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International Evidence on the Impact of Transfers and Taxes on Alternative Poverty Indexes

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Abstract

Changes in the headcount rate are the standard metric for gauging how public transfers and taxes affect poverty. An alternative strategy, one theoretically more appealing and complete, is to rely on distribution-sensitive indexes [Sen (1976, 1981)]. How would policy's measured impacts change if such an approach were to be used? This study provides new empirical evidence based on Luxembourg Income Study data for seventeen countries covering various years between 1969 and 1997. Poverty is measured using three indexes from the class developed by Foster, Greer, and Thorbecke (1984), one of which is the headcount rate. Estimates of the policy impacts are obtained by computing index values with before- and after-policy income. Evidence is also provided on the determinants of cross-country differences in index values and policy effectiveness, and on the extent to which variations in the different indexes are correlated with those in the United Nations Human Development Index.

Key Words: Poverty measurement; Distribution-sensitive poverty indexes; Luxembourg Income Study, Human Development Index, Anti-poverty policy.

I. Introduction

This study examines how changes in income due to government transfers and taxes affect alternative indexes of poverty. Standard analyses have focused on headcount rates (percent of the population which is identified as poor), gauged using either the official poverty thresholds or ones adjusted to overcome their perceived shortcomings[1]. Doing so assumes, implicitly or explicitly, that reducing the number of poor people is the sole objective of policy. Such an approach provides useful information, but is also seriously incomplete and potentially misleading, in light of Sen's (1976, 1981) seminal and influential work.

Sen (1976, 1981) argued that poverty indexes should minimally satisfy two criteria beyond including the number of poor individuals: the *monotonicity* axiom, which requires overall poverty to increase if the income of a poor person decreases; and, the *transfer* axiom, which directs overall poverty to rise whenever resources are transferred from a poor person to another person with more resources. Thus, focusing on the headcount rate alone ignores two other ways by which transfers and taxes can affect poverty. That is, government policies might affect not only the number of poor people, but also, and independently, the depth of their poverty and the distribution of resources among the poor (their relative deprivation). Ignoring these other effects of government programs can produce a seriously misleading picture of how programs affect poverty, and lead to misguided decisions about program viability.[2]

In broad terms, investigations of how policy affects poverty have proceeded along two lines. One approach has measured how much poverty changes when individuals' incomes are reduced by the value of government transfers received and taxes paid, with no account taken of possible changes in behavior. Transfers have included cash payments, the values (either market or fungible) of non-cash payments, or both. Taxes have covered levies at both the federal and

state levels. Depending on the types of transfers and taxes considered, and the population under study, the measured effects of policy can be relatively large, changing the headcount poverty rate by several percentage points. A second method has studied the possible disincentives for wealth-creating activities resulting from government polices, and the likely effects on incomes [see, e.g., Murray (1984)]. Several studies suggest that the behavioral impacts of these disincentives appear to be relatively small [see, e.g., Danziger, Haveman and Plotnick (1981), Burtless and Haveman (1987), Moffitt (1992) Atkinson and Morgensen (1993), and Kenworthy (1998)], although some disagreement remains.[3]

This analysis follows the first approach, and estimates how changes in income due to government transfer and tax policies affect three alternative poverty indexes[4]. The poverty measures belong to a class of indexes developed by Foster, Greer, and Thorbecke (1984) [henceforth, P_α]. This class of measures is instructive because it permits indexes that aggregate poverty with increasing levels of complexity depending on the parameterization chosen. Three members of P_α are studied here: one which aggregates using a simple headcount rate of poor individuals (P_0); a second which reflects both the headcount rate and the average poverty gap ratio (P_1); and, a third which includes the headcount rate, the poverty gap ratio, and the degree of income inequality among the poor (P_2). The third measure has the important benefit of satisfying both of Sen's criteria. By using a single class of indexes and a consistent data set for comparisons, the implications of alternative aggregation schemes can be isolated.

The study employs the Luxembourg Income Study (LIS) for various years in the 1969 to 1997 period. The LIS provides the only data that allow income, inequality and poverty to be measured consistently across countries.[5] It contains detailed information on cash and in-kind transfers received, as well as tax liabilities. We estimate the combined effects of transfers and

taxes on poverty by computing values for the three indexes, P_0, P_1 and P_2, using alternative income definitions, and then comparing the different computations in ways that isolate program impacts. We also provide evidence on possible sources of cross-country differences in index values, and on the correlation between variations in the index values and the United Nations Human Development Index.

II. The P" Family of Indexes

The general class of indexes developed by Foster, Greer and Thorbecke (1984) [henceforth, FGT] is written as:

$$P_\alpha = \frac{1}{nz^\alpha} \sum_{i=1}^{q} g_i^\alpha \qquad (1)$$

where n is the total number of households rank-ordered in increasing income levels y_i , z is a predetermined poverty line, $g_i = z-y_i$ is the income shortfall of the i^{th} household, q is the number of poor households (i.e., for which g_i is greater than zero), and " is a parameter measuring "aversion to poverty", with a higher " indicating greater aversion.

A key attribute of equation (1), particularly for this study, is the range of aggregation procedures that it admits. The specific way by which poor individuals are aggregated depends on "; here, we employ values of " equal to 0, 1, and 2. When "=0, equation (1) produces a simple poverty headcount; for "=1, equation (1) is the average proportionate poverty gap; and for "=2, equation (1) represents the average squared proportionate poverty gap. Alternatively, setting "=2 can be thought of as producing a weighted average proportionate poverty gap, where the weights

are the poverty gaps themselves, thus giving relatively more importance to relatively poorer individuals. The three indexes are referred to as P_0, P_1, and P_2, respectively.[6]

P_0, P_1, and P_2 can be rewritten so as to illuminate the specific characteristics of the poor population imbedded in their respective aggregations. Letting H signify the headcount ratio, q/n; I the average poverty-gap ratio, 1- (μ_z / z), where μ_z is the average income of poor households; and, CV^2 the squared coefficient of variation of income among poor households, the three indexes can be expressed as [FGT (1984) and Ravallion (1994)]:

$$P_0 = H;$$

$$P_1 = H \cdot I; \text{and} \qquad (2)$$

$$P_2 = H\left[I^2 + (1 - I)^2 \cdot CV^2\right].$$

Thus, the aggregation procedures implicit in $P_{"}$ become increasingly complex as " increases. The index incorporates only the headcount for P_0, the headcount and the average poverty-gap ratio for P_1, and the headcount, average poverty-gap ratio, and income inequality among the poor (i.e., relative deprivation) for P_2.

There are other distribution-sensitive indexes in the literature. Sen's (1976) original formulation is one, although it suffers from certain well-known shortcomings.[7] As noted by Shorrocks (1995) and others, the Sen index violates the so-called "transfer axiom," it is not additively decomposable, it is not replication invariant, and it is not a continuous function of individual incomes. Shorrocks (1995) has, however, modified the Sen index to correct most of the problems. The resulting measure, known as the "SST index", is similar to the FGT P_2 index.[8] We rely on the FGT family of indexes because of its greater computational simplicity and the

greater ease with which standard errors for the estimated indexes can be produced (as is discussed below). The FGT family of indexes has the added desirable feature that it is additively decomposable, something which the SST index is not, although we do not make use of that feature here.

III. Methodological Issues

The empirical analysis employs LIS data spanning the years 1969 to 1997. Seventeen countries are studied: Australia, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Norway, Spain, Sweden, Switzerland, the United Kingdom and the United States.[9] The years for which data are available differ by country [see Table 1].

Two alternative income definitions are used. One, which is meant to capture the income available to families before the impact of government taxes and transfers, is LIS "market income." LIS market income is the sum of gross wage and salary income, farm self-employment income, non-farm self-employment income, cash property income, private pensions, and public-sector pensions for public employees (explicitly not social security). The other income definition is LIS disposable income. This equals LIS market income plus cash sickness insurance benefits, accident pay, disability pay, social retirement benefits, child or family allowances, unemployment compensation, maternity allowances, military/vet/war benefits, other social insurance, means-tested cash benefits, and all near cash benefits, minus mandatory contributions for self-employed, income taxes and mandatory employee contributions.

We follow standard conventions and assume that all income is shared within families. Similarly, we adopt the OECD equivalence scale in order to place the income of each individual on an equivalent welfare basis. Each person's equivalent income is

$$Y = Y_p/(1 + 0.7(N_a - 1) + 0.5N_c),$$

where Y_p is the market or disposable income of the person's household, N_a is the number of adults in the household, and N_c is the number of children.[10]

In order to identify individuals considered to be poor, we rely on the frequently employed poverty threshold of one half the median equivalent disposable income in a country for the year in question.[11] Individuals with equivalent income below the threshold are classified as poor. The headcount rate, depth of poverty, and income inequality of these individuals form the basis for the empirical estimates of the poverty indexes.

