Services and Fringe Benefit Taxation (Treasury 2001*b*).

The predominant attitude of policy makers during this time, with a focus

on efficiency above vertical equity concerns, is articulated clearly by subsequent writing from the Committee of Experts on Tax Compliance (Report 1988) and the New Zealand Business Roundtable (Buchanan and Hartley 2000). McClure (1996) goes further in discussing the motivation for tax and transfer policy changes during this period, noting the shift away from universality in benefit payments towards greater targeting of need.

The previous literature on tax-transfer changes in New Zealand during this time has focused on analysis of factor incomes from raw survey data (Podder and Chatterjee 2002), generalised Lorenz curve comparisons of disposable income (Chatterjee et al. 2008), comparisons of market and final income estimates (Aziz et al. 2012), and arithmetic microsimulation based decompositions (Creedy et al. 2010, Creedy and Eedrah 2016, and Ball and Creedy 2015). Although these exercises are all useful, they largely fail to give us a clear equity basis for considering the distributional consequences of the reforms.[1]

Although generalized Lorenz dominance and discussion of an *equity* to *efficiency* trade-off proxied by the relationship between inequality and income aggregates are useful, in order to more deeply understand the nature of changes in tax-transfer policy we would want to consider how tax-transfer policies transform the income distribution along the lines of *vertical* and *horizontal* equity.

As a result, the focus of this paper is on the vertical and horizontal equity changes that were embedded in tax and transfer changes between the 1988 tax year and the 2013 fiscal year. Contrary to received wisdom the tax-transfer system did not imply a decline in horizontal inequity among market income equals during this period. But rather than this being a policy failure, it suggests that the policy makers view of equals in the tax-transfer system differs from that defined solely by market income.

The outline of the paper is as follows. In section 2 the method for measuring vertical equity and horizontal inequity is introduced. In section 3, an outline of the data used and a summary of the data is given. Section 4 provides the key results about changes in vertical equity and horizontal inequity between 1988 and 2013. Section 5 investigates the sensitivity

[1] Chatterjee et al. 2008 suggest that most of the generalized Lorenz Dominance of the pre-reform period can be put down to policy. However, this assumes that the pre-reform economic situation was sustainable - a large assumption given the external shocks New Zealand was experiencing and the fact that the unsustainability of government accounts was catalyst for reforms in both 1984-87 and 1991.

of these results to the choice of equivalence scale. Finally, section 6 summarises and concludes the results of the paper.

This research will add to the literature in several ways. It is the first paper to apply this decomposition method to New Zealand data, extending the equity analysis of Creedy et al. 2010. This allows for a discussion of changes in horizontal inequity in the New Zealand tax-transfer system which is comparable to results from overseas (eg Herault and Azpitarte 2014a).

It considers the combined effect of tax and transfer payments where the method has largely only been applied to taxation in isolation (Lambert and Urban 2008). The paper then outlines the methodological shortcomings associated with extending this form of analysis, especially when it is extended to include transfer payments.

Finally it introduces bandwidth selection based on log income rather than the direct dollar bands which are used in previous studies. Log bands provide a more intuitively appealing way of forming groups of pre-tax income equals and shift the focus of horizontal inequity away from low income families toward middle income families.

2 Methodology and measurement framework

Discussions of vertical and horizontal equity are based on underlying concepts of *ability to pay*, *natural rights* and *equal sacrifice* (Young 1990, Musgrave 1990). These concepts are that those with the greatest ability to pay should pay more, that individuals have a natural right over the income they earn, and that the burden of taxation on individuals should be spread equally in terms of utility sacrificed.[2]

However, given that objective interpersonal comparisons of utility are not possible (Arrow 1950) and given the imprecision of the concept of ability to pay, these terms are inherently value laden. As a result, it is worthwhile to consider how the tax-transfer system satisfies certain principles of fairness in isolation. This focus gives rise to considering vertical and horizontal equity. Lambert (2001) gives the broadest definition of both:

[2] As noted in Musgrave (1993) there is an open debate regarding whether equal sacrifice refers to absolute, proportional, or marginal sacrifice - each of which imply very different levels of progressivity.

> The purpose of horizontal equity (HE) command generally is to pursue justice and equality and ensure that the law does not serve anybody's self-interest. The purpose of the vertical equity (VE) command is to take appropriately into account different people's relative merits. That word 'appropriately' makes VE a matter of judgement or societal taste, whereas HE can be seen as an absolute.

Vertical equity (VE) regards the redistribution of income, specifically from those with a greater ability to pay due to having access to more resources for meeting needs and satisfying wants. This is often termed the *Pigou-Dalton principle*. Horizontal equity (HE) regards non-discrimination - treating *equals* equally. In this context both vertical and horizontal equity are value-laden, as defining discrimination and ability to pay depends on a view of what constitutes equals.

To make horizontal equity consistent with vertical equity it is common to define equals in terms of initial access to resources. In the literature this is narrowed down to pre-tax and transfer (market) income. Then VE and HE concepts are measured through how this market income is transformed into post-tax and transfer (disposable) income.

In this way a tax-transfer system is exhibiting horizontal inequity (HI) if it is treating people with the same market income differently. While it is exhibiting vertical equity if it is, in net terms, taking proportionally more market income from those with greater market income.

The Gini coefficient can then be used to evaluate claims about the equity effects of tax and transfer policy. The Gini coefficient provides a summary measure of the relative absolute distance between income units (Yitzhaki and Schechtman 2013), and as a result a smaller Gini coefficient after the imposition of a tax-transfer system implies that the distance between individuals has declined.[3]

As a result, the difference between market and disposable income Gini coefficients that will be used as a measure of the redistributive effect of tax-transfer systems in this paper. The goal is to decompose this measure

[3] The Gini coefficient is equivalent to half of the relative mean absolute difference, which is the sum of all pairwise differences in income divided by mean income. As the transformation from market to disposable income lowers mean income a decrease in the absolute distance between income units does not ensure that the Gini coefficient will be lower, but a lower Gini coefficient implies that *relative* absolute distance between income units has declined.

into appropriate vertical and horizontal equity terms.

2.1 Decomposition of the Gini coefficient

As noted by Urban (2014) there is a large, and not necessarily consistent, literature regarding the decomposition of Gini coefficients into vertical, horizontal, and reranking components. The framework in this paper is based upon the definitions of vertical equity, horizontal inequity, and reranking given in Lambert and Urban (2008).[4]

When the tax-transfer system transforms market income into disposable income it changes an income units income relative to other income units in two ways: It changes the relative distance between an income unit and other income units, and it changes the order of the income parade for income units. If there is progressivity in the tax-transfer system then income units higher up the income distribution are moved proportionally more relative to lower income units. In most circumstances this will (for the same ordering of income units) move income units closer togeter. However, this transformation may also lead some income units to change position on the income parade. This second effect is termed reranking.

The existence of reranking creates complications when considering the redistributionary impact of tax-transfer policy using the Gini coefficient. Kakwani's (1977*b*a) critique of Musgrave and Thin's (1948) discussion of progressivity in the tax system illustrated that the progressivity of a tax-transfer system and redistribution (in terms of a lower Gini coefficient after the application of taxes and transfers) are different things. It was then Kakwani (1984) who established a measure of redistribution that takes into account reranking among income units.[5] An excellent, and critical, history of the measurement of progressivity and the redistributive effect can be found in Urban (2009).

The split into potential progressivity and reranking gives an initial decomposition of the observed redistribution caused by tax-transfer policies. The goal of such a decomposition is then to break down observed redistribution in the income distribution into a potential redistribution term that represents the progressivity inherent in the tax-transfer transformation (vertical equity) and a term that captures the effect reranking due to

[4] The definitions used in this paper are outlined directly in Urban (2014).

[5] Building off the work regarding reranking by Atkinson (1980), Plotnick (1981) and his own earlier work on progressivity in Kakwani (1977*a*b).

the tax-transfer system and its impact on the distribution of income.

The observed *redistributive effect* of the tax-transfer system, RE, is defined as:

$$RE = G_Y - G_D \tag{1}$$

Where G_Y is the Gini coefficient of pre-tax income (market income, Y) and G_D is the Gini coefficient of post-tax and transfer income (disposable income, D).[6]

If the transformation from Y to D were to keep individuals in the same order and lead to a lower Gini coefficient then the narrowing of the distance between income units associated with this transformation is equivalent to the VE in the tax-transfer system. As a result, vertical equity involves considering the market and disposable income distributions keeping individuals in the same order. This is the idea behind the (modern) Kakwani progressivity/disproportionality measure (Reynolds and Smolensky 1977, Urban 2009, Aronson et al. 1994). Namely:

$$V^K = G_Y - C_D \tag{2}$$

Where C_D is the concentration coefficient for post-tax and transfer income.[7,8]

Kakwani (1984) extended the above method by noting that the key difference between G_D and C_D is the reranking of income units that occurs due to the transformation of pre-tax income (y) caused by the tax function ($T(y)$). Reranking then explains why G_D and C_D differ.

[6] This is an imperfect measure of real redistribution, given that the pre-tax income distribution is not independent of the choice of policy instruments and the values associated with these instruments - as a result, this relies on the strong assumption that the pre-tax income is independent of policy settings.

[7] It is useful to think about the concentration index with reference to pre-tax Lorenz curve and concentration curves. The pre-tax Lorenz curve involves ordering pre-tax income units in ascending order and then plotting the cumulative income of all income units earning at or below given income levels. The concentration curve for post-tax and transfer income involves the same ordering of income units, but plots cumulative post-tax and transfer income.

