THE UNIVERSITY OF MELBOURNE

FACULTY OF BUSINESS & ECONOMICS

Melbourne Institute Working Paper Series

Working Paper No. 14/15

How Income Mobility and Income Growth Explain Income Inequality Trends

Nicolas Herault

MELBOURNE INSTITUTE®
of Applied Economic and Social Research

How Income Mobility and Income Growth Explain Income Inequality Trends*

Nicolas Herault
Melbourne Institute of Applied Economic and Social Research
The University of Melbourne

Melbourne Institute Working Paper No. 14/15

ISSN 1328-4991 (Print)

ISSN 1447-5863 (Online)

ISBN 978-0-7340-4386-3

August 2015

* I am grateful to Francisco Azpitarte, Stephen Jenkins, Paul Jensen and Moshe Justman for helpful comments and discussion.

Melbourne Institute of Applied Economic and Social Research
The University of Melbourne
Victoria 3010 Australia
Telephone **(03) 8344 2100**
Fax **(03) 8344 2111**
Email **melb-inst@unimelb.edu.au**
WWW Address **http://www.melbourneinstitute.com**

Abstract

Jenkins and Van Kerm (2006) show how income inequality trends can be explained by income mobility and the equalising effect of panel-income changes. This paper extends their framework to show explicitly how the distributional effect of panel-income changes depends on the respective size and distribution of income gains and losses. An application to US data illustrates the contribution of the approach. One of the new insights of the application to US data for the 1970/2009 period is that most of the equalising effect of income growth occurs through income gains rather than income losses even in times of recession. The analysis also reveals some interesting trends regarding income mobility and the business cycle.

JEL classification: D31, D63

Keywords: Income inequality, income mobility, income growth

1. Introduction

Income mobility and income inequality are two topics that have been the subject of extensive research. Although both topics are clearly related, building a bridge between them remains a challenging task. The aim of this paper is to propose a new approach capable of explaining concomitant changes in income inequality and income mobility. Building on Jenkins and Van Kerm (2006) — hereafter referred to as JVK — the new method establishes a direct link between income-rank mobility, the distribution of winners and losers (i.e. the distributional effect of income growth) and changes in inequality. The application to US data covering the period between 1970 and 2009 illustrates how this approach can bring new insights on the dynamics of income distribution.

The relationship between mobility and inequality can be hard to grasp. As Duval-Hernandez *et al.* (2014) point out even a Nobel Prize-winning economist may not understand how both inequality and mobility can increase over the same period. Yet, Hernandez *et al.* (2014, p1) indicate that it is not only possible but also common to find increases in inequality even though "when we follow the same people over time, those who earned the least to begin with gained more in dollars than those who started at the top of the earnings distribution."

Partly, this apparent contradiction is due to the fact that "the very concept of income mobility is not well-defined" (Fields and Ok 1999, p557). In response a stream of the literature has proposed mobility measures that have a clear relationship with inequality measures. Shorrocks (1978) popularised the idea that mobility can be measured by the extent to which inequality is reduced by an extension of the income-accounting period (see, for example, Bayaz-Ozturk *et al.* 2014 and Kopczuk *et al.* 2010 for recent applications of Shorrocks' approach to the US).[1]

This type of mobility measures bears a clear relationship with inequality measures in that more mobility is always synonymous with less inequality. The trade-off, however, is that they have distanced themselves from the most intuitive definitions of mobility. JVK addresses this limitation in the special case of the widely used Gini index. By drawing on the income tax literature, they show that if mobility is simply defined as income reranking the only

[1] Recent developments by Fields (2010) and Aaberge & Mogstad (2014) propose new measures of mobility as an equalizer of permanent income in an attempt to address the limitation pointed out by Fields (2010, p418) that "neither the sign nor the relative magnitudes [of the Shorrocks' index] conveys any information about whether the mobility process is an equalizing or a disequalizing one".

remaining factor that explains changes in inequality is the degree to which income growth (i.e., the panel-income changes) is more favourable to the poorer individuals than to the richer individuals.