Measuring the Impacts of Policy. The study adopts the standard approach for measuring the effects of transfers and taxes on poverty. Relevant literature includes Paglin (1980), Danziger, Haveman and Plotnick (1981), Smeeding (1982, 1992), Danziger, Haveman and Plotnick (1986), Plotnick (1989), Gramlich, Kasten and Sammartino (1993), Danziger and Weinberg (1994), Kenworthy (1998), Smeeding, Rainwater and Burtless (2001), Osberg and Xu (2000), DeFina and Thanawala (2001), and U.S. Census Bureau (2001). The amount of equivalent market income is calculated for each individual, and baseline estimates of the three poverty indexes are computed using equation (2). Next, equivalent disposable incomes are used to recompute values for the poverty measures. The percentage differences between the baseline values of the indexes and the values generated with the policy-adjusted incomes provide a metric of each policy's effects. The study analyzes the combined effects of transfers and taxes, rather than attempting to measure the impact of a particular policy or subset of policies. Doing so avoids the intractable problem of deciding the order in which to analyze individual transfers and taxes, decisions that can greatly influence measured impacts.[12]

IV. Empirical Results

The Impact of Taxes and Transfers on the Indexes. The estimated values for each of the indexes, based on both market and policy-influenced income are presented in Table 1. Values for each of the indexes vary considerably across countries and over time within given countries, although cross-country variation is greater. A comparison of index values based on market income against the corresponding value based on policy-influenced income indicates that for every county and every year, policy intervention has considerably reduced poverty.

The extent of the reduction is indicated more clearly in Table 2, which contains the percent change in each country/year index due to policy. For the headcount rate (P_0), the reductions range from about 20 percent to about 87 percent, with an average of about 61 percent for a country/year. Policy thus appears to play a substantial poverty-reducing role. The largest reductions are registered by Belgium and the Scandinavian countries (Denmark, Finland, Norway and Sweden). The smallest occur in the United States. The percentage poverty reductions gauged using the P_1 and P_2 indexes tend to be larger than those for P_0, averaging 79 percent and 85 percent respectively. They also reveal less variation across countries. The coefficient of variation in the reductions is 0.30, 017 and 0.13 for P_0, P_1 and P_2 respectively. As with the P_0 index, the policy-induced reductions for the other two indexes are smallest for the United States.

An alternative way to think about the effects of policy is to compare the rankings of the poverty indexes before and after policy. A relatively simple approach involves assigning each point estimate of a country/year poverty index value a numerical ranking, and calculating the correlation coefficients for all index pairs. The results of the exercise are displayed in Table 3.

Three aspects of the results are noteworthy. First, the correlations between the pre-policy

headcount rate (P_0) and the pre-policy values of P_1 and P_2 are significant, but considerably less than unity. By contrast, the correlation between pre-policy values of P_1 and P_2 is 0.97. Reliance on the headcount rate thus can noticeably skew inter-country comparisons of pre-policy poverty.

Second, the correlations between each pre-policy index and its post-policy counterpart are quite small. The small correlations indicate that the anti-poverty policies of each country have widely differing degrees of effectiveness. That is, policy actions are causing the relative country rankings to change substantially. Third, the correlations between post-policy index values are relatively high, 0.9 or greater. The finding that the post-policy rankings are so similar, given that the pre-policy rankings are so different, underscores the widely different effects of policy across both indexes and countries. It also suggests conclusions about post-policy rankings historically have been independent of the index used to gauge poverty.

Comparing the point estimates of the indexes is informative, but also is less than ideal because the index estimates are subject to sampling error. Consequently, differences in point estimates and in the associated rankings might not be statistically significant. Standard errors and confidence bands for the estimates can be computed in different ways. But an important hurdle still remains, in that ranking 53 country/year values while accounting for possible ties (in a statistical sense) is impractical.

To partly illuminate the importance of sampling variability, we calculated the standard errors for each of the pre- and post policy indexes for each country using the techniques described by Kakwani (1993).[13] We then computed the 95% confidence interval for each year/county/index estimate. The point estimates and the confidence intervals are presented graphically in Charts 1 through 3. Each chart has two panels: panel a, which shows the before-policy ranking; and, panel b, which shows the post-policy ranking. Some of the graphed values

imply fairly clear conclusions. For instance, even after recognizing sampling error, the post-policy values for the United States indexes are at the high end, while those for Belgium and Luxembourg are generally at the low end. Overall the comparisons are complicated by the overlaps in the confidence intervals.

The Impact of Transfers and Taxes on the Components of Poverty. As noted earlier, the three poverty indexes are comprised of one or more of the following three elements – the headcount rate, the average poverty gap and the squared coefficient of variation of poor individual's income. Some insight into the impacts of policy on the indexes thus can be gained by examining how policy affects the fundamental index components. Table 4 contains the estimated values for each component calculated using the alternative income definitions, while Table 5 contains the percentage changes due to the influence of policy.

As can be seen in Table 5, taxes and public transfers reduce all three elements of the poverty indexes for every country/year combination. The policy reductions tend to be largest for the income dispersion among the poor (75%). The next largest are for the headcount rate (61%), and then the poverty gap (48%). Changes in the headcount rate tend not to be highly correlated with changes in either the poverty gap or CV^2. The simple correlation between headcount rate percent changes and those for the poverty gap is 0.48. The correlation coefficient for the headcount rate and CV^2 is 0.29. Thus, policies that are effective for reducing the headcount rate are not necessarily effective for other aspects of poverty. By contrast, the correlation coefficient between reductions in the poverty gap and those in CV^2 is 0.9.

The Sensitivities of the Indexes to Changes in their Components. An issue of practical interest is the extent to which each poverty index changes due to a given change in the underlying components. Such information can be helpful to policy makers, for example, when

trying to gauge where to concentrate their poverty reduction efforts. Perhaps the best way to view the issue is in terms of elasticities – by what percentage does an index change in response to a one percentage point change in an underlying component?

The answers for P_0 and P_1 can be obtained in a straightforward analytical way. Since P_0 equals the headcount rate, its elasticity with respect to a change in the headcount rate must equal unity. Similarly, because P_1 equals the headcount rate times the average poverty gap (see equation (2)), its elasticities with respect to the headcount rate and the poverty gap must each take a value of unity. To see this, simply note that $\ln(P_1) = \ln(\text{headcount rate}) + \ln(\text{average poverty gap})$, where ln signifies the natural log. The answer for P_2 is less straightforward. As suggested by equation (2), $\ln(P_2)$ is written as a linear combination of ln (headcount rate) + the natural log of a nonlinear function of the average poverty gap and CV^2. So, while the elasticity of P_2 with respect to the headcount rate is unity, the elasticities with respect to the poverty gap and CV^2 are non-constant, and depend on the level of the other component. For example, the elasticity with respect to the poverty gap depends on the existing level of CV^2. Thus, these two elasticities must be solved for numerically, given the existing level of the other component.

The elasticities with respect to the poverty gap are computed by calculating the value of P_2 using the market value poverty gap and the policy influenced values for the headcount rate and CV^2. By comparing this synthetic value to the actual post-policy value of P_2, the percent change in the index due to a change in the poverty gap alone is obtained. Taking that percent change as a ratio to the policy-induced change in the poverty gap gives the desired elasticity. The same procedure is followed for the elasticity with respect to CV^2.

The results of the exercise are shown in Table 6. The results are rather striking. As discussed, the elasticity with respect to the headcount rate is a constant equal to 1. The

elasticities for the poverty gap, by contrast, average around 1.4, with one value (France 1981) exceeding 2. Thus, given the actual values for CV^2 in each country/year, P_2 is considerably more sensitive to changes in the poverty gap than in the headcount rate. The P_2 index is least sensitive to changes in CV^2, with the average elasticity near 0.75.

Factors Affecting Cross-County Differences in Poverty and Policy Effectiveness. The results presented thus far indicate that the extent of poverty differs noticeably across countries for alternative poverty indexes and for alternative income concepts (before and after policy). Some researchers [e.g., Kenworthy (1998) and Smeeding, Rainwater and Burtless (2001)] have suggested that observed differences in the 1990s are at least partly explained by cross-country differences in the fraction of GDP devoted to cash and non-cash transfers and to differences in the percent of a country's employment consisting of low-wage workers (those earning at most 65% of the median). They presented evidence on cross-country differences in post-policy headcount rates. Here, we extend their analysis by examining whether these variables help determine cross-country differences in P_0, P_1, P_2, the income gap and CV^2, both before and after policy. We also study whether they help explain cross-country differences in the magnitudes of policy's impacts.

For comparability, we use the Smeeding, et al. (2001) data on the fraction of a country's GDP devoted to transfers and the percent of a country's employment comprised by low-wage workers. There is one observation for each country for each variable, covering a year in the 1990s. Following Smeeding, et al., we regress a poverty measure or its change due to policy on a constant and either the government transfer variable or the low wage variable. The years for the publicly available poverty index values do not exactly match those available for the independent variables, and so the index values for the years closest to the independent variables

are used.

The estimated regression line and the actual data index values are displayed in Charts 4 and 5.[14] The actual estimates show that both before-policy and after-policy P_0 are significantly related (5% level) to the fraction of GDP devoted to transfers and the percent of low-wage workers. Increases in the fraction of GDP going for transfers are associated with decreases in the headcount rate, while increases in the fraction of low-wage workers are associated with increases in the headcount rate. These results confirm the general findings of Smeeding, et al. (2001), which concentrated on the after-policy headcount poverty rate.

In contrast to the significant effects found for the headcount rates, cross-country variation in income gaps and CV^2 are not significantly related (5% level) either to the transfer or low-wage variables. These outcomes obtain for both the before-tax and after-tax measures. One interpretation of the results is that policies have concentrated on reducing the poverty headcount and have given little attention to other dimensions of poverty. Another is that policy measures have sought to influence the income gap and income distribution among the poor but have simply been ineffective.

Variations in the P_1 and P_2 indexes are significantly related to the transfer and low-wage variables. However, the strength of these relationships derives mainly from the links of the explanatory variables to P_0, given that the explanatory variables do not significantly affect either the income gap or CV^2.