[8] Lambert (1985) initially questioned the appropriateness of the Kakwani (1977*b*a) measure of progressivity for considering the redistributive effect of taxation when we look at both tax and transfer changes that involve tax functions that cross. As in Herault and Azpitarte (2014a) we will use a value of V^K based on Lambert (1985) to take account of both tax and transfer policies. However, unlike Herault and Azpitarte (2014a) we do not estimate the tax and benefit systems effect separately.

It then follows that the redistributionary effect of a tax change can be decomposed into two terms - a term that represent the change in the Gini coefficient in the absence of reranking (V_t^K), minus the redistribution that is lost due to the reranking of income units (The Atkinson-Plotnick measure defined by Aronson and Lambert (1994)). The redistributive effect of a policy change can then be defined in the following way motivated by Kakwani (1984) and the reranking definitions of Atkinson (1980) and Plotnick (1981).

$$RE = (G_Y - C_D) - (G_D - C_D) = V^K - R^{AP} \tag{3}$$

Where V_t^K is the Kakwani vertical effect of taxation, and R_t^{AP} is Atkinson-Plotnick reranking term.[9]

2.2 Exact equals and horizontal inequity

As Urban (2009) notes, this reranking term was traditionally called horizontal inequity in the literature (Atkinson 1980, Plotnick 1981, King 1983, and Kakwani 1984) with the authors explicitly defining horizontal inequity as reranking.

However, Aronson et al. (1994) and Aronson and Lambert (1994) pointed out that this still constituted *unequal treatment of unequals*, which differs from the classical definition of horizontal inequity as unequal treatment of *equals*.[10]

Aronson et al. (1994) determined *classical* HI by decomposing the Kakwani vertical effect into two terms, a vertical effect V and a horizontal effect H, such that $V^K = V^{AJL} - H^{AJL}$ with a residual term that captures reranking $R^{AP} = R^{AJL}$. With defined groups of equals, horizontal inequity involves differential net tax treatment *within* these groups, while vertical equity pertains to the idea of differential tax treatment *between* these groups. In this context the *residual* term that exists for traditional population Gini coefficient decomposition represents reranking in the case of comparing market

[9] This is defined as the difference between G_D and C_D based on a lexicographic ordering of equals as in Aronson and Lambert (1994) - this stems from the population subgroup decomposition literature starting with Bhattacharya and Mahalanobis (1967). Note that this term will always be positive as an ordering from smallest to largest always gives the largest concentration coefficient, and that is what is occurring with G_D.

[10] The strong criticism of Kaplow (1989) clearly outlined this view.

and disposable income distributions. Aronson and Lambert (1994) give a clear graphical representation of this result. [11]

Unlike Theil's entropy measure and the mean logarithmic deviation, the decomposition of the Gini coefficient into population subgroups cannot be subdivided solely into *between* and *within* group measures. Namely the Gini coefficient is not additively decomposable. As shown in Bhattacharya and Mahalanobis (1967) any decomposition of the Gini coefficient into subgroups requires an *overlapping* term, a requirement that sees the Gini fail in terms of the five axioms of a good relative inequality measure (the others being *anonymity*, *the principle of transfers*, *scale invariance*, and the *principle of population* (Cowell and Kuga 1981)). However, Aronson et al. (1994) discovered that this property is useful when discussing redistribution as it defined reranking.

Assuming that there are $j = \{1, ..., J\}$ groups, Creedy et al. (2001) state that the Gini coefficient for a given income distribution can be decomposed into the following:

$$RE = G_B - G_W - E \tag{4}$$

Where G_B is the Gini coefficient if each person in a group earned the mean income in that group (the between group term), G_W is a weighted aggregate of the Gini coefficients for each group (the within group term), and E is a residual/reranking term that captures how groups of equals overlap in terms of pre-tax income. Given this the redistributive effect can be rewritten as:

$$\begin{aligned} RE &= (G_{Y,B} - G_{D,B}) - (G_{D,W} - G_{Y,W}) - (E_D - E_Y) \\ &= (G_{Y,B} - G_{D,B}) - \left(\sum_{j=1}^{J} a_{D,j} G_{D,j} - \sum_{j=1}^{J} a_{Y,j} G_{Y,j} \right) - (E_D - E_Y) \end{aligned} \tag{5}$$

Where G_j is the Gini coefficient of population subgroup j, $a_j = \sum_{j=1}^{J} \frac{N_j^2 \mu_j}{N^2 \mu}$ is the product of the population and income shares of subgroup j, and

[11] There is a compelling argument that backs Plotnick's (1985) view that reranking may be all that matters - with Dardanoni and Lambert (2001) arguing that only ordinal comparisons make sense, and since in the limit classical HI only occurs when reranking occurs the distinction is inconsequential.

G_B, G_W, and E represent the between group, within group, and residual subgroup decomposition of the given Gini coefficient.[12]

When the income subgroups are for income units which are *exact equals* in terms of pre-tax income, as in Aronson et al. (1994), then $G_{Y,j} = 0$, $G_{Y,B} = G_Y$, and the overlapping term $E_Y = 0$.

This gives the RE in the form:

$$RE = V^{AJL} - H^{AJL} - R^{AJL} \tag{6}$$

Where V^{AJL}, H^{AJL}, and R^{AJL} can be defined as:

$$V^{AJL} = G_Y - G_{D,B} \tag{7}$$

$$H^{AJL} = \sum_{j=1}^{J} a_{j,D} G_{j,D} \tag{8}$$

$$R^{AJL} = E_D = G_D - C_D = R^{AP} \tag{9}$$

This allows a clear definition of vertical, horizontal, and reranking effects.

The **vertical effect** of the tax system is the change in inequality *between* groups of equals induced by the tax-transfer system.

The **horizontal effect** is the sum of the *within* group inequality among pre-tax equals created by the tax-transfer system.

The **reranking effect** is the overlapping of income groups induced by the tax-transfer system.

When considering horizontal inequity as a whole both classical horizontal inequity and reranking effects are forms of HI (Dardanoni and Lambert (2001)), and so they must be considered together when discussing how horizontal inequality has changed.

[12] Where N_j is the population of subgroup j, N is the full population, μ_j is the average income of subgroup j, and μ the average income of the whole population.

2.3 Defining equals

With exact equals there is a clean distinction between horizontal and vertical equity, with horizontal equity. However, in most datasets few people have exactly the same market income as others, which is problematic for talking about horizontal equity for *exact equals*.

As a result, an assumption about what constitutes *close-equals* must be made. Namely, the estimation of horizontal and reranking effects require the estimation of a tax schedule that is a function of pre-tax income for every group - an estimate that will be subject to large error bands when there are few people in each group. Furthermore, when there is only a single person in each income group, the horizontal effect will be zero. As a result, there is a question of the *bandwidth* for the range of income that defines *close equal groups* (CEGs) following Creedy et al. 2001.

The *optimal* bandwidth in this case involves a trade-off between the two effects of increasing the bandwidth:

1. The averaging effect: The larger bandwidth increases the number of people in each CEG, improving the estimate of tax schedule. This tends to increase estimates of V^{AJL}, H^{AJL}, and R^{AJL} as the bandwidth rises.
2. The appropriation effect: The larger the bandwidth gets (including a more diverse group of individuals as determined by pre-tax income), the greater amount of V^{AJL} and R^{AJL} are attributed to H^{AJL}. This will tend to decrease V^{AJL} and R^{AJL}, but have an ambiguous effect on H^{AJL}.

As a result, the *optimal bandwidth* is given as the bandwidth value that maximises the value of V^{AJL}. Given V, and given R^{AJL} and RE as sample statistics, H can be readily estimated.

Although the optimal bandwidth method was a significant improvement on defining arbitrary groups, the creation of close equal groups leads us to the same issue of reranking within theses groups that occurs when we consider the income distribution as a whole. As a result, the reranking term R^{AJL} would differ from the true reranking in the income distribution R^{AP}.

According to Lambert and Urban (2008) there were two types of reranking

that were not being taken account of in this framework:[13]

1. Reranking of individual income units within CEGs
2. Reranking of entire CEGs

Lambert and Urban (2008) propose that $R^{AP} = R^{AJL} + R^{WG} + R^{EG}$ where R^{WG} and R^{EG} are the within group and entire group reranking terms respectively. Given the nature of these reranking terms, we can define $V = V^{AJL} + R^{EG}$ and $H = H^{AJL} - R^{WG}$ and we will have:

$$RE = V - H - R^{AP} \tag{10}$$

Here the reranking effect and the difference $V - H$ are both defined independently of CEGs, as R^{AP} and V^K respectively. As a result, a definition of close equal groups is only required for defining how V^K is split into vertical and horizontal effects, as in Aronson et al. 1994.

Once the CEGs are defined we can write V^K as:

$$V^K = \left(G_{pre} - \hat{C}_{pst}\right) - \left(C_{pst} - \hat{C}_{pst}\right)$$

Where $\hat{C}_{pst}$ is the post tax and transfer concentration coefficient assuming that all units in a CEG face common tax and transfer rates equal to the ratio of taxes and transfers to total pre-tax and transfer income for that CEG.

The way we define this *smoothed income* is centrally important for defining our decomposition of V^K into their final vertical and horizontal terms. This is complicated in the case where a number of families have zero pre-tax income which is transformed into positive post-tax and transfer income. This issue is discussed further in section 4.