This paper adopts the same mobility concept as in JVK to propose a new method capable of explaining why and how income growth may reduce inequality or, according to JVK, be 'pro-poor'. The new method is particularly helpful to shed light on the relationship between income mobility and inequality. We depart from JVK by recognising that over any time period some individuals will see their income increase while others will experience an income loss, and yet other individuals may face no change. It follows that how the income growth process affects inequality depends on the respective size and distribution of the income gains and losses. Moreover, distinguishing income gains and losses is relevant from a social welfare perspective as there is evidence that people treat them differently.[2]

One of the major new insights of the application to US data for the 1970/2009 period is that most of the equalising effect of income growth occurs through income gains rather than income losses, a finding that persists even in times of recession. Finally, income mobility shows no clear long-term pattern but it declined during the Great Recession, which is in contrast with previous recessions.

The remaining of the paper is organised as follows. The new method to decompose inequality changes is presented in Section 2. The application to US data is discussed in Section 3 and Section 4 concludes.

2. A new method to explain inequality changes

JVK establish a parallel between observed inequality changes and Kakwani (1984)'s proposed decomposition of the redistributive effect of a tax. A change in inequality — either the observed change over time in JVK or the change due to the implementation of a tax in Kakwani (1984) — can be decomposed into a vertical and a reranking effect. Let G_i denote the Gini coefficient of year i incomes and C_i^j denote the concentration coefficient for year i incomes calculated using year j rankings.[3] JVK show that

[2] See the literature on prospect theory (e.g. Jantti et al. 2013 or Wodon 2001 p. 451).
[3] JVK shows how their approach can be extended to allow for different degrees of inequality aversion by using the generalized Gini coefficient. This extension applies in the same way to the approach laid out in this section. Note also that in principle there is an index number issue since the final year could be used as the reference point instead of the initial year. However, JVK (p. 536) notes that "in practice this is less important as the

$$\Delta G = G_1 - G_0 = R - V$$
$$\textit{where } R = G_1 - C_1^0 \text{ and } V = G_0 - C_1^0 \tag{1}$$

They interpret V as a measure of the progressivity (or the equalising effect) of the income changes and R as an index of mobility in the form of reranking. In the context of the income tax literature, V is the vertical effect of the income changes as it depends both on the size and progressivity of the income changes.

R is a relative-income-weighted average of changes in social weights. It follows that $M = R / G_1$ is the asymmetric Gini mobility index discussed in Wodon (2001) and Yitzhaki and Wodon (2004). If there is no change in the ranking of the income units, then the mobility index equals zero. For instance, this may arise if the loss (or gain) in mean income is equally shared by all income units in proportion of their initial income level. By contrast, maximum mobility occurs if there is a total reversal in the ranks. As noted by Wodon (2001, p. 454), the advantage of this mobility index is that "it takes into account both the level of income of the individuals and their ranking in the distribution of income, with the changes in rankings which traditionally define mobility being weighted by the changes in income levels".

It follows from equation (1) that in the absence of reranking the reduction in inequality is entirely determined by the size and progressivity of the income changes as measured by V. In this framework, inequality is reduced by pro-poor income changes unless more than offset by concomitant income mobility.

If there is a change in mean income μ from year 0 to year 1, V can be rewritten as

$$V = \frac{\pi}{1+\pi} K \tag{2}$$

where $\pi = (\mu_1 - \mu_0) / \mu_0$ is the proportionate change in the population's average income and K is an index of the proportionality of the income changes defined in a similar fashion as the tax progressivity index introduced by Kakwani (1977). Again there is a clear parallel with the income tax literature. Kakwani's progressivity measure is defined as the difference between the concentration index of taxes and the Gini coefficient for pre-tax income. However, an adaptation is required here since Kakwani's index is not designed to deal with bidirectional income changes, such as the typical panel-income changes. This issue is examined in the

---

forward-looking perspective is the natural one to use when examining (the progressivity of) income growth over time."

income tax literature interested in the effect of net taxes (taxes minus benefits). Crucially, Lambert (1985, 2001) shows that Kakwani's approach is ill-suited to examine the progressivity of net taxes since the sign and the value of the index are unstable as the average net tax approaches zero. This implies that the index of the proportionality of the income changes, *K* defined in equation (2), is unstable for small average income changes.

This explains why JVK do not introduce a distinction between the magnitude and the progressivity of the income changes but focus instead on the index *V*, which subsumes both of these aspects. Yet, such a distinction has proved to be useful in the income tax literature as the same level of redistribution can be achieved through a small but highly progressive income tax or a large but barely progressive income tax. Similarly, one would expect that the same reduction in inequality could be achieved by either limited income growth disproportionally concentrated among the poor or substantial income growth only mildly concentrated among the poor.

