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In Search for a Smoking Gun: What Makes Income Inequality Vary Over Time in Different Countries?

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Abstract

Forces affecting the development of the distribution of income in OECD-countries are investigated by analysing an unbalanced panel with information covering 16 countries from 1966 to 1994. Income inequality is measured with the Gini-coefficient of equivalent disposable income. The results suggest that many factors affect the development of inequality. Factors are strictly economic or outside a strictly defined market-sphere as well as being demographic. However, a relation between the unemployment rate and inequality could not be found.

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1. Introduction

In recent years considerable progress has been made in empirical research on income inequality at the household level in industrialised countries. For many countries there are now studies showing how income inequality has changed during recent years (See for example the various chapters in Gottschalk, Gustafsson & Palmer (1997), Atkinson (1997) or the survey by Gottschalk & Smeeding (1997)). A typical, although not universal, result is that inequality increased during the 80s. Another important development has been the launching of the Luxembourg Income Study (LIS) in which microdatasets from various countries have been harmonised. Thus there are now much better possibilities than previously for studying how income inequality varies cross-countries (for recent results see Atkinson et al (1995)).

In this literature a certain consensus has emerged in using equivalent disposable income as the variable under study. Constructing such a variable means that analysts start from household income and they control for the size of the household by using an equivalent scale, although there is no consensus on which equivalence scale to use. This derived variable-value is then assigned to each individual in the household, which means assuming that income is equally shared within the household. Thus measurements are made with individuals as the unit of analysis.

The advancement in methods of measurement, and in empirical knowledge can be contrasted with the lack of insight into causes for differences in inequality cross time. This should perhaps not come as a surprise as the distribution of income in a country is the outcome of numerous decisions made by households, firms, organisations and the public sector. One could think of an almost infinite number of micro-level causes for differences and changes in income inequality. But, one would also surmise that some causes are more important than others, and the search for "the smoking gun" is the purpose of this paper.

Many previous studies have limited the scope to single countries when looking for causes for inequality to vary. Others have looked for causes as to why inequality varies cross-countries at one point in time. Here we use a more general approach by working with an unbalanced panel for sixteen industrialised countries and use panel data methods. We are not aware of this approach having been previously applied in studying industrialised countries and the target variable equivalent income.

The rest of the paper is laid out in the following way: In the next section the approaches in explaining variations in income inequality at the country level are surveyed. We discuss our research strategy at a general level and present the data in Section 3, and the econometric methodology in Section 4. Results from estimating models are presented in Section 5. Finally we sum up the conclusions in Section 6.

2. Approaches in explaining variations in income inequality

This very short literature survey serves the purpose of motivating our choice of variables to be used in the empirical analysis. As our empirical analysis focuses on industrialised countries, the survey pays only very little attention to the literature on determinants of income inequality in developing countries. Although any attempt to classify different writings under a few headings runs the risk of not giving full justice to individual works, such simplifications make it easier to discuss justifications of our choice.

Explanation A "It is economic development and / or the sector structure of the economy ".

Kuznets (1955) introduced the now famous U-hypothesis, that the relation between development and inequality follows an inverse U-shape. As a rationale for this consider an economy consisting of a low-paying agricultural sector and a high-paying industrial sector. This is the only cause for income inequality as inequality within each sector is negligible. As a larger proportion of the population moves from the agricultural sector inequality increases, but later decreases when the majority of the labour force is in the industrial sector.

During the four decades following the original article a large number of authors have investigated the relation between economic development and income inequality. Most studies are cross-sectional, covering countries at various stages of development. However, there are also studies of single countries over a long period of the development process (for example Williamson (1985, 1991)). Results reported in Figure 1 from two cross-section studies (Paukert (1973) and Ahluwalia (1976) exemplify the U-hypothesis has found support.

However, not surprisingly this kind of relation is found to not be very robust to variations in econometric specifications. (Anand & Kanbur (1993)) It can also be noted that the development of income inequality in most industrialised countries during the 80s is not consistent with predictions from the inverted U-shaped relation.
/Figure 1 about here/

When writing about the U.S. experience during recent years, several authors have put forward de-industrialisation as an inequality-generating force. Because of changed demand, labour has been forced from manufacturing (with many middle class jobs) to the service sector, with some high paying jobs and several low paying jobs. ”While deindustrialisation focused on manufacturing jobs in general, it implicitly concerned productive workers and craftsmen - the people who would become ‘hamburger flippers’ in the service sector - rather than engineers and market specialists.” (Levy & Murnane (1992)).

Explanation B. ”It is the international division of labour”

The role international trade plays for the economy varies over time and cross-countries and there is much current literature on how international trade affects earnings inequality, see Burtless (1995). For example in his influential monograph, Wood (1994) starts from the observation that trade from less developed to developed countries (south - north trade) has increased substantially during later decades. Increased trade has exposed less qualified workers in industrialised countries to more competition, which in turn has pushed their wages down. As a consequence earnings inequality in industrialised countries has tended to increase.

Figure 1 is available in hard copy only.

However, although earnings are a very important income source for families, others also exist. Therefore the south - north trade might not necessarily be the (only) smoking gun.

In sociological literature several empirical studies have linked income inequality to external economic variables. Such examples are variables on external debts and foreign reserves (Rubinson (1976)) and measures of international dependency (Chase - Dunn (1975)). A variant is to focus on the role played by transnational companies (Bornschier & Ballmer - Cao (1979) and Bornschier (1983)).