We re-estimated the regression models using percent changes in the poverty index values. As before, the explanatory variables are the fraction of GDP devoted to transfers and the fraction of low-wage workers.[15] The results mirror those for the before- and after-policy index levels. That is, the percent changes in P_1 due to policy are negatively and significantly related to the

transfer variable and positively and significantly related to the low-wage variable. Neither the changes in the income gap nor in CV^2 have significant relationships to the explanatory variables, although changes in P_1 and P_2 do (again, on the strength of the P_0 relationships.)

Finally, as a way to offer evidence on the possible importance of incentive effects, we follow Kenworthy (1998) by regressing pre-policy poverty indexes on the share of GDP devoted to social transfers. We would expect to see a positive and significant coefficient on the transfer variable if, as some have hypothesized, transfers lead to increased poverty. The estimated coefficients were not close to being significant at even the 10% level (not reported). This supports the findings of Kenworthy (1998) and indicates the lack of identifiable disincentive effects in the cross-country variations.

How Do the Poverty Indexes Correlate With Human Capabilities? Poverty reduction, in itself, is an important goal. But, as Sen [2000] has emphasized, full human development depends on things other than family incomes. Specifically, Sen makes the case that true development is to be judged by the real freedoms, or capabilities, that people enjoy. These capabilities reflect human and political rights, literacy, public health facilities, and so on, things that may or may not be correlated with income poverty, however measured. Sen [2000] writes:

> *Development requires the removal of major sources of unfreedom: poverty as well as tyranny, poor economic opportunities as well as systematic social deprivation, neglect of public facilities as well as intolerance or overactivity of repressive states. Despite unprecedented increases in overall opulence, the contemporary world denies elementary freedoms to vast numbers – perhaps even the majority – of people. Sometimes the lack of substantive freedoms relates directly to economic poverty, which robs people of the freedom to satisfy hunger, or to achieve sufficient nutrition, or to obtain remedies for treatable illnesses, or the opportunity to be adequately clothed or sheltered, or to enjoy clean water or sanitary facilities. In other cases, the unfreedom links closely to the lack of public facilities and social care, such as the lack of epidemiological programs, or of organized arrangements for health care or educational facilities, or of effective institutions for the maintenance of local peace and order. In still other cases, the violation of freedom results directly from a denial of political and civil liberties… (pp. 3-4)*

Sen illustrates his point using several examples.[16] He further explains that:

> *The contrast between the different perspectives of income and capability has a direct bearing on the space in which inequality and efficiency are to be examined. For example, a person with high income but no opportunity of political participation is not "poor" in the usual sense, but is clearly poor in terms of an important freedom.* (pp. 93-94)

The question naturally arises here of how the alternative measures of poverty presented here, both pre- and post policy intervention, correlate with the Sen's broader notions of capability and freedom. To illuminate the issue, we employ the United Nations Human Development Index (HDI) as a proxy for the overall level of capability and freedom enjoyed by citizens of each country. The HDI, which incorporates numerous income and non-income dimensions of well being, captures Sen's vision of capabilities and so appears as a reasonable summary measure.[17]

Values for the HDI are publicly available for the years 1975, 1980, 1985, 1990, 1995 and 2000. The poverty indexes for some of the countries in our study do not exactly match these dates. When they do not, we linearly interpolate the values of the HDI. To measure the degree of correlation between each poverty index and the HDI, we use a fixed-effects regression model. The fixed-effects model effectively controls for unknown factors that affect the mean levels of each country's poverty index and the average index level in different time periods.

We implement the model by regressing the HDI for each country/year combination on a constant, a country/year poverty index value, country dummies, and a dummy for the years 1990 and after (the country and time dummies capture the fixed effects). We use only one time dummy to save degrees of freedom. There are seventeen different years covered by the data. The sixteen year dummies plus another sixteen country dummies, plus a constant and the HDI would leave only ten degrees of freedom. Controlling for cross-country differences in mean is in our judgment more important, given that cross-country variations in the indexes were greater

than time variations.

The estimated poverty index coefficients and the associated adjusted R^2s are shown in Table 7. Dummy variable coefficients are not displayed, although several were significant at the 5% level. This includes the time dummy, which had a positive and very significant coefficient.

Regardless of the poverty concept employed, its coefficient fails to be even close to significant at standard levels. That is, movements in the poverty indexes historically have not been closely related to changes in the HDI. Sen's insights thus seem to have a good deal of practical relevance, a finding of some importance for policy makers. Reductions in income poverty, however measured, need not guarantee progress against deprivation more broadly conceived.

V. Summary and Conclusions

The analysis has employed the Luxembourg Income Study (LIS) for various years in the 1969 to 1997 period to estimate the combined effects of transfers and taxes on poverty in a selection of countries. This was accomplished by computing values for three poverty indexes, using alternative income definitions, and then comparing the different computations in ways that isolate program impacts. The study also provided evidence on possible sources of cross-country differences in index values, and on the correlation between variations in the index values and the United Nations Human Development Index.

The results consistently indicate that government transfers and taxes policy had favorable effects in terms of reductions in poverty levels. This is true regardless of whether one takes into account (1) only the headcount rates, or (2) headcount rates and depth of poverty, or (3) headcount rates, depth of poverty and the relative deprivation among the poor. Further, the

results indicate that the magnitudes of policy impacts vary considerably across countries and across the components of the poverty indexes (i.e., the headcount, the depth of poverty, and the distribution of income among the poor). Observed cross-country differences in the headcount rates are significantly related to cross-country differences in the extent of low-wage workers and in the shares of GDP devoted to social transfers. Neither of the other poverty indexes is. Cross-country differences in the indexes are unrelated to differences in Human Development Index values.

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Table 1: Pre- and Post-Policy Index Values

	P_0		P_1		P_2	
Country/ Year	**Market**	**Policy**	**Market**	**Policy**	**Market**	**Policy**
AUSTRALIA 81	0.1823	0.1111	0.1042	0.0793	0.0311	0.0152
85	0.1677	0.0742	0.1027	0.0796	0.0224	0.0124
89	0.1921	0.0813	0.1186	0.0932	0.0246	0.0128
BELGIUM 85	0.1668	0.0257	0.0462	0.0217	0.0053	0.0021
88	0.1705	0.0282	0.0491	0.0234	0.0047	0.0017
92	0.1111	0.0267	0.0522	0.0382	0.0051	0.0019
CANADA 71	0.1760	0.1284	0.0825	0.0546	0.0424	0.0220
75	0.1765	0.1076	0.0824	0.0543	0.0309	0.0145
81	0.1749	0.1009	0.0806	0.0527	0.0281	0.0127
87	0.1832	0.0926	0.0881	0.0580	0.0257	0.0115
91	0.1968	0.0867	0.0934	0.0615	0.0229	0.0097
97	0.1910	0.0837	0.0939	0.0632	0.0216	0.0093
DENMARK 87	0.2184	0.0542	0.1538	0.1303	0.0165	0.0096
92	0.2415	0.0439	0.1761	0.1512	0.0154	0.0091
FINLAND 87	0.1471	0.0361	0.0641	0.0394	0.0087	0.0036
91	0.1486	0.0341	0.0662	0.0417	0.0082	0.0036
FRANCE 79	0.2643	0.0911	0.1155	0.0743	0.0255	0.0118
81	0.2360	0.0843	0.0705	0.0331	0.0206	0.0095
89	0.2526	0.0618	0.1046	0.0645	0.0146	0.0062
GERMANY 73	0.1592	0.0619	0.1067	0.0863	0.0160	0.0077
78	0.1983	0.0475	0.1338	0.1081	0.0102	0.0043
81	0.0817	0.0433	0.0378	0.0250	0.0095	0.0041
83	0.2074	0.0424	0.1323	0.1035	0.0067	0.0019
84	0.2080	0.0550	0.1556	0.1366	0.0112	0.0042
89	0.1989	0.0477	0.1471	0.1281	0.0119	0.0056
IRELAND 87	0.2152	0.0705	0.1208	0.0907	0.0177	0.0084
ITALY 86	0.2134	0.1001	0.1047	0.0728	0.0264	0.0111
91	0.2638	0.0956	0.1532	0.1225	0.0240	0.0104
LUXEMBOURG 85	0.1567	0.0410	0.0427	0.0202	0.0068	0.0022
91	0.2283	0.0299	0.0958	0.0663	0.0038	0.0008
NETHERLANDS 83	0.1054	0.0319	0.0573	0.0407	0.0093	0.0047
87	0.1022	0.0438	0.0610	0.0456	0.0129	0.0066
91	0.1661	0.0342	0.1061	0.0817	0.0115	0.0069
NORWAY 79	0.1506	0.0406	0.0885	0.0650	0.0114	0.0054
86	0.1523	0.0322	0.0904	0.0671	0.0088	0.0040
91	0.1942	0.0317	0.1151	0.0872	0.0088	0.0045
SPAIN 80	0.1818	0.1139	0.0708	0.0401	0.0334	0.0153
90	0.2144	0.0885	0.0921	0.0582	0.0239	0.0108
SWEDEN 67	0.1193	0.0580	0.0708	0.0559	0.0207	0.0126
75	0.1836	0.0391	0.1147	0.0887	0.0106	0.0050
81	0.2411	0.0486	0.1518	0.1158	0.0140	0.0062
92	0.3265	0.0469	0.2209	0.1789	0.0172	0.0094
SWITZERLAND 82	0.1578	0.0824	0.0855	0.0606	0.0191	0.0089
UK 69	0.1520	0.0698	0.0689	0.0486	0.0122	0.0042
74	0.1405	0.0515	0.0765	0.0561	0.0087	0.0031
79	0.1760	0.0415	0.1067	0.0827	0.0094	0.0042
86	0.2187	0.0554	0.1307	0.1008	0.0180	0.0102
US 74	0.1798	0.1280	0.0896	0.0617	0.0436	0.0231
79	0.1956	0.1396	0.0975	0.0673	0.0443	0.0223
86	0.2067	0.1612	0.1060	0.0739	0.0544	0.0271
91	0.2240	0.1621	0.1126	0.0771	0.0520	0.0259
94	0.2334	0.1640	0.1201	0.0841	0.0544	0.0277
97	0.2210	0.1558	0.1114	0.0771	0.0473	0.0227