Hence, we depart from JVK's framework to explicitly distinguish income gains and losses and to show their separate distributional consequences. By drawing a parallel with the treatment of net taxes in the income tax literature (see Lambert, 1985), we obtain

$$V = \underbrace{\frac{l}{1-l+g} P_l}_{VE_l} \underbrace{- \frac{g}{1-l+g} P_g}_{VE_g} \tag{3}$$

where *l* is the average income loss as a share of year 0 income and *g* is the average income gain as a share of year 0. More specifically, let denote x_{it} the income of individual *i* in period *t*, *l* and g are

$$l = \frac{1}{N} \sum_{i=1}^{N} \frac{x_{i0} - x_{i1}}{x_{i0}} I_{x_{i1} < x_{i0}} \tag{4}$$

$$\mathrm{g} = \frac{1}{N} \sum_{i=1}^{N} \frac{x_{i1} - x_{i0}}{x_{i0}} I_{x_{i1} > x_{i0}} \tag{5}$$

where $I_{(.)}$ is an indicator equal to 1 if (.) is true and 0 otherwise. Kakwani's disproportionality indices P_l and P_g are defined in the usual sense as the concentration index of income gains (or losses) minus the Gini coefficient for year 0 incomes. The difficulty mentioned above in the definition of *K* is avoided as income gains (and income losses) all imply an income change in the same direction. Equation (1) still applies and equation (3)

simply provides a meaningful interpretation of V by stating that it is the sum of the equalising effects of income gains and losses. More specifically, the degree of redistribution achieved by the income changes depends on (i) the size of the income gains, (ii) the extent to which they are more concentrated among poorer individuals than among richer individuals (i.e. their regressivity), (iii) the size of the income losses and (iv) the extent to which they are more concentrated among richer individuals than among poorer individuals (i.e. their progressivity). The vertical effect of income losses VE_g encompasses (i) and (ii), while VE_l summarises (iii) and (iv).

3. Changing income inequality and mobility in the US between 1970 and 2009

The data source for this application is the US Panel Study on Income Dynamics (PSID), as released in the Cross National Equivalence File (CNEF) (Burkhauser *et al.* 2001). The measure of income for each individual is based on the post-tax post-transfer annual income of the household to which they belong. Household income is adjusted for differences in household size by dividing by the square root of the household size, a commonly used equivalence scale. All incomes are converted to 2009 dollars using the consumer price index, negative incomes are recoded to zero, individuals of all ages are included and all calculations use sample weights. Standard errors for all estimates are obtained by using the bootstrap resampling methods described in Van Kerm (2013) and Saigo, Shao and Sitter (2001).

The data cover the period from 1970 to 2009 with yearly data between 1970 and 1997 and biennial data after 1997. Hence, we carry out decompositions over successive two-year periods with one exception, the 1984–1987 period, to allow for the switch from even to odd years.[4] The period of analysis is marked by six recessions in 1973–75, 1980, 1981–82, 1990–91, 2001 and 2007–09 according to the National Bureau of Economic Research (NBER).

Table 1 shows the estimates of inequality changes and their decomposition for each two-year period between 1970 and 2009. Figure 1 provides a graphical representation of inequality changes, the reranking index R and the vertical effects of the income gains, VE_g , and income

[4] Unlike Jenkins and Van Kerm (2006), income is not averaged over three years in order to better assess the influence of short-term income changes and the business cycle on inequality and mobility measures.

losses, VE_l. Figure 2 shows the evolution of the regressivity of the income gains ($-P_g$) and of the progressivity of the income losses P_l.

The results show that most of the redistributive effect of the panel income changes occurs through income gains rather than income losses (see Table 1 and Figure 1). And this finding is independent of the business cycle. These findings represent new insights in the dynamics of income distribution. They show, perhaps unexpectedly, that whether the economy is growing or contracting, most of the equalizing effect of the panel-income changes is attributable to income gains rather than income losses. There are two main reasons to explain the dominance of income gains. First, income gains are larger than income losses on average, a mere reflection of the positive income growth observed over most sub-periods. Second, and most importantly, the disproportionality of income gains with respect to initial incomes (i.e. their regressivity) is systematically greater than the progressivity of income losses (Figure 2). In other words, it is essentially because income winners are disproportionately found in the lower part of the income distribution that panel income changes reduce inequality.