Given this, $V = G_{pre} - \hat{C}_{pst}$ and $H = C_{pst} - \hat{C}_{pst}$. To calculate the CEGs involves selecting an income bandwidth for group size that maximises the vertical component as justified in Creedy et al. (2001) and applied in Herault and Azpitarte (2014). This paper does not select the maximum value for V, and instead follows Lambert and Urban (2008) in showing how V and H are sensitive to bandwidth selection.

[13] These are both mentioned in Creedy et al. (2001), hence why the authors suggests calculating H as a residual with $R = R^{AP}$ rather than through the within group definition.

When looking at equal groups the literature traditionally bases the CEGs on levels of market income, with an equally sized bandwidth value (band) across the income distribution. This leads to a large concentration of *equals* towards the bottom of the income distribution.

Figure 1 shows the number of people in each income band except the first income band, where the band is denoted by the minimum log income of that band. The first income bin is excluded as it contains a high proportion of the sample, with nearly 3600 families, or 20% of the sample, in first band.

However, moving along the income distribution larger income bands are arguably representative of equal groups. This can be represented with an estimated bandwidth based on the *logarithm of market income*, which implies that the market income bands get wider as income rises. This bandwidth leads to a larger concentration of *equals* towards the middle of the income distribution.

Figure 2 illustrates the number of people in each income band (excluding the first band) where the band is denoted by the maximum log income of that band. As in the case with the level of income, the first income band is excluded as it contains a high proportion of the sample, with just over 2600 people in first band, or 14.6% of the sample.

Apart from the first band, families in the lower section of the income distribution are not grouped as equals by this method, while the size of the bands in the middle of the income distribution increases significantly. Using a log income bandwidth also reduces the size of the first band, as it now effectively only includes families with zero pre-tax income.

Overall, the use of a log bandwidth instead of a level bandwidth implies that the density of groups of equals moves from the bottom of the income distribution towards the middle of the distribution.

When comparing level and log bandwidth, it isn't until the 85th percentile when the level and log bandwidth refers to the same level of income - at a lower percentile the log bands refer to a lower income, while at a higher percentile they refer to a higher income. Furthermore, the bandwidth size is equal at approximately the 58th percentile - with the log band using a finer bandwidth at a lower percentile and a larger bandwidth at a higher percentile.

The differences in groupings of equals is illustrated by looking at the density plots for both bandwidth estimates in Figures 1 and 2.

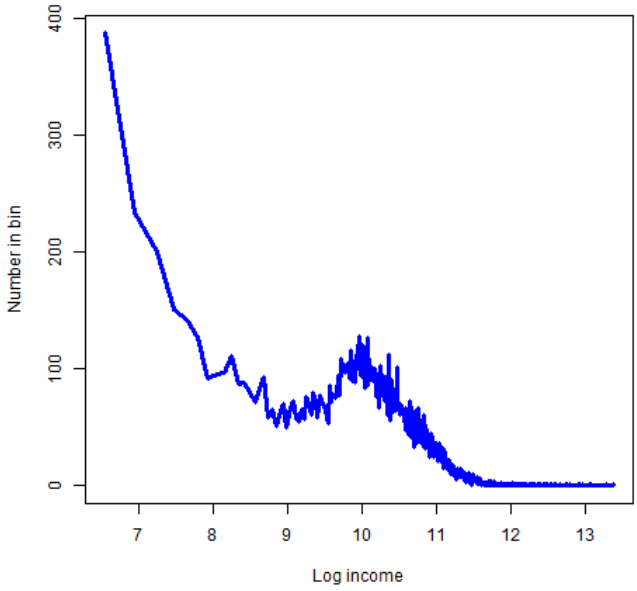

Figure 1: Families in each income band, selected by income level, HES88-91.

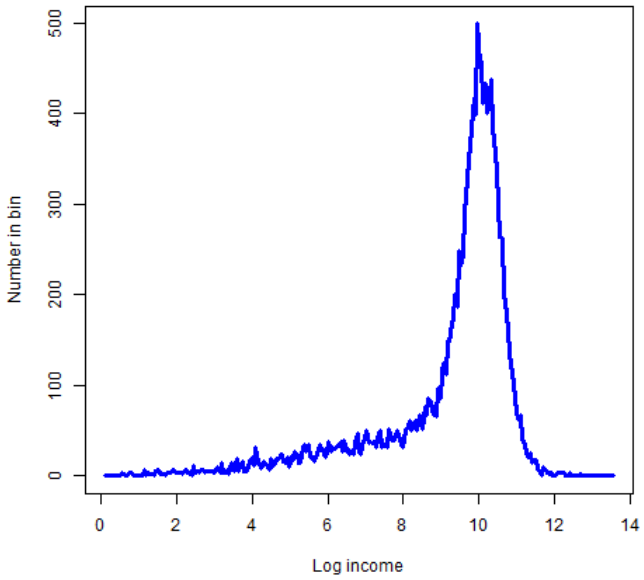

Figure 2: Families in each income band, by log income level, HES88-91.

Intuitively, a larger income band for defining equals for larger incomes makes sense - eg a $10,000 income gap is a lot less relevant to the difference between two millionaires than it is between two beneficiaries. As a result, equals defined by a log income bandwidth are used in this paper to calculate V and H. However, tables reporting results using both the level and log income bandwidths are provided in section 6.

2.4 Absolute Horizontal Inequity

As discussed in Lambert and Urban (2008) it is conceivable that the horizontal inequity term in this framework could be negative. With horizontal inequity defined as $\sum_{j=1}^{J} a_{D,j} G_{D,j} - \sum_{j=1}^{J} a_{Y,j} G_{Y,j}$ minus the reranking that occurs within groups, there may be groups where the tax system leads to a lower Gini coefficient within the group than existed prior.[14] This redistribution within a group makes outcomes among our group of equals more equal, and hereby suggests a reduction in horizontal inequity as defined.

The propensity for horizontal inequity to become negative is reinforced by the inclusion of the benefit system. In Herault and Azpitarte (2014) they estimate separate horizontal terms for the tax system and for the transfer system. The horizontal inequity transfer terms are significantly negative for eight of the ten years that are selected for analysis.

Lambert and Urban (2008) note that in such a situation the concentration curves for post-tax and smoothed post-tax income would cross. As the gap between these curves and the measure of complete income equality is captured by C_{pst} and $\hat{C}_{pst}$ the given measure of horizontal inequity will be reduced whenever the cumulative sum of smoothed post-income is below the cumulative sum of actual post-tax income.

The horizontal measure, H, is stating that if the actual tax system is redistributing within these groups then it is reducing horizontal inequity.

However, if instead horizontal inequity is when equals faced proportionally different tax-transfer treatment the inequality in pre-tax income among our equals will be perceived as equitable while any change in it is seen as generating horizontal inequity.

[14] Technically, where the tax system leads to a progressive transfer - equivalent to V_k for that specific group.

To discuss horizontal inequity in this sense involves considering *absolute* difference between the treatment of the tax system (as given by the post-tax income distribution) and the treatment of a system where all people in a group pay/receive the same tax-transfer rate (as given by the smoothed post-tax income distribution).

This is given by:

$$H^T = H_P + |H_N| \tag{11}$$

Where H_P are the values of H for the groups that show an increase in horizontal inequity while H_N is the value of H for the groups that show a decrease in horizontal inequity.

This value is also reported in the results in section six and will be termed both classical and absolute horizontal inequity.

2.5 Varying bandwidth

As noted in Lambert and Urban (2008), the criteria of maximising vertical equity was specific to the decomposition of Creedy et al. 2001.

After correcting for additional forms of reranking $V = V^K + H$ where V^K takes a fixed values irrespective of the bandwidth. As a result, the maximisation of V is equivalent to the maximisation of H which occurs for a very large bandwidth. This is intuitively unappealing as in the limit it suggests the appropriate bandwidth will treat everyone as equals.

Herault and Azpitarte (2014) estimate the bandwidth by maximising the V value that is given by the Creedy et al. 2001 method. Given that estimate for the bandwidth, the authors then recalculate V and H using the Lambert and Urban (2008) method. This is not the method used in this paper, however when using this method similar results for the size of the bandwidth were found.

In this paper the log bandwidth is selected based on local maximisation of V around 2000 bands for the HES89-91 period. Keep the bandwidth range the same, adjusting for income growth, this bandwidth is then used to compute the values of V and H for the HES11-13 period.

Figure 3 illustrates how the value of V varies as the number of bands increases, from 10 to 2000.

Outside of the results for up to 25 bands, the measure of vertical equity falls in a very narrow range - as shown by Figure 4. As a result, our assumption about the appropriate number of bands (and thereby the size of the bandwidth) has very little effect on the estimates of V or H as long as there should be more than 25 log income bands.

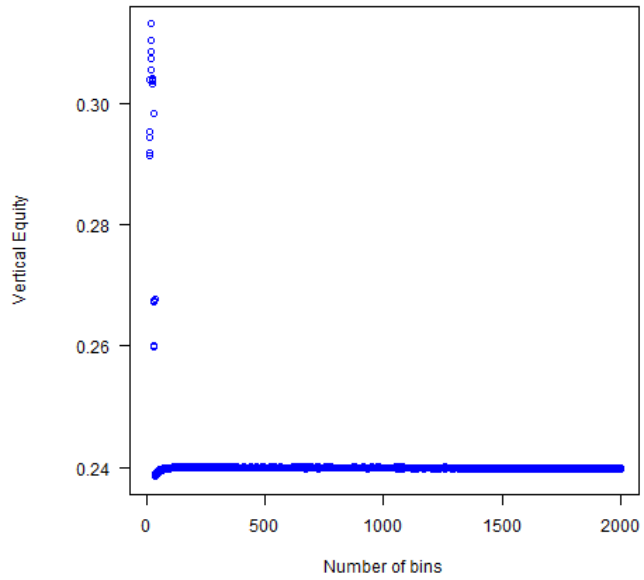

Figure 3: VE by number of bands - from 10 to 2000.