Table 2: Percent Change in Indexes Due to Policy

Country/Year	P0	P1	P2
AUSTRALIA 81	-0.39053	-0.7012	-0.80863
85	-0.55729	-0.78161	-0.84423
89	-0.57683	-0.79291	-0.86265
BELGIUM 85	-0.84612	-0.88473	-0.90532
88	-0.83488	-0.90357	-0.92593
92	-0.75958	-0.90248	-0.94925
CANADA 71	-0.27043	-0.48567	-0.59637
75	-0.39073	-0.6248	-0.7331
81	-0.42275	-0.65148	-0.75873
87	-0.49453	-0.70838	-0.80193
91	-0.55927	-0.75495	-0.84284
97	-0.56155	-0.76951	-0.85199
DENMARK 87	-0.75202	-0.89259	-0.92658
92	-0.81836	-0.9127	-0.93977
FINLAND 87	-0.75471	-0.86353	-0.90855
91	-0.77024	-0.87584	-0.91284
FRANCE 79	-0.65542	-0.77905	-0.84171
81	-0.64293	-0.70743	-0.71211
89	-0.75534	-0.86049	-0.90386
GERMANY 73	-0.61088	-0.84992	-0.91086
78	-0.76061	-0.92359	-0.95994
81	-0.47012	-0.74912	-0.83399
83	-0.79561	-0.94969	-0.98145
84	-0.73546	-0.92825	-0.9693
89	-0.76021	-0.91938	-0.95608
IRELAND 87	-0.67234	-0.85392	-0.90731
ITALY 86	-0.53075	-0.74756	-0.84795
91	-0.63772	-0.84342	-0.91494
LUXEMBOURG 85	-0.73817	-0.84088	-0.89264
91	-0.86897	-0.96055	-0.98766
NETHERLANDS 83	-0.697	-0.83682	-0.88573
87	-0.57098	-0.78788	-0.85503
91	-0.79437	-0.89149	-0.91597
NORWAY 79	-0.73029	-0.87155	-0.91693
86	-0.78846	-0.90273	-0.94049
91	-0.83702	-0.92327	-0.94832
SPAIN 80	-0.37336	-0.52897	-0.6187
90	-0.58723	-0.74032	-0.81462
SWEDEN 67	-0.514	-0.70808	-0.77429
75	-0.7871	-0.90778	-0.9438
81	-0.79858	-0.90794	-0.94682
92	-0.85636	-0.92225	-0.94765
SWITZERLAND 82	-0.47774	-0.77656	-0.85248
UK 69	-0.54092	-0.82307	-0.91273
74	-0.6337	-0.88614	-0.9451
79	-0.76447	-0.91145	-0.94908
86	-0.74686	-0.86226	-0.89874
US 74	-0.28812	-0.51284	-0.62484
79	-0.28633	-0.54533	-0.66924
86	-0.22005	-0.48713	-0.63325
91	-0.27641	-0.5379	-0.66412
94	-0.29724	-0.54693	-0.66993
97	-0.29507	-0.5757	-0.70595

Table 3: Poverty Index Correlations

	Pre-policy			Post-policy		
	P_0	P_1	P_2	P_0	P_1	P_2
Pre-policy						
P_0	1					
P_1	0.75762	1				
P_2	0.631672	0.979278	1			
Post-policy						
P_0	0.386228	0.19521	0.106838	1		
P_1	0.386792	0.235043	0.159168	0.953717	1	
P_2	0.357846	0.244477	0.181503	0.896468	0.981616	1

Table 4: Poverty Components Before and After Policy

	Headcount Rate		Poverty Gap		CV^2	
Country/ Year	**Market**	**Policy**	**Market**	**Policy**	**Market**	**Policy**
AUSTRALIA 81	0.1823	0.1111	0.571704	0.280287	0.589748	0.112042
85	0.1677	0.0742	0.612574	0.30218	0.664674	0.155708
89	0.1921	0.0813	0.6176	0.302238	0.710214	0.135901
BELGIUM 85	0.1668	0.0257	0.276832	0.207374	0.102187	0.058947
88	0.1705	0.0282	0.28825	0.168334	0.10663	0.047947
92	0.1111	0.0267	0.469666	0.190513	0.436917	0.05526
CANADA 71	0.1760	0.1284	0.468615	0.33036	0.321062	0.139402
75	0.1765	0.1076	0.466771	0.287449	0.315421	0.102621
81	0.1749	0.1009	0.460833	0.27823	0.306833	0.093348
87	0.1832	0.0926	0.48083	0.277404	0.316238	0.090095
91	0.1968	0.0867	0.47461	0.263885	0.315856	0.077095
97	0.1910	0.0837	0.491767	0.25851	0.344058	0.081498
DENMARK 87	0.2184	0.0542	0.704216	0.305014	1.148853	0.172978
92	0.2415	0.0439	0.729345	0.350545	1.285596	0.20089
FINLAND 87	0.1471	0.0361	0.435444	0.242256	0.245998	0.071813
91	0.1486	0.0341	0.445537	0.24076	0.266843	0.084065
FRANCE 79	0.2643	0.0911	0.437008	0.280209	0.284287	0.09767
81	0.2360	0.0843	0.298753	0.244788	0.103424	0.093005
89	0.2526	0.0618	0.414018	0.236078	0.244503	0.07644
GERMANY 73	0.1592	0.0619	0.670439	0.258589	0.85628	0.104444
78	0.1983	0.0475	0.674465	0.215272	0.848305	0.072772
81	0.0817	0.0433	0.462573	0.219018	0.317367	0.078352
83	0.2074	0.0424	0.638053	0.157055	0.702045	0.02903
84	0.2080	0.0550	0.748271	0.20296	1.532603	0.055181
89	0.1989	0.0477	0.739725	0.248711	1.429623	0.099379
IRELAND 87	0.2152	0.0705	0.561605	0.250385	0.55309	0.100716
ITALY 86	0.2134	0.1001	0.490394	0.263813	0.388005	0.075604
91	0.2638	0.0956	0.580706	0.250995	0.72285	0.082019
LUXEMBOURG 85	0.1567	0.0410	0.272667	0.165707	0.103243	0.036519
91	0.2283	0.0299	0.419572	0.126331	0.33927	0.014926
NETHERLANDS 83	0.1054	0.0319	0.543485	0.292693	0.437141	0.120089
87	0.1022	0.0438	0.596648	0.295008	0.553812	0.128177
91	0.1661	0.0342	0.638874	0.337129	0.639932	0.198568
NORWAY 79	0.1506	0.0406	0.587409	0.279759	0.509582	0.105503
86	0.1523	0.0322	0.593302	0.2728	0.535882	0.093672
91	0.1942	0.0317	0.592346	0.278857	0.589384	0.124144
SPAIN 80	0.1818	0.1139	0.389495	0.292774	0.18526	0.097191
90	0.2144	0.0885	0.429413	0.270148	0.268197	0.092071
SWEDEN 67	0.1193	0.0580	0.593885	0.35673	0.703862	0.218604
75	0.1836	0.0391	0.625016	0.270748	0.659604	0.102119
81	0.2411	0.0486	0.629664	0.287802	0.609769	0.08662
92	0.3265	0.0469	0.676575	0.366203	0.860412	0.16316
SWITZERLAND 82	0.1578	0.0824	0.541833	0.231814	0.431291	0.092794
UK 69	0.1520	0.0698	0.453002	0.174586	0.38163	0.044378
74	0.1405	0.0515	0.544182	0.16916	0.494849	0.045169
79	0.1760	0.0415	0.605975	0.227817	0.65922	0.083223
86	0.2187	0.0554	0.597576	0.325161	0.641364	0.172735
US 74	0.1798	0.1280	0.498336	0.341022	0.377226	0.148786
79	0.1956	0.1396	0.4984	0.317523	0.380593	0.125996
86	0.2067	0.1612	0.513045	0.337361	0.39884	0.123955
91	0.2240	0.1621	0.502469	0.320889	0.370723	0.123207
94	0.2334	0.1640	0.514585	0.331759	0.404661	0.132326
97	0.2210	0.1558	0.504057	0.303396	0.385128	0.110146