The roles of income gains and losses in explaining the equalising effect of panel-income changes show — perhaps surprisingly — little sensitivity to the business cycle. This is despite the fact that (as expected) average income losses tend to increase and income gains tend to fall in recessions. This pattern, however, is somewhat offset by the tendency of income gains to become more concentrated at the bottom of the income distribution in times of recession (with the exception of the double-dip recession of 1980 and 1981–82, see Figure 2). As for the progressivity of income losses, that is the extent to which losses tend to be more concentrated among richer individuals than among poorer individuals, it increased in the last three recessions (1990–91, 2001 and 2007–09), which contributed to reinforce the equalising effect of income losses.

A long-term increasing trend in income inequality starting from the early 1980s is clearly evident from Table 1. This trend is consistent with the dynamics of panel-income changes as it coincides with an increasing trend in income reranking contributing to an increase in inequality, which was only partially offset by the increased redistribution achieved through panel-income changes. We also note that there are seven two-year windows in which inequality decreased and they all correspond to an entry into recession with only two exceptions, the 1976–78 and 2001–03 periods. Interestingly, however, the double-dip recession of 1980 and 1981–82 does not coincide with a reduction in inequality unlike other

recessions, perhaps suggesting that recessions triggered by a tightening of monetary policy have specific distributional consequences.

Finally, we note that the reduction in mobility, as measured by the normalized reranking index M, observed in the 1980s (and also found by JVK) was only temporary. The decrease in mobility was reversed between the late 1980s and the early 1990s. Mobility then plateaued until it started to decline again between 2003 and 2009.

4. Conclusion

This paper extends the method proposed by Jenkins and Van Kerm (2006) to reconcile two closely-related concepts whose interactions are often poorly understood, namely income mobility and income inequality. The extension is particularly useful to understand the interrelated dynamics of income mobility, inequality and growth. The application to the US based on data from 1970 to 2009 shows that if panel-income changes (i.e. income growth) are equalising it is largely due to income gains rather than to income losses, a finding that also applies in times of recession. A valuable avenue for future research is to examine how taxes and transfers affect mobility and alter the extent to which the income growth process contributes to inequality trends.

5. References

Aaberge, R. and Mogstad, M. (2014). Income mobility as an equalizer of permanent income, Discussion Paper 769, Statistics Norway Research Department.

Bayaz-Ozturk, G., Burkhauser, R. and Couch, K. (2014). Consolidating evidence on income mobility in the Western states of Germany and the U.S. from 1984 to 2006, *Economic Inquiry*, 52(1), 431–443.

Burkhauser, R. V., Butrica, B. A., Daly, M. C. and Lillard, D. R. (2001). The Cross-National Equivalent File: A product of cross-national research, in I. Becker, N. Ott, and G. Rolf (eds), *Soziale Sicherungi n einer dynamsichenG esellschaftF. estschriftf ir RichardH auser zum* 65. Geburtstag Campus, Frankfurt and New York, 354–376.

Fields, G. S. (2010). Does income mobility equalize longer-term incomes? New measures of an old concept, *Journal of Economic Inequality*, 8, 409–427.

Fields, G. S. and Ok, E. A. (1999). The measurement of income mobility. In: Silber, J. (ed.) *Handbook of Income Distribution Measurement*. Kluwer, Boston.

Duval-Hernández, R., Fields, G. S. and Jakubson, G. H. (2014). Changing Income Inequality and Panel Income Changes in Times of Economic Growth and Economic Decline, unpublished manuscript.

Jäntti, M., Kanbur, R., Nyyssolä, M. and Pirttila, J. (2013). Poverty and welfare measurement on the basis of prospect theory, CESinfo WP no. 4095.

Jenkins, S. P. and Van Kerm, P. (2006). Trends in income inequality, pro-poor income growth, and income mobility, *Oxford Economic Papers*, 58, 531–548.

Kakwani, N. C. (1977). Measurement of tax progressivity: An international comparison, *The Economic Journal*, 87, 71–80.

Kakwani, N. C. (1984). On the measurement of tax progressivity and redistributive effect of taxes with applications to horizontal and vertical equity, *Advances in Econometrics*, 3, 149–168.