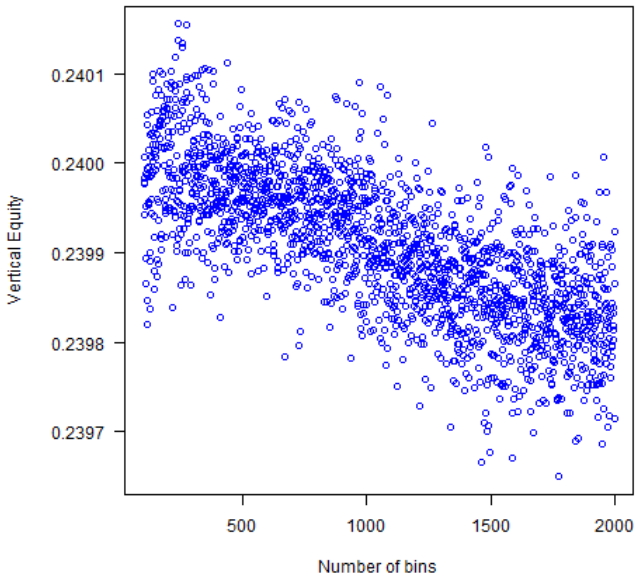

Figure 4: VE by number of bands - from 100 to 2000.

3 Data sources and assumptions

This paper uses survey data from Statistics New Zealand's Household Economic Survey (HES) from between the 1988 and 2013 surveys. HES years are referred to by the end date of the survey (eg HES88 refers to the survey that took place between April 1987 and March 1988).

In the HES survey individuals within a household are asked to report on their characteristics, income, and expenditure for the prior year.[15] The survey respondents may be interviewed at any point in a year long period, and as a result income data in HES can be reported from over a two year period - from a year before the start of the survey up until the end date of the survey.

The raw survey data collects information about all income categories (eg work income, tax paid) from both current sources and previous income sources for the past year. As this survey data is based on the recall of sur-

[15] Since 1998 the expenditure section of the survey has only been undertaken triannually.

vey respondents, each income source reported is subject to recall bias. This bias is expected to be worse for more irregular payments and payments that are not current. Furthermore, given the characteristics of individuals, their reported incomes, and administrative data about tax-transfer expenditure by government the benefits and tax numbers in this survey data appear inaccurate Ball and Ormsby (2017).

Due to these limitations the raw data is transformed in two ways:

- Treasury's tax-transfer microsimulation model, TAXWELL, is used to calculate the tax paid and transfer payments received by individuals. Taking the details of the tax-transfer system for a given year TAXWELL calculates the tax that an individual was liable to pay and the transfer payments they were eligible to receive. This can then be used to transform pre-tax income into post-tax income.
- For job and transfer income only current sources of income, rather than income from previous sources, are used. These figures are annualized, treating the individuals current situation as the situation they have been in for the entire year. The justification for this assumption is two fold: the poor quality of reporting about prior income sources, and in order to ensure that reported income only refers to the tax year of interest.

Only first tier benefits and the direct income tax system are modelled, with supplementary benefit and tax payments taken from the raw HES data. This combination of data is then used to transform market income into disposable income.

This transformation has the clear limitation that it captures only a subset of the policy changes that were implemented during the period of analysis.

Horizontal equity was an important driving force for the majority of policy changes from 1984 onwards, and so could only be comprehensively evaluated by taking into account changes in indirect taxes and tariffs, industrial and labour regulation, and the removal of quotas as well as changes in the direct tax and transfer system. Even though many of these types of policy changes occurred in the period preceding our analysis (1984-87) such factors remained relevant for judging the reforms well into the 1990s.

As a result, the analysis here is focused on the vertical and horizontal equity changes associated with family level tax and transfer changes, not an evaluation of the vertical and horizontal properties of the full set of re-

forms in New Zealand over the past 30 years.

3.1 Smoothed Income

Prior application of these methods (eg Aronson et al. 1994, Creedy et al. 2001, and Lambert and Urban 2008) concentrated solely on the tax system. As a result, the transformation from pre-tax to post-tax income solely involved reducing incomes based upon the average tax rate for that group.

In such a case the construction of *smoothed income* (as discussed in the method section) is straightforward, as the counterfactual tax system that removes horizontal inequity is one that sees each individual/family pay the same proportion of their market income in tax. As a result, another conceptual useful way of viewed this distribution is that it is the assumed HE equivalent distribution of income.

This paper evaluates the full tax-transfer system, and as a result this creates two clear issues when considering the transformation of income that creates then horizontally equal smoothed income measure.

- Proportionally changing the income of those who earned $0 leads to no change in their income.
- Very low income bands where transfer income dominates see wildly different proportional increases in the pre-tax income for these individuals. For example, comparing a person with $50 of pre-tax earnings to someone with $100 of pre-tax earnings - both of who are then paid $8,500 in benefits. If these individuals are in the same band horizontal equity would denote giving these individuals very different benefit payments to keep the same tax and transfer transformation rate - when intuitively these people may be viewed as equals. This generates additional changes in HI and reranking.

Lambert and Urban (2008) state "In a tax system with refundable credits, g could in principle be negative. 'Reducing' each pre-tax income X by the same fraction g would then amount to increasing those incomes, and by more, the higher X is". As a result, implementing benefit payments across most of the income distribution can be captured by the method. However, a benefit payment to someone with zero pre-tax income is different to a tax rebate for someone who already has positive pre-tax income.

Assumptions about how to treat those on zero and very low market in-

comes has a significant effect on estimates of horizontal inequity. As a result, the construction of smoothed income for this part of the income distribution needs to be stated clearly.

Figure 5 shows the HES88-91 income parade for market (in black) and disposable (in green) income in ascending order by the income units market income, using log income bands. Over 14% of families have pre-tax income equal to zero, while nearly a quarter of families have pre-tax income of less than $1,000 in TY91 prices.[16]

As can be seen in Figure 5, there is significant reranking in the income distribution at the very low levels of income. By using log bands, this include fewer individuals/families in these bands.

Figure 6 shows the HES88-91 income parade for disposable (in green) and smoothed disposable (in red) income in ascending order by the income units market income, using log income bands. The smoothed income series transforms each individuals income by the average tax-transfer rate for that group - thereby removing horizontal inequity generated by the observed tax-transfer system. At zero income, the smoothed income function is undefined as the proportional transformation is infinite. The solution used in this paper is to give everyone with zero market income the same absolute smoothed income, which is equal to the average disposable income for this group.

The concentration curve for disposable income and the concentration curve for smoothed disposable income are shown in Figures 7 and 8 for the HES88-91 and HES11-13 periods respectively. When forming close equal groups based on market income, horizontal inequity can be thought of as the difference between the concentration curve for disposable income and the concentration curve for smoothed disposable income. This difference is shown in Figure 9 for the first set of pooled years and Figure 10 for the second set of pooled years.

The actual tax-transfer system gives income units with zero market income varying levels of disposable income. As a result, attaching the same smoothed income to each income unit with zero market income implies that the actual tax-transfer system generates horizontal inequity accord-

[16] The sample used only excludes those who are outside the remit of the tax-transfer system (those who have negative market income, and those who have disposable income below $5,000 in TY2013 prices, eg mostly students) or who are not surveyed (eg those living in shared accommodation).

ing to this papers measure of HI.[17]

An alternative way of constructing smoothed income would be to set the smoothed income for every individual with zero pre-tax income equal to their observed disposable income. This would remove the HI generated by this group. However, this would not be consistent with the method applied to all other income units, as by definition units with the same pre-tax income (in this case zero) are equals. As a result, this is horizontal inequity via the definition of what an equal is and should be included.

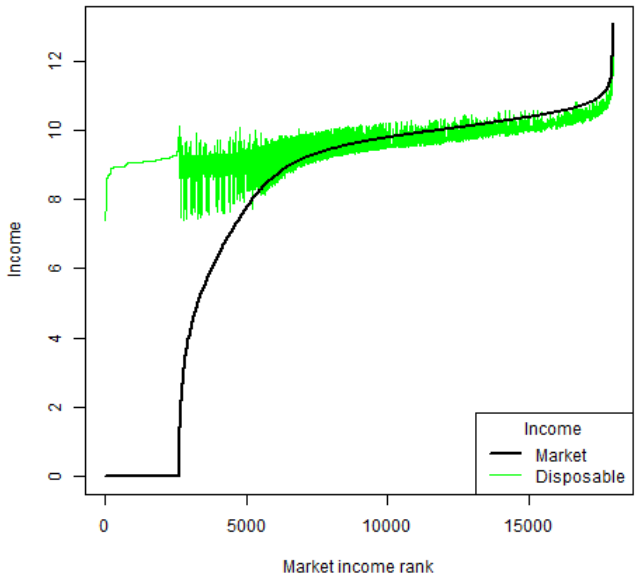

Figure 5: HES88-91 Income ordered by Market income rank.

[17] However, as we have used the average disposable income for this group it does not generate HI later in the income distribution - Which would occur if we used values that kept cumulative income for smoothed income at a different level than for disposable income. This indicates that any method used has to ensure that the cumulative smoothed income given to those with zero market income is equal to the cumulative disposable income of that group.