Table 5: Percent Change in Poverty Components Due to Policy

Country/Year	Headcount Rate	Poverty Gap	CV2
AUSTRALIA 81	-0.3905	-0.5097	-0.8100
85	-0.5573	-0.5067	-0.7657
89	-0.5768	-0.5106	-0.8087
BELGIUM 85	-0.8461	-0.2509	-0.4232
88	-0.8349	-0.4160	-0.5504
92	-0.7596	-0.5944	-0.8735
CANADA 71	-0.2704	-0.2950	-0.5658
75	-0.3907	-0.3842	-0.6747
81	-0.4228	-0.3963	-0.6958
87	-0.4945	-0.4231	-0.7151
91	-0.5593	-0.4440	-0.7559
97	-0.5616	-0.4743	-0.7631
DENMARK 87	-0.7520	-0.5669	-0.8494
92	-0.8184	-0.5194	-0.8437
FINLAND 87	-0.7547	-0.4437	-0.7081
91	-0.7702	-0.4596	-0.6850
FRANCE 79	-0.6554	-0.3588	-0.6564
81	-0.6429	-0.1806	-0.1007
89	-0.7553	-0.4298	-0.6874
GERMANY 73	-0.6109	-0.6143	-0.8780
78	-0.7606	-0.6808	-0.9142
81	-0.4701	-0.5265	-0.7531
83	-0.7956	-0.7539	-0.9587
84	-0.7355	-0.7288	-0.9640
89	-0.7602	-0.6638	-0.9305
IRELAND 87	-0.6723	-0.5542	-0.8179
ITALY 86	-0.5308	-0.4620	-0.8052
91	-0.6377	-0.5678	-0.8865
LUXEMBOURG 85	-0.7382	-0.3923	-0.6463
91	-0.8690	-0.6989	-0.9560
NETHERLANDS 83	-0.6970	-0.4615	-0.7253
87	-0.5710	-0.5056	-0.7686
91	-0.7944	-0.4723	-0.6897
NORWAY 79	-0.7303	-0.5237	-0.7930
86	-0.7885	-0.5402	-0.8252
91	-0.8370	-0.5292	-0.7894
SPAIN 80	-0.3734	-0.2483	-0.4754
90	-0.5872	-0.3709	-0.6567
SWEDEN 67	-0.5140	-0.3993	-0.6894
75	-0.7871	-0.5668	-0.8452
81	-0.7986	-0.5429	-0.8580
92	-0.8564	-0.4587	-0.8104
SWITZERLAND 82	-0.4777	-0.5722	-0.7849
UK 69	-0.5409	-0.6146	-0.8837
74	-0.6337	-0.6892	-0.9087
79	-0.7645	-0.6241	-0.8738
86	-0.7469	-0.4559	-0.7307
US 74	-0.2881	-0.3157	-0.6056
79	-0.2863	-0.3629	-0.6690
86	-0.2201	-0.3424	-0.6892
91	-0.2764	-0.3614	-0.6677
94	-0.2972	-0.3553	-0.6730
97	-0.2951	-0.3981	-0.7140

Table 6: Policy Elasticities

Country/Year	Headcount Rate	Poverty Gap	CV2
AUSTRALIA 81	1	1.3512	0.7954
85	1	1.3523	0.7800
89	1	1.3621	0.7910
BELGIUM 85	1	1.6328	0.5989
88	1	1.2756	0.7224
92	1	1.2402	0.8875
CANADA 71	1	1.7689	0.5688
75	1	1.5087	0.6597
81	1	1.4832	0.6737
87	1	1.4515	0.6821
91	1	1.4224	0.7108
97	1	1.3804	0.7389
DENMARK 87	1	1.2984	0.8564
92	1	1.3799	0.8153
FINLAND 87	1	1.3925	0.7065
91	1	1.3563	0.7263
FRANCE 79	1	1.5403	0.6523
81	1	2.1047	0.4961
89	1	1.3848	0.7191
GERMANY 73	1	1.2626	0.8756
78	1	1.2151	0.9185
81	1	1.2771	0.8014
83	1	1.1888	0.9529
84	1	1.2021	0.9594
89	1	1.2317	0.9288
IRELAND 87	1	1.2872	0.8321
ITALY 86	1	1.4072	0.7513
91	1	1.3033	0.8655
LUXEMBOURG 85	1	1.3334	0.7235
91	1	1.2259	0.9419
NETHERLANDS 83	1	1.4069	0.7185
87	1	1.3622	0.7598
91	1	1.4162	0.7121
NORWAY 79	1	1.3457	0.7716
86	1	1.3363	0.7920
91	1	1.3234	0.7976
SPAIN 80	1	1.8537	0.5195
90	1	1.5062	0.6619
SWEDEN 67	1	1.5499	0.6959
75	1	1.3074	0.8271
81	1	1.3586	0.7888
92	1	1.4790	0.7205
SWITZERLAND 82	1	1.2570	0.8257
UK 69	1	1.2313	0.8951
74	1	1.1968	0.9227
79	1	1.2413	0.8834
86	1	1.4302	0.7342
US 74	1	1.7247	0.5848
79	1	1.5815	0.6375
86	1	1.6513	0.6061
91	1	1.5902	0.6241
94	1	1.6157	0.6215
97	1	1.5085	0.6700

Table 7
Human Development Index Regressions

Table 7 contains the estimation results from regressing the Human Development Index for each county/year combination on a constant, the corresponding value for the indicated poverty concept, country dummies, and a dummy for the years 1990 and later. The constant and dummy coefficients are not shown.

Poverty Concept	Coefficient	Standard error	Adjusted R2
Market Income			
Headcount Rate	.057	0.050	0.699
Poverty Gap	-0.001	0.026	0.684
CV2	0.002	0.009	0.684
P2	0.207	0.167	0.701
Post-Policy Income			
Headcount Rate	0.042	0.125	0.685
Poverty Gap	-0.045	0.053	0.692
CV2	-0.714	0.009	0.700
P2	-0.601	1.200	0.687

Endnotes

[1]See Orshansky (1965, 1969) and Fisher (1992) for a discussion of official procedures for measuring poverty in the United States. Comprehensive reviews of associated issues are found in Ruggles (1990), Panel on Poverty and Family Assistance (1995), Jorgensen (1998) and Triest (1998).

[2]Some studies have separately examined the effects of transfers and taxes on either the poverty gap or on overall income inequality (as opposed to inequality among the poor which is emphasized by Sen). Gramlich, Kasten and Sammartino (1993) and U.S. Bureau of the Census (2001) estimate the effects of taxes and transfers on overall income inequality as measured by the Gini coefficient. Paglin (1980) provides evidence about the impact of in-kind transfers on the poverty gap. None of these studies has addressed the impact on more comprehensive poverty measures such as those studied here.

[3]Burtless (1994) points out that even if programs provide work disincentives that reduce effort by small amounts, the associated earnings loss among the poor families could equal a large fraction of the income payments that they receive. He cites examples from federally sponsored negative income tax experiments during the 1970s in which the loss could reasonably be considered large and others in which the loss could be considered small.

[4]Because the methodology does not account for possible wealth-creating disincentives associated with transfers and taxes, the estimates presented theoretically overestimate the anti-poverty impacts of the policies, although the actual extent is unknown.

[5] See Atkinson and Brandolini (2001) for a discussion of the limitations of the LIS data and other secondary data sources.

[6]Kakwani (1980) proposes that acceptable indexes satisfy another axiom, called Transfer Sensitivity, which requires greater weight being placed on transfers among the poorest poor, while Hagenaars (1986) maintains that indexes should be decomposable. As discussed, $\mathbf{P}_{\alpha}$ meets Hagenaars requirement for any choice of α. It also satisfies Kakwani's axiom for α equal to, or greater than, three. However, the theoretical and empirical literatures have concentrated on indexes that satisfy Sen's two criteria [see, e.g., Foster, Greer, and Thorbecke (1984) and, more recently, Ravallion (1994), Shorrocks (1995), and Chakravarty (1997)]. Limiting the value of α to a value no greater than two permits a parameterization that satisfies the two Sen criteria, and allows the main points to be made while keeping the analysis manageable. Useful surveys of poverty measures include Hagenaars and van Praag (1988), Seidl (1988), Foster and Shorrocks (1991), Ravallion (1994) and Zheng (1997). $\mathbf{P}_0$, $\mathbf{P}_1$, and $\mathbf{P}_2$ have been referred to as the incidence, depth, and severity of poverty, respectively [e.g., United Nations Development Programme (1997)].

[7]Bishop, Formby, and Zheng (1997), Formby (1997), and Bishop, Formby and Zheng (1999) analyze U.S. urban and regional poverty using an index developed by Sen (1976), which includes the headcount rate, the average depth of poverty and income inequality among the poor as measured by the Gini index. Their computations employ alternative income definitions, including one that reflects the types of transfer and tax policies studied here, and so complement the present findings.

[8]The limiting value of Shorrocks (1995) index is the same as that of Thon's (1979) index as the sample size approaches infinity. Thus, the index is referred to as the Sen-Shorrocks-Thon, or SST, index [see, e.g., Osberg and Xu (2000)]. Osberg and Xu (2000) apply the SST index to the

LIS data to estimate and rank the intensity of poverty for 19 countries. They also develop a bootstrap methodology for estimating standard errors for the estimated SST index values.

[9]Following Osberg and Xu (2000), we exclude Eastern European countries due to potentially significant income measurement problems. Also, Austria is omitted due to pervasive missing data.

[10]Following Osberg and Xu (2000), observations with negative or zero incomes are excluded. There are relatively few observations with negative or zero income. Osberg and Xu (2000) provide evidence on the importance of excluding observations with zero income on the magnitudes of SST index values.

[11] Some authors, such as Smeeding, et al. (2001) use both 40% of the median and 50% of the median. Given the range of poverty indexes that we study, we use only one poverty standard to keep the discussion of the results manageable.