Kopczuk, W., Saez, E. and Song, J. (2010). Earnings inequality and mobility in the United States: Evidence from Social Security data since 1937, *Quarterly Journal of Economics*, 125(1), 91–128.

Lambert, P. J. (2001). *The distribution and redistribution of income (3rd ed.)*, Manchester: Manchester University Press.

Lambert, P. J. (1985). On the redistributive effect of taxes and benefits, *Scottish Journal of Political Economy*, 32(1), 39–54.

Saigo, H., Shao, J. and Sitter, R. R. (2001). A repeated half-sample bootstrap and balanced repeated replications for randomly imputed data, *Survey Methodology*, 27(2), 189–196.

Shorrocks, A. F. (1978). Income inequality and income mobility, *Journal of Economic Theory*, 19, 376–393.

Van Kerm, P. (2013). rhsbsample – Stata module for repeated half-sample bootstrap resampling, Statistical Software Component S457697, Boston College Department of Economics.

Wodon, Q. (2001). Income mobility and risk during the business cycle: Comparing adjustments in labour markets in two Latin-American countries, *Economics of Transition*, 9(2), 449–461.

Yitzhaki, S. and Wodon, Q. (2004). Mobility, Inequality, and Horizontal Equity, in John A. Bishop, Yoram Amiel (ed.) Studies on Economic Well-Being: Essays in the Honor of John P. Formby (*Research on Economic Inequality*, Volume 12), Emerald Group Publishing Limited, 179–199.

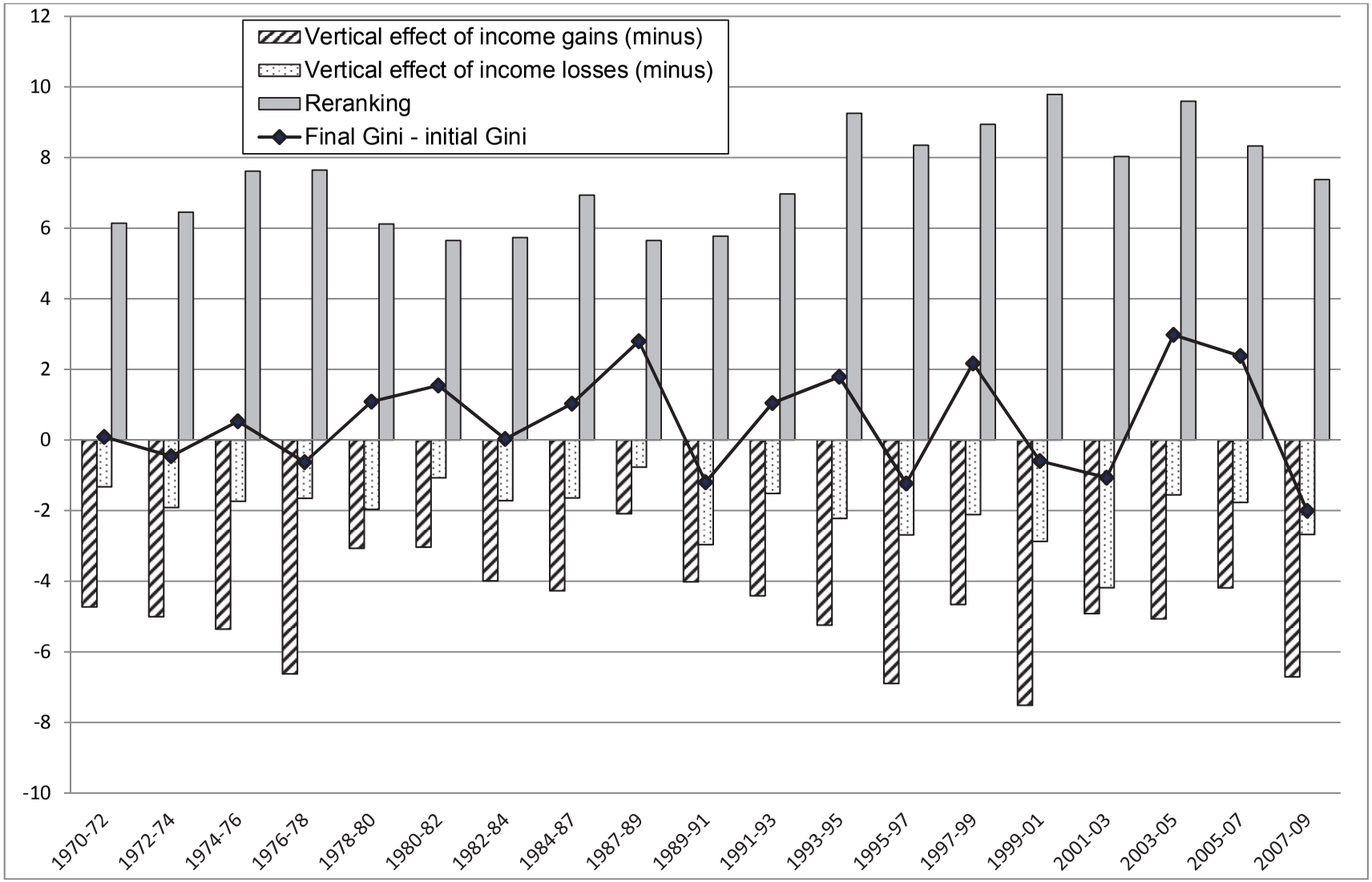
Table 1 Decomposition of changes in income inequality (US 1970–2009)[a]