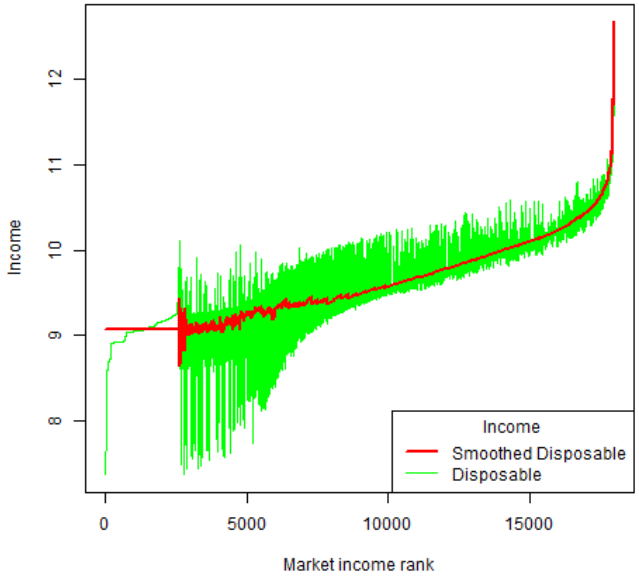

Figure 6: Disposable income ordered by Market income rank.

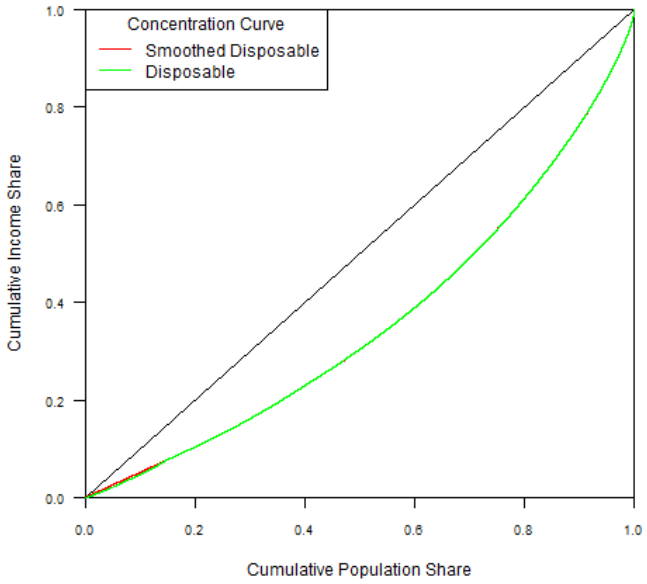

Figure 7: HES88-91 Concentration Curves for disposable income.

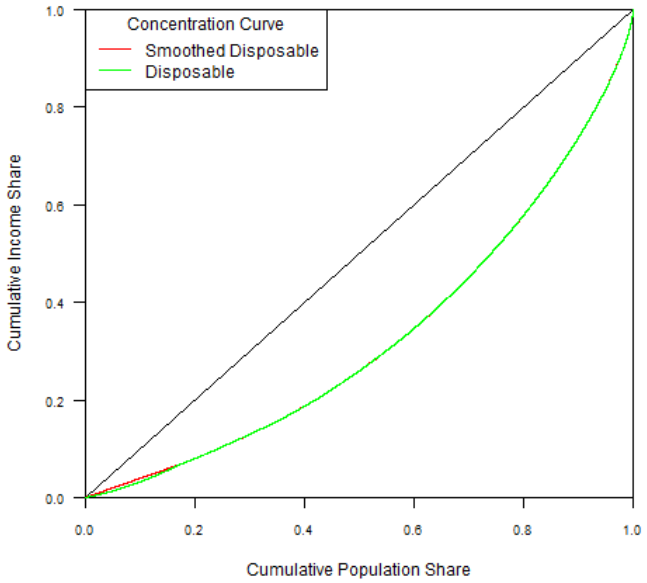

Figure 8: HES11-13 Concentration Curves for disposable income.

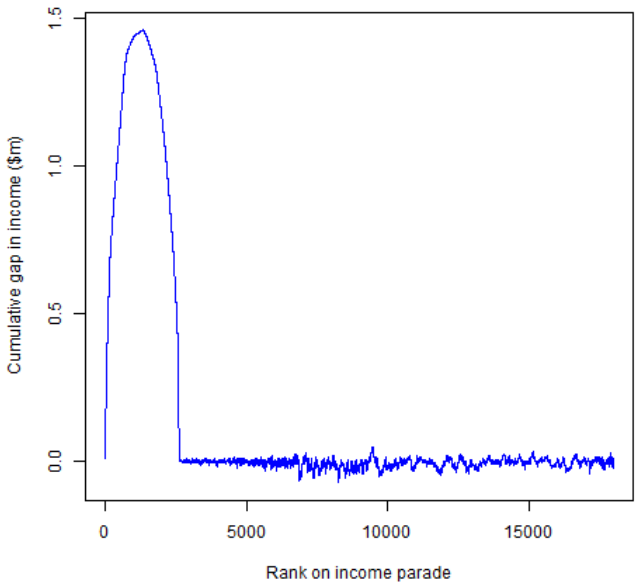

Figure 9: Disposable and smoothed income gaps HES88-91.

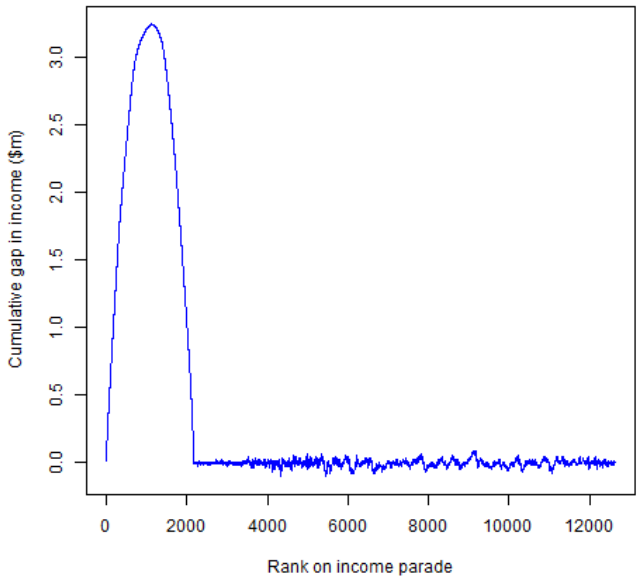

Figure 10: Disposable and smoothed gaps HES11-13.

Herault and Azpitarte (2014) use market income for this analysis and discuss the effect of benefit and tax policy separately, following the discussion of Urban (2009) and Lambert (1985) regarding how the effects of benefits and taxes can be separated. This allows Herault and Azpitarte (2014) to concentrate on decomposing two vertical terms, one that references taxation and one that references benefits. In this paper we focus solely on the overall impact of net taxes.

3.2 Year selection

For the analysis in this paper pooled data from two sets of HES years which represent the two ends of policy during this period are used.

The first set of years covers the HES88-HES91 surveys inclusively.[18] Income data is deflated using the Consumer Price Index to TY91 prices. From this dataset approximately 38,000 individuals, 26,500 non-dependants, and 17,900 families were selected for analysis.

[18] This represents data collected from April 1987 to March 1991

The 1988 tax year is in the middle of the economic reforms of the Fourth Labour government. At this point, tax reforms had led to a broadening of the base - with the introduction of a 10% rate of GST, a Fringe Benefit taxation, and a reduction in the number of tax thresholds from 5 to 2. Although the top tax rate had been cut from 66%[19] in TY84 to 48%, this was partially compensation for the tax switch to GST and Fringe Benefit taxation, which mainly hit high income earners, rather than a genuine cut in tax burden Stephens (2003).

During this first period the top tax rate was cut (mid TY89), the GST rate was increased to 12.5%, and the LIR (Low Income Rebate) was introduced. By the end of the period, the top tax rate was cut significantly - falling to 33% for TY90.

In summary, the first period includes the significant tax reforms that happened during the 1980s but does not include the sizeable changes in the benefit system that were to occur over the following two decades following the 1991 Budget.

The second set of years covers the HES11-13 surveys inclusively.[20] This period was prior to the July 2013 benefit reforms, but includes the 2010 tax cuts. Income data is deflated using the Consumer Price Index to TY13 prices. From this dataset approximately 25,500 individuals, 19,000 non-dependants, and 12,500 families were selected for analysis.

As a result, changes in the tax and transfer systems from this period consider a system that largely had the same structure to the first period, but with very different rates and thresholds.

A history of the changes in tax rates and scales is shown below:

Table 1: Tax thresholds and rates: TY88-13

Thresholds	TY88		TY90		TY98	
	Threshold	Rate	Threshold	Rate	Threshold	Rate
Zero income	_	15%	_	15%	_	15%
First threshold	$\$9,500$	30%	$\$9,500$	28%	$\$9,500$	21.75%
Second threshold	$\$30,000$	48%	$\$30,875$	33%	$\$34,200$	24%
Third threshold	_	_	_	_	$\$38,000$	33%

[19] This includes a temporary tax surcharge on the top tax bracket that was reapproved each year.

[20] This represents data collected from July 2010 to June 2013.