[12]Consider, for example, a transfer payment that lifts everyone out of poverty. If analyzed first, all other programs would have zero marginal impact on poverty. However, if analyzed last, other programs would have a measured impact and the measured impact of the initial payment would decrease or disappear. U.S. Bureau of the Census (2001) provides sequential estimates of the effects of individual transfer payments and taxes.

[13] See Bishop, Formby and Zheng (1997), Formby (1997), and Osberg and Xu (2000) for alternative treatments of confidence bands.

[14] We present the results in graphical form for ease of comparability with the results of

Smeeding, et al. (2001).

[15] We do not use the first difference of the explanatory variables because we do not use the first differences of the poverty indexes as the independent variable. It is sensible to expect, for example, that the sizes of the poverty index reductions due to policy, which we study, are related to the fractions of GDP spent on transfers, not their change.

[16] For instance, he states that, "The citizens of Gabon or South Africa or Namibia or Brazil may be much richer in terms of per capita income than the citizens of Sri Lanka or China or the state of Kerala in India, but the latter have very substantially higher life expectancies than do the former" (pp. 6-7).

[17] Descriptions of the HDI, along with the data used in this study, are found in the United Nations Human Development Report 2001.

Chart 1a: Pre-policy P_0

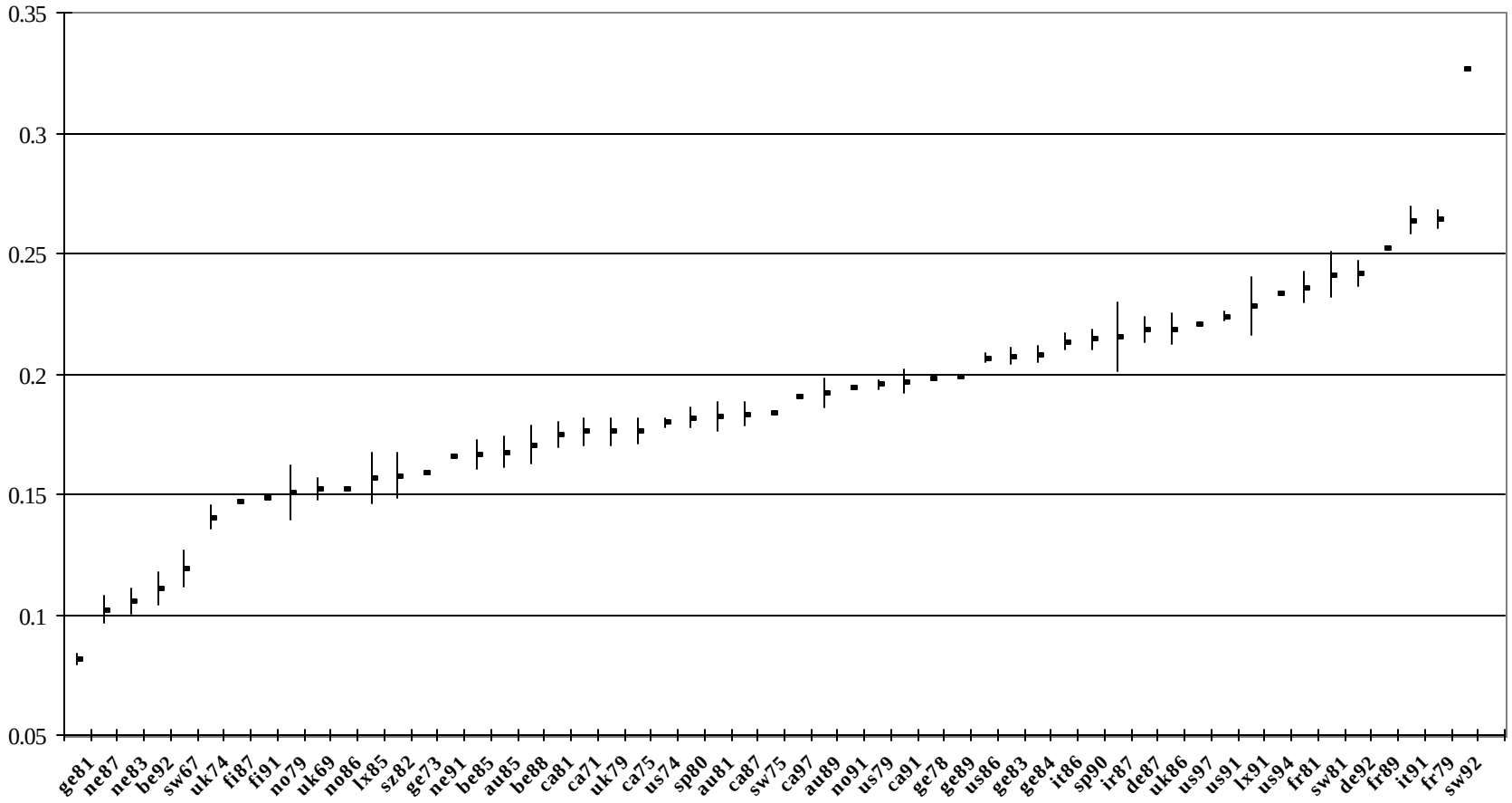

Chart 1b: Post-policy P_0

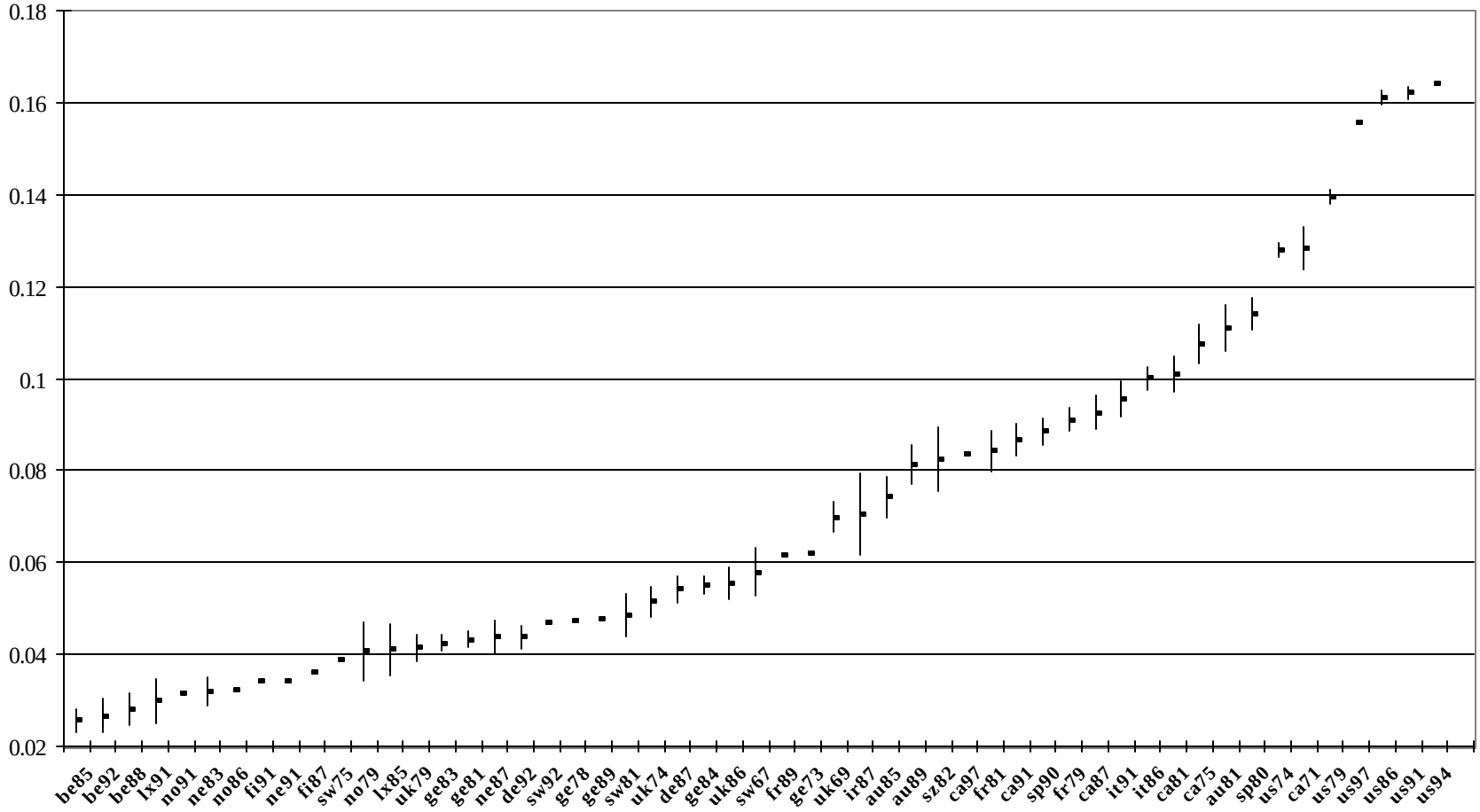

Chart 2a: Pre-policy P_1

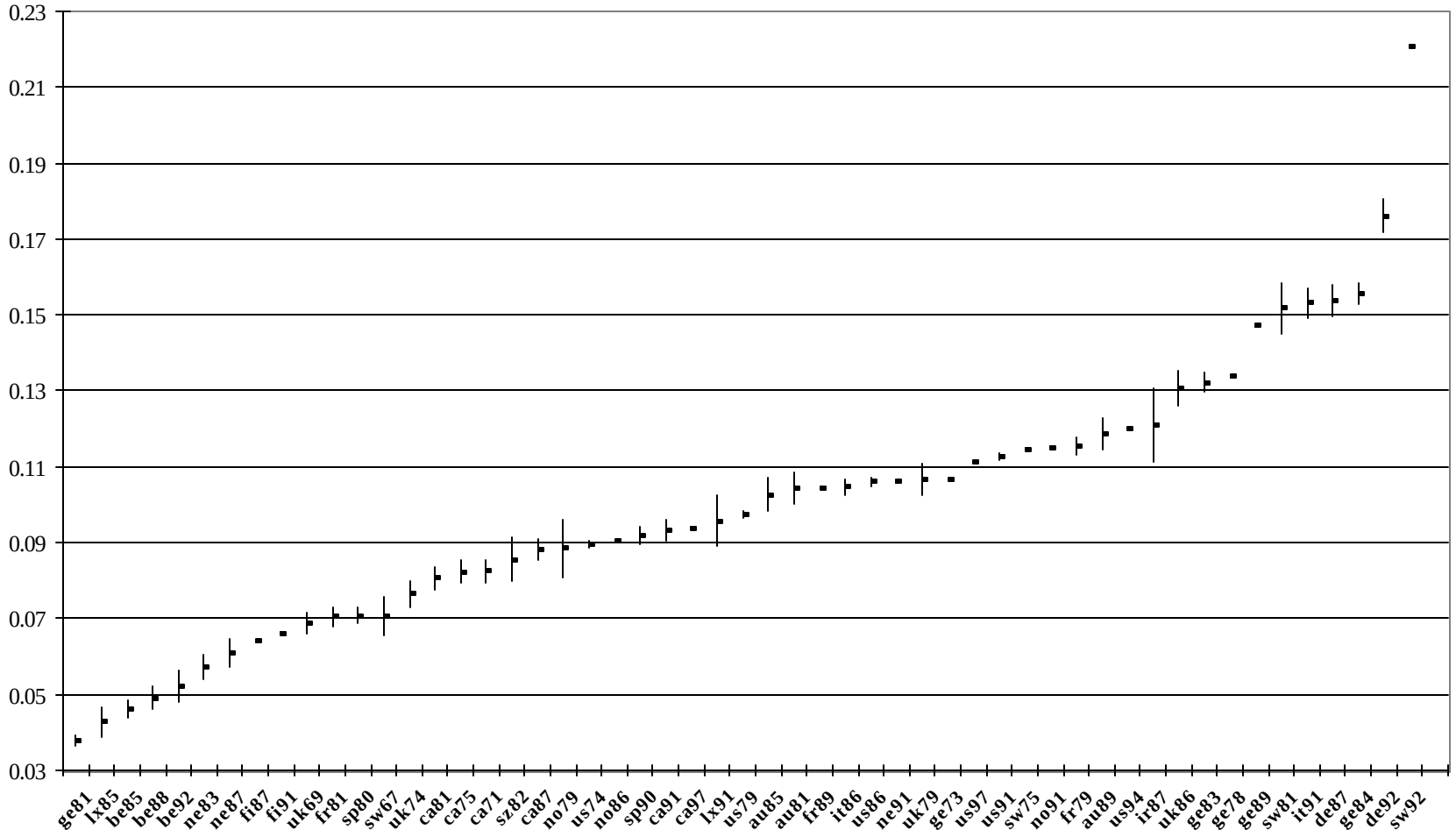

Chart 2b: Post-policy P_1

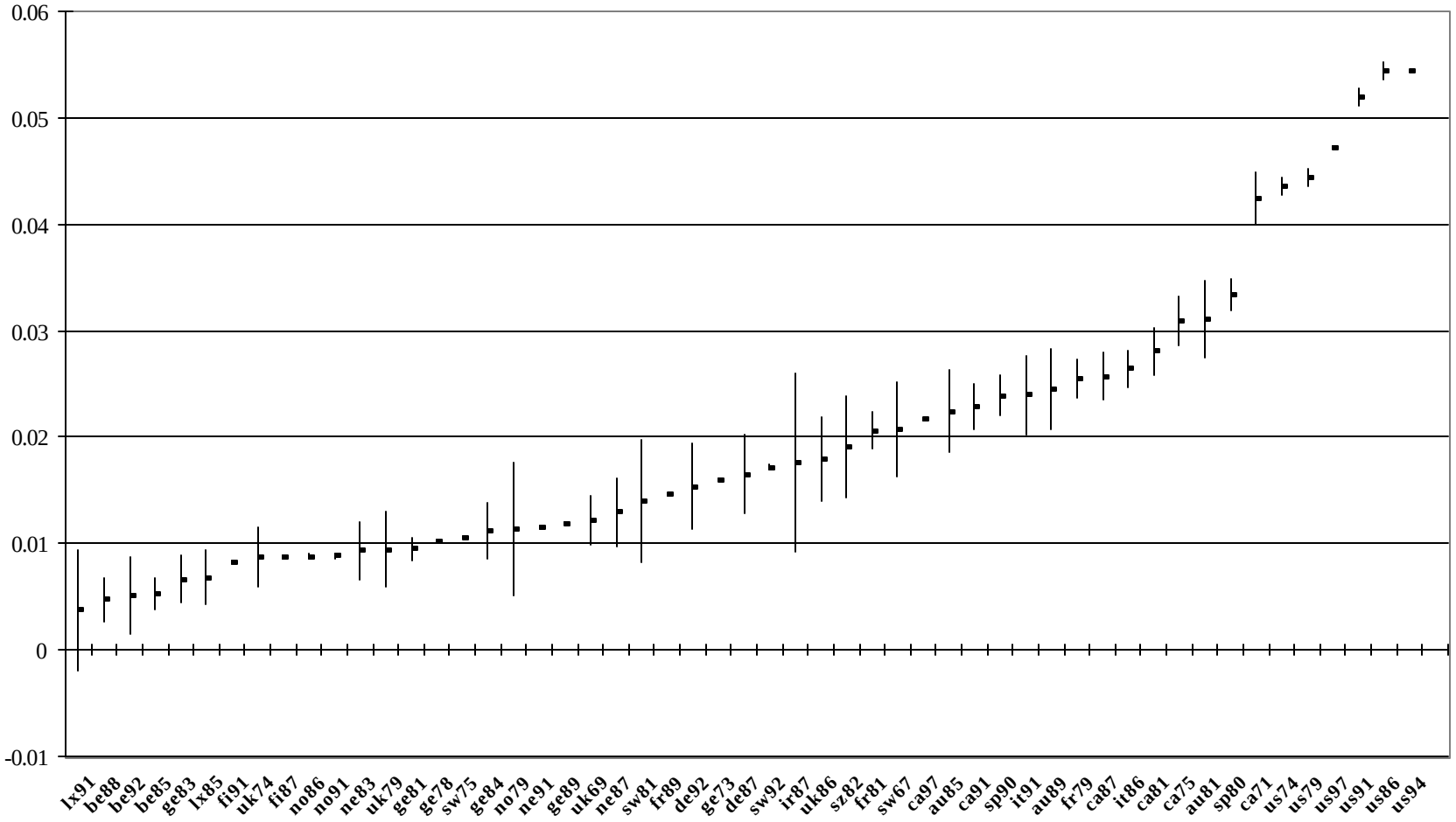

Chart 3a: Pre-policy P_2

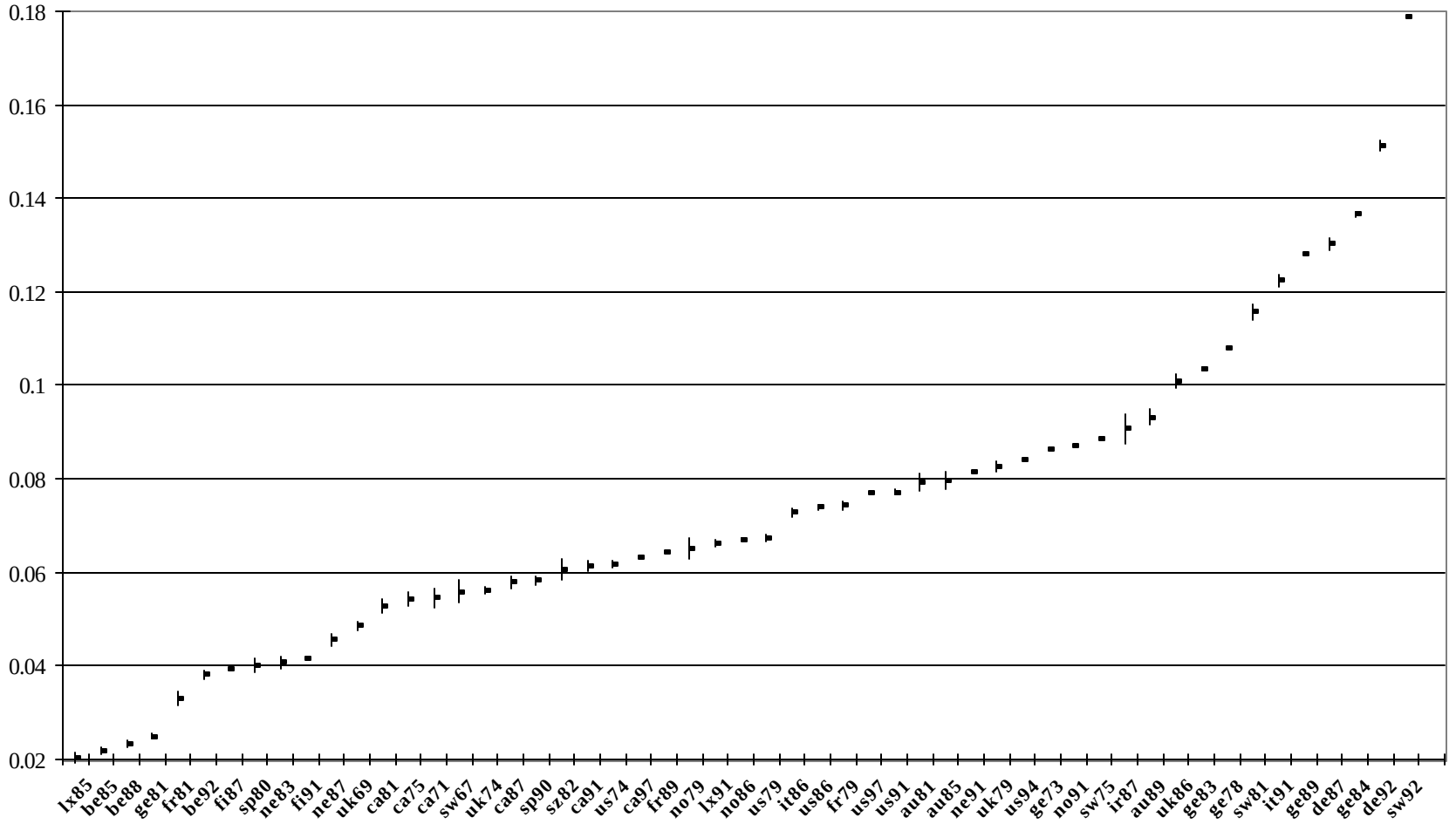

Chart 3b: Post-policy P_2

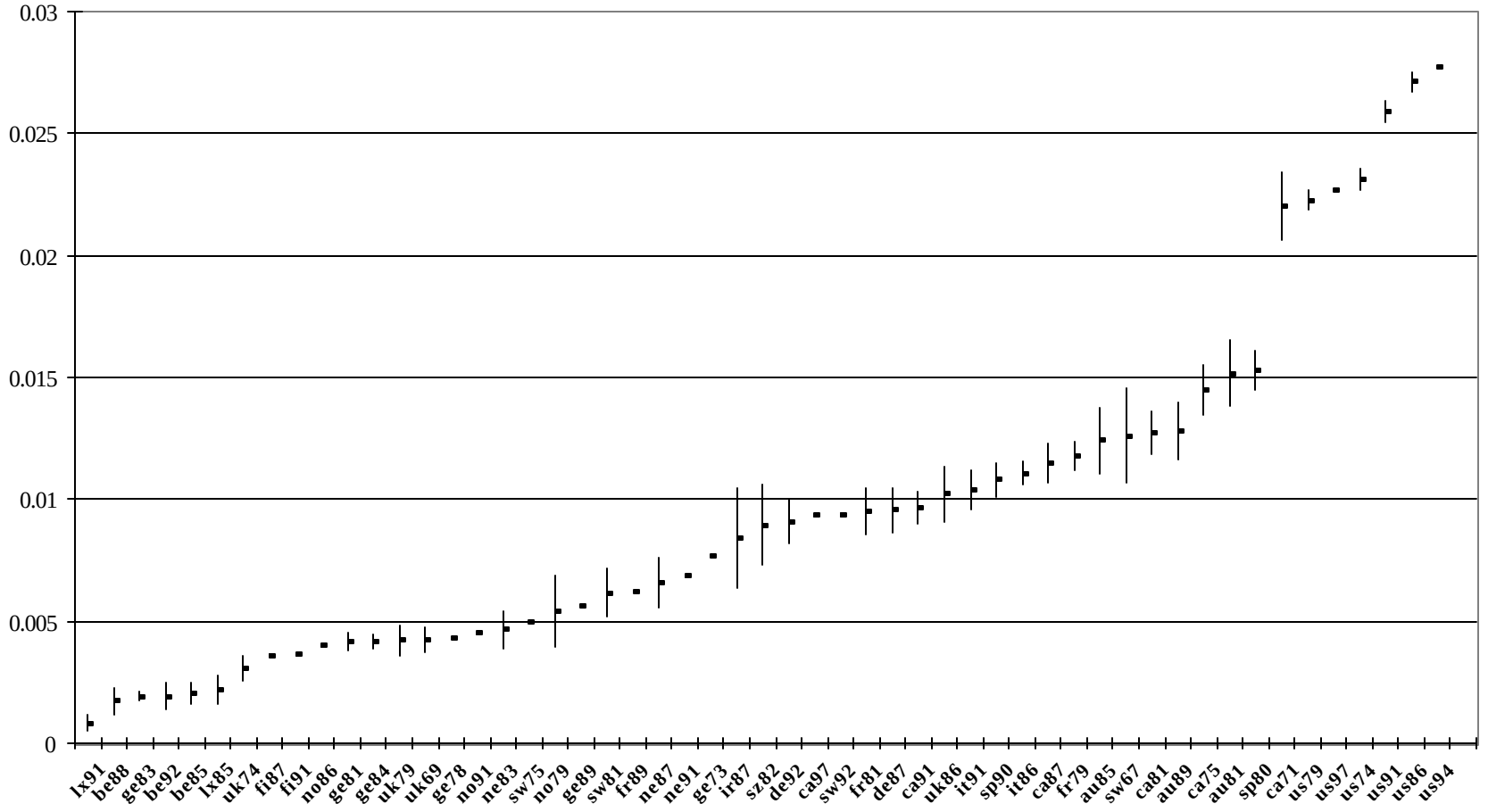

Chart 4a: Low Wages and P_0

Chart 4b: Low Wages and the Income Gap

Chart 4c: Low Wages and CV^2

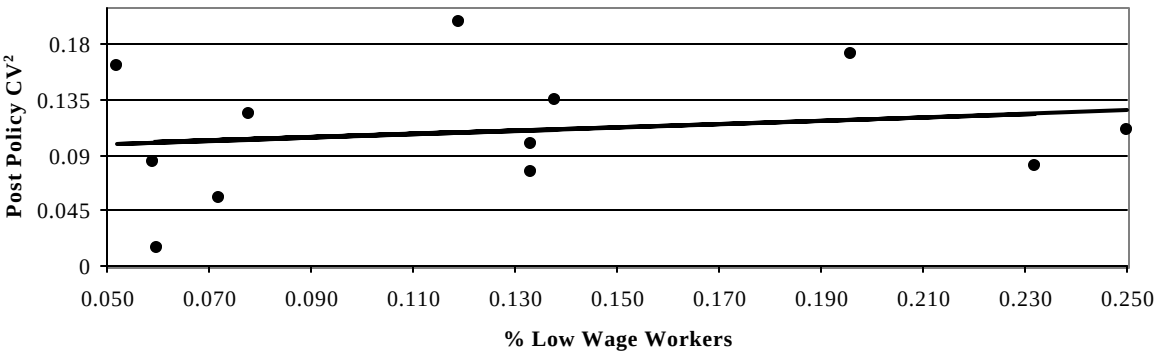

Chart 5a: Public Transfers and P_0

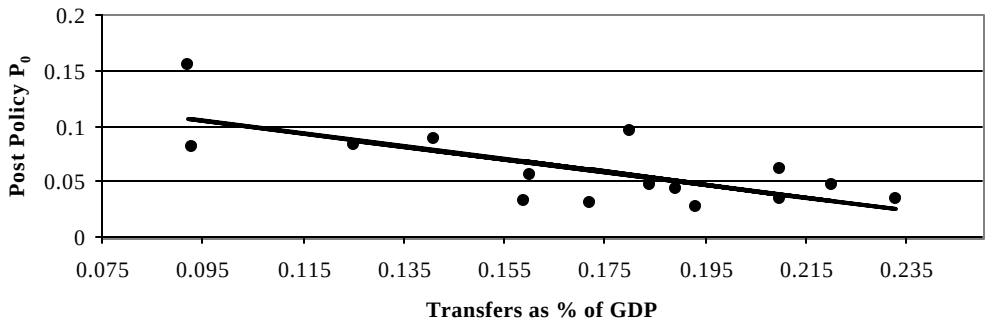

Chart 5b: Public Transfers and the Income Gap

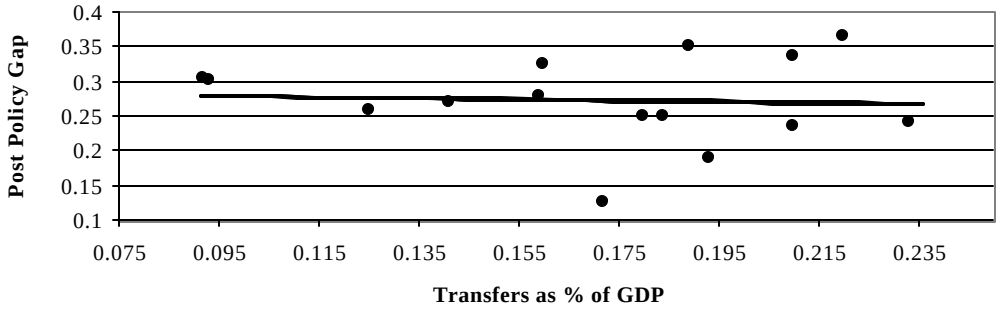

Chart 5c: Public Transfers and CV^2