		Gini coefficient						Income gains			Income losses		
Initial year	Final year	Initial year	Final year	Change	Reranking R	Mobility M (R/G_I)	Vertical effect V	Vertical effect VE_g	Progressivity P_g	Av. gain g^b	Vertical effect VE_l	Progressivity P_l	Av. loss l^b
1970	1972	30.58	30.67	0.09	6.14	0.200	6.05	4.73	–28.69	17.85	1.32	15.19	9.45
		(0.24)	(0.24)	(0.20)	(0.17)	(0.01)	(0.25)	(0.17)	(1.02)	(0.30)	(0.14)	(1.25)	(0.26)
1972	1974	30.42	29.96	–0.46	6.45	0.215	6.91	5.00	–46.56	10.39	1.91	13.51	13.67
		(0.25)	(0.25)	(0.20)	(0.22)	(0.01)	(0.27)	(0.21)	(1.58)	(0.26)	(0.14)	(0.80)	(0.24)
1974	1976	29.75	30.28	0.53	7.62	0.252	7.09	5.36	–36.38	15.25	1.73	15.40	11.65
		(0.25)	(0.24)	(0.21)	(0.27)	(0.01)	(0.31)	(0.24)	(1.39)	(0.32)	(0.16)	(1.16)	(0.28)
1976	1978	30.14	29.51	–0.63	7.64	0.259	8.27	6.62	–49.02	13.72	1.65	13.78	12.16
		(0.24)	(0.23)	(0.21)	(0.33)	(0.01)	(0.34)	(0.29)	(1.68)	(0.35)	(0.13)	(0.91)	(0.25)
1978	1980	29.33	30.42	1.09	6.12	0.201	5.03	3.07	–28.79	10.05	1.96	11.76	15.74
		(0.23)	(0.47)	(0.43)	(0.17)	(0.01)	(0.47)	(0.41)	(4.98)	(0.54)	(0.15)	(0.77)	(0.26)
1980	1982	30.49	32.03	1.55	5.65	0.176	4.10	3.03	–21.36	14.73	1.07	10.13	10.97
		(0.46)	(0.59)	(0.32)	(0.15)	(0.01)	(0.35)	(0.28)	(2.33)	(0.43)	(0.14)	(1.12)	(0.25)
1982	1984	32.09	32.12	0.03	5.73	0.178	5.70	3.99	–24.65	17.21	1.72	16.81	10.85
		(0.60)	(0.31)	(0.54)	(0.17)	(0.01)	(0.55)	(0.22)	(1.46)	(0.39)	(0.42)	(3.07)	(0.68)
1984	1987	32.24	33.27	1.03	6.94	0.209	5.91	4.27	–23.87	19.26	1.64	15.29	11.56
		(0.32)	(0.37)	(0.29)	(0.18)	(0.01)	(0.34)	(0.24)	(1.56)	(0.43)	(0.17)	(1.24)	(0.32)
1987	1989	33.26	36.06	2.80	5.65	0.157	2.85	2.08	–11.46	20.10	0.77	8.80	9.64
		(0.37)	(0.72)	(0.50)	(0.18)	(0.01)	(0.57)	(0.51)	(3.12)	(0.83)	(0.14)	(1.36)	(0.26)
1989	1991	36.11	34.91	–1.20	5.78	0.165	6.97	4.01	–31.49	12.47	2.96	19.83	14.61
		(0.70)	(0.39)	(0.57)	(0.20)	(0.01)	(0.57)	(0.22)	(1.89)	(0.33)	(0.45)	(1.96)	(0.71)
1991	1993	34.99	36.03	1.05	6.97	0.193	5.92	4.41	–28.77	15.69	1.51	11.63	13.31
		(0.40)	(0.42)	(0.35)	(0.23)	(0.01)	(0.38)	(0.29)	(2.15)	(0.48)	(0.19)	(1.19)	(0.34)
1993	1995	35.79	37.58	1.79	9.25	0.246	7.46	5.24	–34.11	15.20	2.22	13.48	16.30
		(0.41)	(0.51)	(0.45)	(0.52)	(0.01)	(0.51)	(0.43)	(2.89)	(0.65)	(0.21)	(1.00)	(0.37)
1995	1997	37.18	35.95	–1.23	8.35	0.232	9.58	6.90	–33.08	22.92	2.69	22.84	12.93
		(0.54)	(0.44)	(0.48)	(0.31)	(0.01)	(0.54)	(0.35)	(1.75)	(0.60)	(0.32)	(1.65)	(0.57)
1997	1999	37.74	39.91	2.17	8.94	0.224	6.77	4.66	–23.35	20.80	2.11	13.30	16.56
		(0.41)	(1.15)	(1.10)	(0.33)	(0.01)	(1.27)	(1.19)	(7.62)	(1.86)	(0.22)	(1.07)	(0.42)
1999	2001	40.22	39.63	–0.59	9.79	0.247	10.38	7.51	–32.36	25.66	2.87	20.99	15.12
		(1.15)	(0.54)	(1.16)	(0.56)	(0.01)	(1.21)	(0.64)	(2.99)	(1.05)	(0.77)	(3.39)	(1.43)