Thresholds	TY01		TY10		TY13	
	Threshold	Rate	Threshold	Rate	Threshold	Rate
Zero income	_	15%	_	12.5%	_	10.5%
First threshold	$\$9,500$	21%	$\$14,000$	21%	$\$14,000$	17.5%
Second threshold	$\$38,000$	33%	$\$48,000$	33%	$\$48,000$	30%
Third threshold	$\$60,000$	39%	$\$70,000$	38%	$\$70,000$	33%

When looking at the tax-transfer system the reforms during this period were focused on a move away from *universality* of payments towards *targeting need* with transfers. This shows up in three different ways:

- **Changes in rates**: First tier payments to beneficiaries have generally been increased with inflation. However, the 1991 Budget (colloquially termed the *Mother of All Budgets*) introduced sizeable cuts to the payments for most beneficiaries - with only nominal payments to those on Invalid's and Carer benefits unchanged. These real cuts persisted in real terms through until our second period of interest.
- **Changes in eligibility**: Tightening of eligibility criteria on benefits has ebbed and flowed over the history of the benefit system. However, the 1991 Budget signalled a watershed moment when the policy debate firmly shifted from providing a minimum standard to targeting need and incentivising work - with the introduction of binding work testing. Further welfare reform in 1996 and the community wage scheme in 1998 increased the intensity and severity of penalties for work testing, and even after the election of the Fifth Labour government in 1999 most of the work testing framework remained in place.
- **Changes in second and third tier payments**: The 1991 Budget was, in part, based on the view that technology had now allowed society to target benefit policy more closely to the needs of the individual McClure (1996).

4 Results of the decomposition

The results reported below are based upon equivalised family level income, where log income bands were used unless otherwise stated.

The adult equivalence scale used was the parametric scale of Creedy et al. (2010). This scale takes the form:

$$m = (n_a + \theta n_k)^{\alpha} \tag{12}$$

Where n_a is the number of adults in the family, n_k is the number of children, $0 \geq \theta \leq 1$ is the weight placed on the number of children, and $0 \geq \alpha \leq 1$ is a measure of scale economies among the family unit. Dividing family income by m gives a measure of the equivalized income of each adult individual in the family unit. The results below use this adult equivalent scale to compare family income.

The base comparison for this parametric scale has values of $\alpha = 0.6$ and $\theta = 0.7$ and gives results comparable to commonally applied Jensen scale.

These estimates suggest that the redistributive nature of the tax-transfer system was larger in 1988-91 than it was in 2011-13. The Gini coefficient for disposable incomes was 42% lower than for market incomes in 1988-91, compared to a 32% reduction in 2011-13.

Observed redistribution can then be broken in to two competing effects - the vertical equity associated with the tax system (how far cumulative post-tax incomes have moved towards the line of complete equality for the same ordering of individuals) and the reranking of individuals by income due to the tax-transfer system. Without groups of equals, this reranking is the only way we can view horizontal inequity.

The vertical equity inherent in the tax-transfer system fell from 44.7% of the market Gini in 1988-91 to 34% in 2011-13. Although the vertical effect declined, it remained a similar proportion of the redistributive effect (RE) for the given year (105%) implying that the decline in redistribution that was experienced was due to a less progressive tax-transfer schedule.

The observed reranking of income units associated with the tax-transfer system reinforces this result. Although the level of reranking declined (from 1.4 Gini points to 1.2 Gini points) as a percentage of the redistributive effect rose from 6.2% to 6.5% between the two periods. If we view HI solely as reranking, this would suggest that the changes in the tax-transfer system did manage to slightly reduce the horizontal inequity measure between these two periods - but did so in a way that induced relatively more HI for the amount of redistribution inherent in the tax-transfer system.

To discuss classical HI in terms of groups of equals requires close equal groups (CGEs). Defining these groups on the basis of a fixed log-income bandwidth allows the decomposition of the preceding vertical effect into

a vertical term (the change in between group inequality due to the tax-transfer system) and a horizontal term (the additional inequality generated within groups due to the tax-transfer system).

According to this measure HI declined between these two periods, but rose as a percentage of the RE. HI decreased from 0.04 Gini points to 0.03 Gini points falling slightly as a percentage of the redistributive effect.

Progressivity in the tax schedule leads to redistribution within income groups, which reduces estimates of HI. If classical HI is instead seen as representing any departure from the previous distribution - be it an increase or decrease in the spread of incomes - then the measure of HI will differ. The term that represents this is H^T. Estimates of H^T see it increase from 0.5% of the RE to 1.0% between these periods.

Overall all these measures suggests that *classical horizontal inequity* - which involves the absolute unequal treatment of equals - rose as a percentage of the redistributive effect of the tax system following the myriad of tax and transfer changes between 1988 and 2013.

4.1 Why did Horizontal Inequity rise?

At first glance an increase in the absolute HI measure as a percentage of the redistributive effect between these two periods is inconsistent with the goals of policy makers in the late 1980s and early 1990s. However, rather than being due to policy failure the observed increase in HI measures is consistent with increased *targeting* in the tax-transfer system - illustrating that these measures of HI may by themselves be inappropriate for evaluating the role of the transfer system with respect to horizontal equity.

To understand this result it is useful to look at HI more closely. Figures 9 and 10 show the difference between the two concentration curves pictured in 7 and 8.

In these figures, those with zero pre-tax income are ordered by post-tax income, and the smoothed income given to each individual is equal to average post-tax income for all those with zero pre-tax income.

As a result, for all individuals with zero pre-tax income the concentration curve is at or below the concentration curve for smoothed income. This is automatically counted as HI by both the H and H^T methods.

If we remove this source of HI, then H becomes virtually zero for both

time periods. The unequal payments that exist in the benefit system are the primary driver of the classical horizontal inequity measure.

With the introduction of Working for Families, the independent earner tax credit, and rising labour force participation by retirees this period has also seen an increase in targeted payments for those who have positive pre-tax income. These payments generated further horizontal inequity in the tax-transfer system, since the definition of equals is characteristic free while these payments are based on individual characteristics.

4.2 Estimated horizontal and vertical equity changes

Table 2: Family Income: Modelled data ($ bands)

	HES88-91		HES11-13	
	Raw	Base Scale	Raw	Base Scale
Market Income Gini (G_Y)	55.05	52.60	57.22	54.38
Disposable Income Gini (G_D)	34.84	30.03	41.09	35.90
Redistributive Effect (RE)	20.20	22.57	16.14	18.18
Kakwani progressivity (V_K)	22.41	23.97	17.49	19.69
Atkinson-Plotnick Reranking (R_{AP})	2.20	1.40	1.35	1.20
Vertical Equity (V)	22.40	23.88	17.56	19.74
Horizontal Inequity (H)	-0.01	-0.09	0.06	0.05
Absolute HI (H^T)	0.27	0.17	0.24	0.19
Bandwidth ($)	$347.72	$225.77	$744.22	$476.63

Table 3: Family Income: Modelled data (Log bands)

	HES88-91		HES11-13	
	Raw	Base Scale	Raw	Base Scale
Market Income Gini (G_Y)	55.05	52.60	57.22	54.38
Disposable Income Gini (G_D)	34.84	30.03	41.09	35.90
Redistributive Effect (RE)	20.20	22.57	16.14	18.18
Kakwani progressivity (V_K)	22.41	23.97	17.49	19.69
Atkinson-Plotnick Reranking (R_{AP})	2.20	1.40	1.35	1.20
Vertical Equity (V)	22.47	24.01	17.58	19.72
Horizontal Inequity (H)	0.06	0.04	0.09	0.03
Absolute HI (H^T)	0.21	0.11	0.22	0.18
Bandwidth (log($)*100)	$2.77	$4.99	$2.98	$5.37

Table 4: Individual Adult Equivalent Income: Modelled data (Log bands)

	HES88-91		HES11-13	
	Per capita	Base Scale	Per capita	Base Scale
Market Income Gini (G_Y)	51.88	50.26	53.23	51.23
Disposable Income Gini (G_D)	33.87	30.19	39.12	35.23
Redistributive Effect (RE)	18.01	20.07	14.11	16.00
Kakwani progressivity (V_K)	19.74	21.43	15.15	17.01
Atkinson-Plotnick Reranking (R_{AP})	1.73	1.35	1.04	1.01
Vertical Equity (V)	19.78	21.43	15.22	17.04
Horizontal Inequity (H)	0.03	0.00	0.07	0.03
Absolute HI (H^T)	0.13	0.08	0.13	0.11
Bandwidth (log($)*100)	$2.05	$1.78	$2.21	$1.92

5 Sensitivity of results to the equivalence scale

As Table 2-Table 4 show, the estimates of the measures of redistribution and equity are dependent on the equivalence scale used. With reference to the distribution of income among families, unequivalized family level data has a smaller redistributive effect, smaller vertical effect, greater reranking, and larger horizontal inequity.[21]

To investigate the general sensitivity of the results the parameters of the equivalence scale were varied. This scale takes the form:

$$m = (n_a + \theta n_k)^{\alpha} \tag{13}$$

Where m is the number of equivalent adults in the family, n_a is the number of adults in the family, n_k is the number of children, $0 \geq \theta \leq 1$ is the weight placed on the number of children, and $0 \geq \alpha \leq 1$ is a measure of scale economies among the family unit. Our unit of analysis (equivalised disposable income) is then equal to overall family income divided by the number of equivalent adults in that family. [22]

The base comparison has the values of $\alpha = 0.6$ and $\theta = 0.7$. As a result, when one of the parameters is varied the other parameter is fixed at its base level eg where α is varied θ is fixed at 0.7.

[21] According to Deaton (1997) it is preferable to apply an equivalence scale over a household rather than a family unit - which is the opposite of what has been applied here. The logic is that many of the scale economies that take place are over an entire household (eg a shared washing machine) rather than at the family level (eg family meals). However, scale economies will still differ significantly between a household made up of two single people and a household made up of one couple. Furthermore, benefit payments are made based on family status - implying that the government implementation of income policy based on need using income sharing between families not households. As the unit of analysis is the family in this paper, and as differential benefit payments are given based on family - not household - size, the equivalence scale was applied on the family rather than the household. This assumption has little material impact on the results reported, and figures using a more typical household equivalence scale are available by request.