Initial year	Final year	Gini coefficient						Income gains			Income losses		
		Initial year	Final year	Change	Reranking R	Mobility M (R/G_1)	Vertical effect V	Vertical effect VE_g	Progressivity P_g	Av. gain g^b	Vertical effect VE_l	Progressivity P_l	Av. loss l^b
2001	2003	39.35	38.29	–1.07	8.03	0.210	9.09	4.91	–30.65	15.41	4.18	20.85	19.28
		(0.54)	(0.63)	(0.66)	(0.31)	(0.01)	(0.74)	(0.50)	(3.98)	(0.73)	(0.38)	(1.12)	(0.62)
2003	2005	38.26	41.24	2.98	9.59	0.233	6.62	5.06	–24.76	21.83	1.55	11.03	15.04
		(0.62)	(1.25)	(1.17)	(0.60)	(0.02)	(1.39)	(1.32)	(8.21)	(2.09)	(0.20)	(1.15)	(0.39)
2005	2007	41.29	43.67	2.38	8.33	0.191	5.95	4.18	–23.17	18.03	1.76	9.69	18.19
		(0.95)	(0.57)	(0.81)	(0.28)	(0.01)	(0.84)	(0.39)	(2.39)	(0.64)	(0.59)	(2.63)	(1.03)
2007	2009	43.47	41.47	–2.00	7.37	0.178	9.38	6.70	–35.81	19.44	2.67	17.79	15.60
		(0.56)	(0.65)	(0.45)	(0.26)	(0.01)	(0.52)	(0.39)	(2.63)	(0.65)	(0.24)	(1.06)	(0.48)