[22] Families, or Economic Family Units, differ from Households - as it is possible to have multiple families in a household. A family unit is assumed to include a principal, their spouse, and their dependant children.

5.1 Varying scale economies

The scale economies parameter represents how much the per capita cost of maintaining a given standard of living falls as the family size rises (Nelson 1988). At a value of 0 m always equals 1 and family income is unequivalised - this suggests that there are maximum scale economies, with family members consumption opportunities from a given family income not depending on the number of individuals in the family unit. At a value of 1 family income is divided by the number of adults in the family plus 0.7 times the number of children in the family implying that there are no scale economies.

The overall redistributive effect (RE) of policy rises with the level of scale economies in the family, but at a decreasing rate. For the HES88-91 period the RE peaked at $\alpha = 0.8$.

However, the estimate of the vertical effect of policy rises with the scale economies parameter for all α. This suggests that at very high levels of the scale economies parameter the combination of horizontal inequity and reranking must be increasing.

Vertical equity (VE) as a percentage of the redistributive effect follows a U-shape in the scale economies parameter declining as relative to RE at low values and rising at high values of α. However, near the parameter value used in the base scale this ratio reaches its lowest level[23] before increasing at a rising rate. This result suggests that, inadvertently, the use of the base scale provides a low estimate of the level of vertical equity in the tax-transfer system.

The most significant difference due to the change in scale economies occurs with reranking. Reranking as a proportion of RE follows the same general pattern as VE. However, for both low and high values of the scale economies parameter reranking in HES88-91 was significantly higher (as a % of RE) than in HES11-13. The result that reranking was greater in the later period only holds for scale economies near the base scale parameter of 0.6. This implies that the greater reranking (as a % of RE) induced inequity in the estimates above only hold if the scale economies parameter is close to the base scale.

Horizontal inequity (HI) as a percentage of the redistributive effect generally declines as the scale economies parameter rises, however the rela-

[23] This occurred at approximately 0.6 for HES 88-91 and 0.4 for HES11-13.

tionship is imperfect as shown in Figure 13. In level terms, HI generally declined for both year periods as the scale economies parameter increased. However, HI was only substantially larger in HES11-13 than in HES88-91 when the scale economies parameter was near the base scale level, 0, or 1.

However, the key result is robust to the scale parameter. Absolute HI (H^t) was greater in HES11-13 than in HES88-91 in both absolute terms and as a proportion of the redistributive effect (Figure 15).

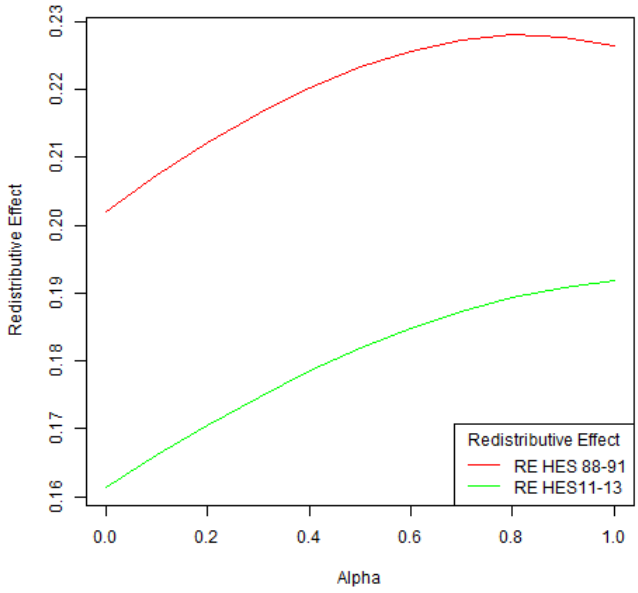

Figure 11: Redistributive effect for varying levels of scale economies.

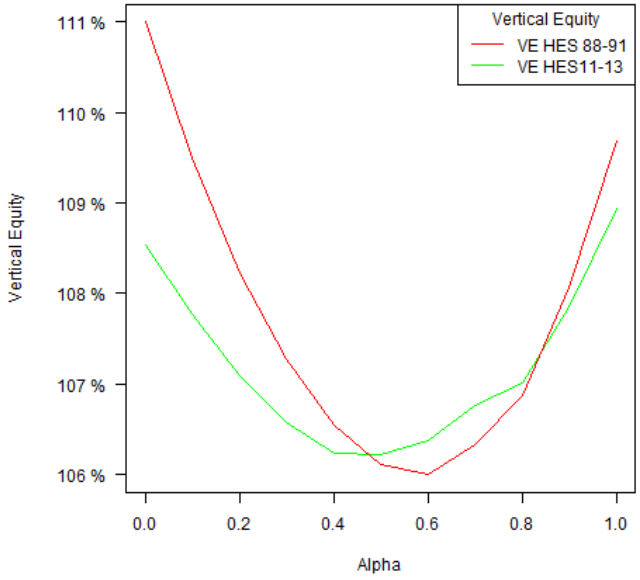

Figure 12: Vertical equity (% RE) for varying levels of scale economies.

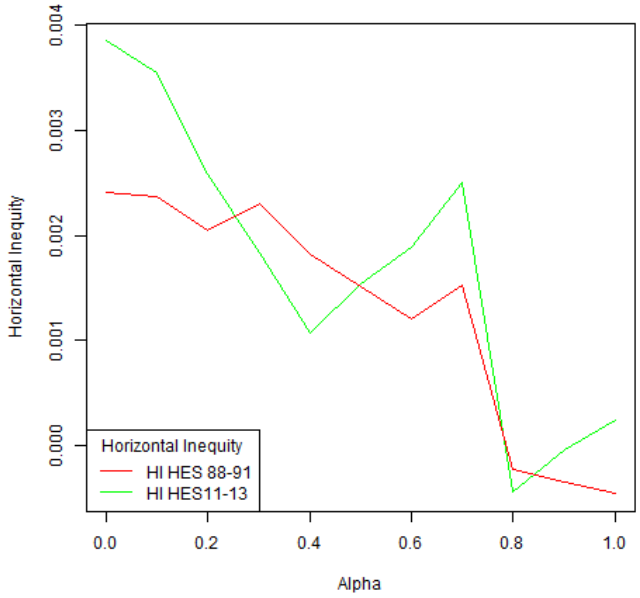

Figure 13: HI (% RE) for varying levels of scale economies.

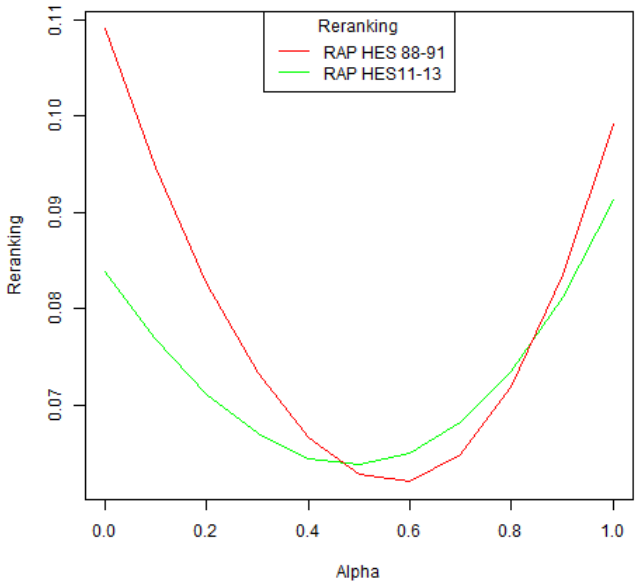

Figure 14: Reranking (% RE) for varying levels of scale economies.

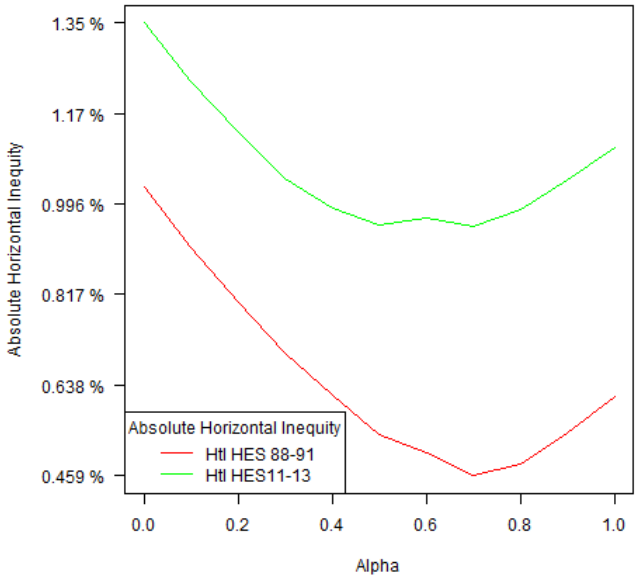

Figure 15: Absolute HI (% RE) for varying levels of scale economies.

5.2 Varying the weight of the child

Changing the weight on the number of children has very little impact on the results. While there was a 12.8% (18.9%) difference between the smallest and largest RE for HES88-91 (HES11-13) when changing the scale economy term, there was only a 1.0% (0.7%) maximum difference in the RE when considering varying child weights.

However, the composition of the decomposition of the redistributive effect does change as the weight placed on children changes - specifically for the HES88-91 year.

For the vertical effect, the base scale weight (0.7) corresponds to the results in this paper - with VE as a proportion of RE slightly higher in HES11-13 than in HES88-91. At a weight of zero, VE is significantly higher for the HES88-91 period than for HES11-13. For both year periods as the child weight is increased from zero to 0.4 VE declines, but the decline is much sharper for the earlier period (Figure 17).

With VE declining and RE unchanged as the child weight rises for the HES88-91 period, this suggests that horizontal inequity must also decline as this weight rises. As shown in Figures 18 and 19 both H and R^{AP} decline as the child weight rises. However, it is the decline in reranking that explains most of the difference between the changes in VE and RE.

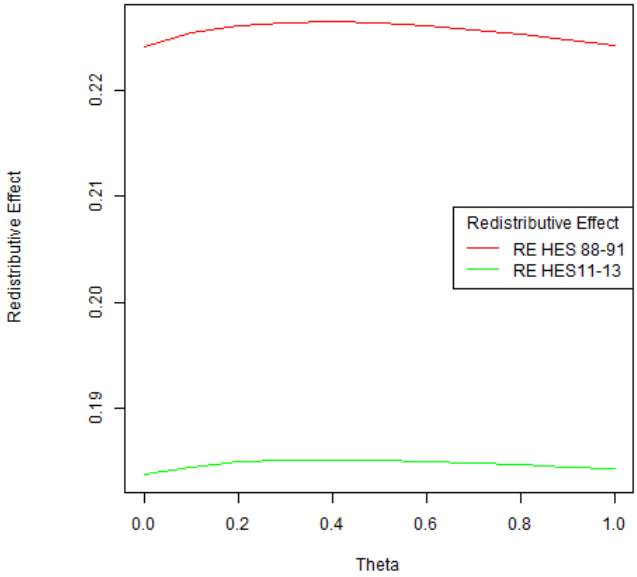

Figure 16: Redistributive effect for varying weights on children.

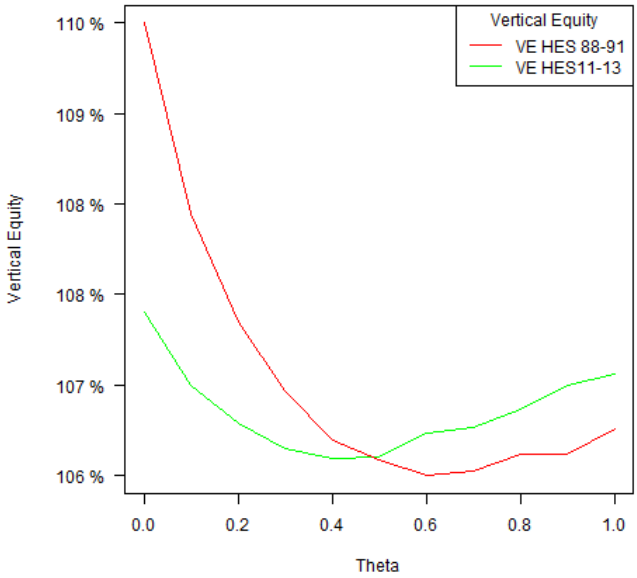

Figure 17: Vertical equity (% RE) for varying weights on children.

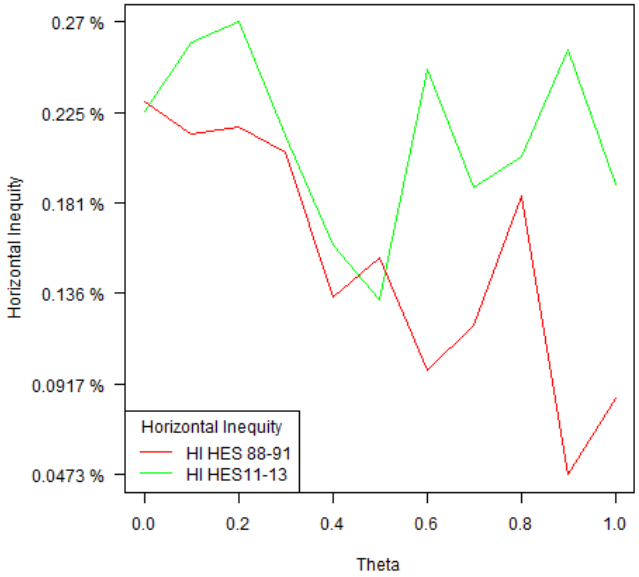

Figure 18: HI (% RE) for varying weights on children.

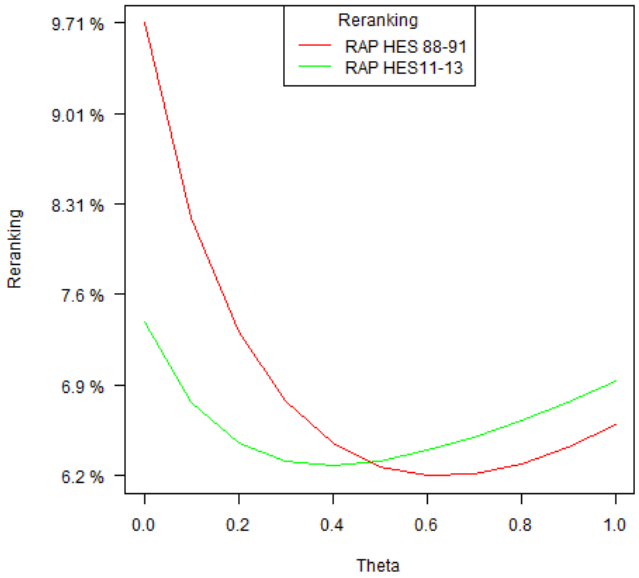

Figure 19: Reranking (% RE) for varying weights on children.

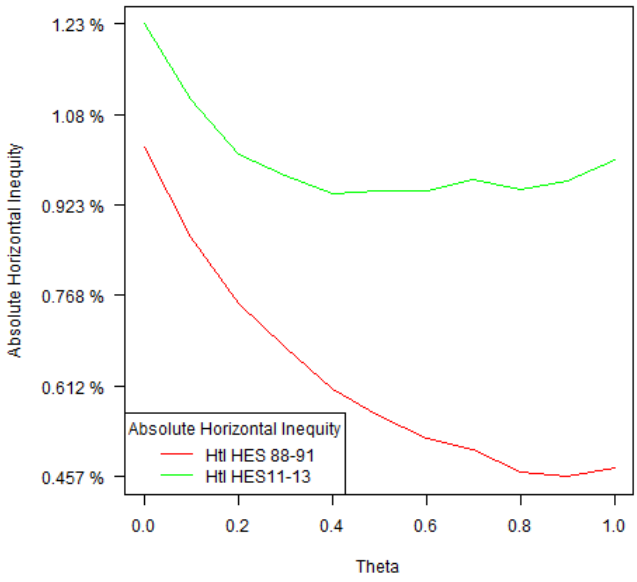

Figure 20: Absolute HI (% RE) for varying levels weights on children.

6 Conclusion

This paper focused on evaluating the equity characteristics of tax-transfer policies changes between 1988-91 and 2011-13. Specifically the goal was to evaluate two claims: whether vertical equity declined in line with the reduction in the redistributive effect of the tax-transfer system, and whether measures of horizontal inequity (in both classical and reranking forms) declined.

There was strong evidence that vertical equity did decline in line with the reduction in the redistributive effect between these two periods, with the estimate of VE falling by the same proportion as the overall redistributive effect of policy during this time.

However, measures of horizontal inequity did not decline. Specifically, all measures of horizontal inequity between families as a proportion of the redistributive effect rose during this period - with the measure of absolute horizontal inequity also rising in level terms. Although the increase in the classical horizontal inequity term is predominantly the result of increasing

targeting of transfer payments, the lift in reranking suggests that the overall system is slightly more wasteful at achieving vertical equity goals due to the reranking of families.

The reranking result is highly sensitive to the equivalence scale used. If the scale economies parameter is sufficiently different from the base scale value - either higher or lower - then the reranking implied by the tax-transfer system as a proportion of the redistributive effect is greater in HES88-91 than it is in HES11-13. Other horizontal inequity change results are largely unaffected by the equivalence scale used.

One lesson to come out of this paper is that the traditional method for estimating the horizontal inequity in the tax system is ill-suited to offering an objective evaluation of the transfer system given that explicit targeting of need in the transfer system is represented as horizontal inequity.

Using an income measure to analyse horizontal equity and then stating the view that reducing horizontal inequities is always just implies that all people with the same (or very similar) income are equivalent in terms of the standard of living they can derive from that income. Equivalence scales are used due to the view that larger households require less income per person to meet the same material standard of living (Nelson 1993). However, this is insufficient to account for the myriad of other differences between these households (eg disabilities, the cost of living in a given location) and the difference that may exist between material standards of living from income and a more general standard of living concept.

A transfer system that targets these non-income characteristics that influence individuals material standard of living will generate horizontal inequity according to these measures, but such horizontal inequity is by design and exists to satisfy policy goals (eg equalizing opportunity or capabilities (Sen 2000)) which are predicated on the idea that these individuals are not equals.

Following Musgrave (1976) the definition of individuals being in an equal position needs to be given *operational meaning*, and assuming people are equals due to the equivalised market income is insufficient for this. These result suggests that applying this general method to a more careful definition of equals that more accurately represents the disparate needs/characteristics of individuals would be a useful direction for future research.

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About the Author

Matt Nolan is a PhD Student at the School of Economics and Finance at Victoria University of Wellington, New Zealand.
Email: Matt.Nolan@vuw.ac.nz

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