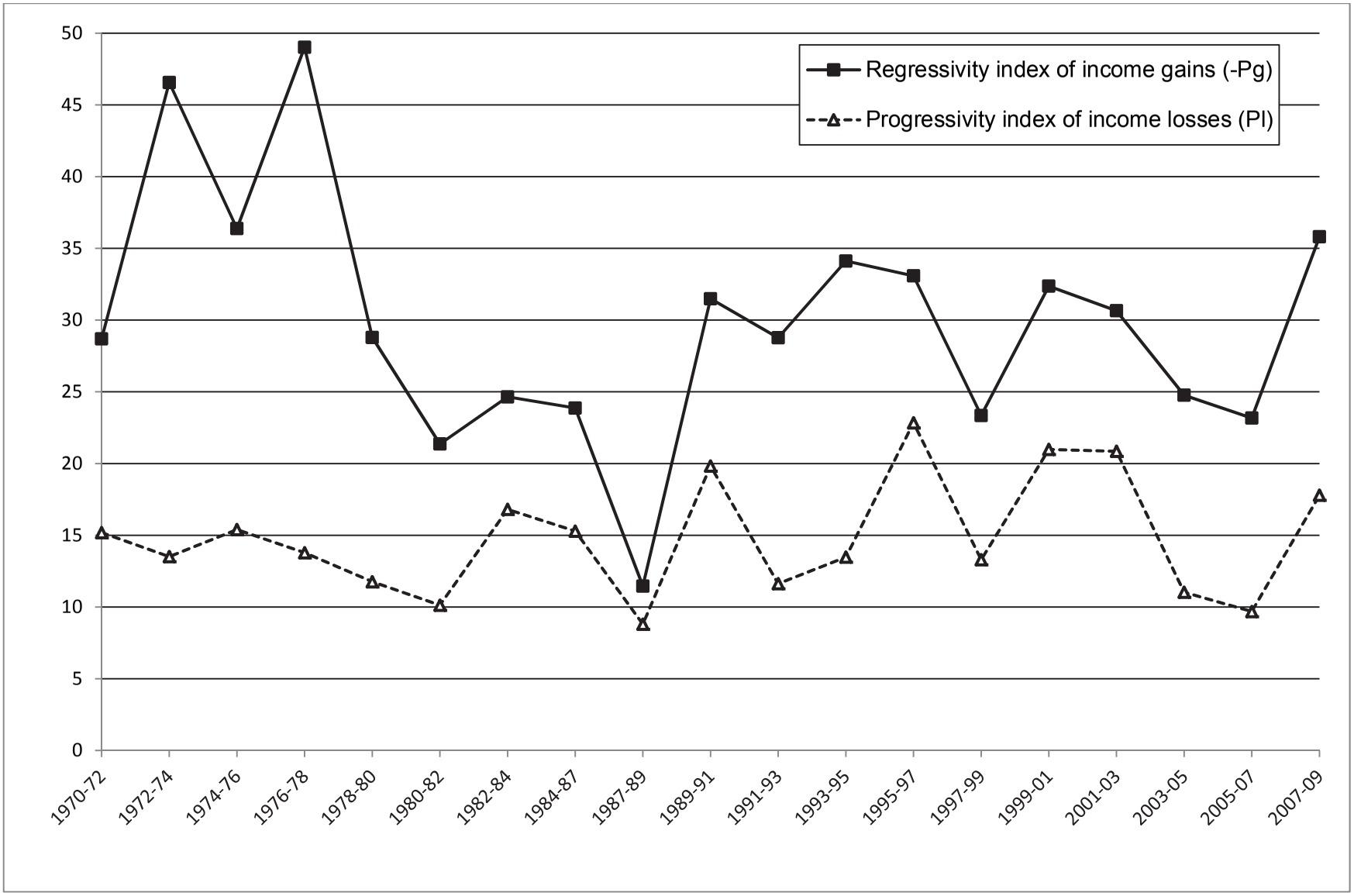
Source: Authors' calculations from the PSID (CNEF release). Separate balanced panels for each period. *Notes*: (a) Income is defined at the individual level by post-tax post-transfer equivalised household annual income. All estimates have been multiplied by 100. Bootstrap standard errors in parentheses. Reranking and vertical effects expressed in Gini points ; (b) As a percentage of initial income for each period.

Figure 1 Inequality changes, reranking and the vertical effects of income gains and lossess (US 1970–2009, Gini points)



Source: Authors' calculations from the PSID (CNEF release). Separate balanced panels for each period. *Notes*: The change in the Gini coefficient is equal to the reranking index minus the vertical effect of income gains and the vertical effect of income losses. Income is defined at the individual level by post-tax post-transfer equivalised household annual income.

Figure 2 Progressivity of income gains and losses (US 1970–2009)



Source: Authors' calculations from the PSID (CNEF release). Separate balanced panels for each period. *Notes*: Income is defined at the individual level by post-tax post-transfer equivalised household annual income.