Explanation C "It is the macroeconomic performance that matters"

Often one thinks of unemployment as more likely to hit hitting those in the bottom of the income distribution harder than others, therefore unemployment has an inequality generating effect. A mechanism through which inflation can affect household real income is by redistributing resources from persons with fixed nominal incomes (pensioners). Inflation might also redistribute income via the tax system. With progressive tax-scales defined in nominal terms, inflation pushes higher income earners into higher tax brackets, which leads to less after tax inequality. Thus it is not self-evident how inflation affects income inequality.

The issue of how inequality in industrialised countries is affected by the business cycle has been addressed by several authors. For example results from earlier studies for the U.S. (Metcalf (1969), Thurow (1970), Mirer, (1973 a, b), Gramlish (1974)) indicated that income inequality increased during recessions and decreased during expansions. Blinder and Esaki (1978) adopted a framework for analysing effects of unemployment and inflation on income

inequality which has been widely used (for example Blank & Blinder (1986), Weil (1984), Buse (1982), Nolan (1986), Gustafsson (1987), Björklund (1991), Blank & Card (1993) and Gustafsson & Palmer (1997)). Income shares of quintals are regressed on unemployment rates and rates of inflation. Results typically, (though not always - take Sweden for example) show unemployment having inequality-increasing effects while it is more difficult to find effects of inflation. A weak or non-existing relationship between the unemployment rate and inequality might be the outcome of income losses from unemployment being cushioned by unemployment benefits or increased labour market activity by other family members.

Explanation D "Reasons are found outside a strictly defined market-sphere (union density, democracy, the size of the public sector)"

The most important income source for households is remuneration for paid work. Work-contracts are made on an individual level but also collectively. Collective contracts by nature mean standardisation. Therefore it can be assumed that the institutional structure of the labour market affects inequality at the household level, although this relation seems not to have received much attention in the literature on the distribution of income at the household level.

In the large body of sociological literature addressing why income inequality varies cross-countries, the existence of political democracy was put forward in the early stages as an inequality decreasing factor and investigated in studies covering a large spectrum of countries. (Cutright (1967 a, b), Jackman (1974), Rubinson & Quinland (1977)). The mere fact that a government is democratically elected affects inequality less than the length of the period the country has experienced democracy (Hewitt (1977), Muller (1988), Simpson (1990)). And

causality can (also) run in the other direction meaning that income equality fosters democracy (Bollen & Jackman (1985)).

Most industrialised countries are political democracies in the usual sense of the word, but they have different sized public sectors. A large proportion of public expenditures go to pension payments and other social insurance payments which most often have a profile benefiting those who are worse off. This statement is supported by results from a number of microstudies reported in the economic literature. A limitation with almost all such studies is that behavioural effects are ignored. Therefore it can be argued that the true distributional effect of public sector transfers is smaller that what the results from the microstudies show. Taken at its extreme one might even argue that payments of public sector transfers are fully offset by behavioural response, so at the macro-level no relation is found. However, an additional argument for stating that the size of the public sector has an inequality decreasing effect is its role as employer. Earnings inequality in the public sector is typically smaller than in the private sector.

In sociological literature some authors have used cross-country data to investigate if the size of the public sector affects income inequality. Stack (1978) concluded from a cross-country analysis that direct government involvement reduced income inequality. However, this analysis was questioned for methodological reasons (Jackman (1980), Firebaugh (1980), see also the reply Stack (1980)). Nevertheless, results pointing in the direction that the size of the public sector negatively affects income inequality have also been reported by Boyd (1988) and more recently also in economic literature by Milanovic (1994).

Explanation E. "It is demography"

Assume that the population of a country consists of two distinct categories having different mean incomes. Income inequality in the total population can thus be separated into a) income inequality within each category b) the difference in mean income between the categories and c) the number of persons in the different categories.[1] From this follows that differences in income inequality between two countries or changes in income inequality over time can be traced to all three factors. Thus changes in the population structure affect income inequality.

In some country studies the above-mentioned type of framework has been used to analyse why income inequality has changed over time. (For example Jenkins (1995), Tsakloglou (1997) and Gustafsson & Palmer (1997)). Although these authors have used different breakdowns of the populations studied, their results do not point toward demographic changes being important for the development of income inequality in the three countries studied (United Kingdom, Sweden and Greece). However, this does not mean that population-composition variables are generally without explanatory power. For example the explanatory power of variables measuring dependency-burden seems not to have attracted much attention. One would expect such variables to be of importance as people in dependent ages often have lower equivalent incomes than people in work active ages.

[1] This is the case if one applies an additively decomposable inequality index. Otherwise there are also terms capturing the interaction between the various factors.

Explanation F. "It is the gender distribution of paid labour"

Most industrialised countries have experienced increases in female labour force participation. In contrast the trend moves in the opposite direction (although most often less pronounced) for labour force participation among men. Such changes must undoubtedly have affected the bargain-power of husbands and wives when deciding upon consumption within the household. However, it is less clear how these changes have affected income inequality at the household level given the assumption that income of spouses are perfectly pooled.

There are several country studies on how labour-market activities of wives affects the development of income among married couples. (For example Bergmann et al (1980), Betson & van der Gaag (1984), Cancian, Danziger and Gottschalk (1993)) These studies use an accounting framework in which income inequality among couples is decomposed to contributions of husband´s income, wife´s income (and other income) and the correlation between the components. Often earnings of wives are found to reduce inequality among couples.

3. Research strategy

Our research strategy is to assemble a panel of estimates of inequality in equivalent income using individuals as the unit of analysis. Observations come from industrialised (OECD) countries. The dataset is used to investigate the relation between various potential explanatory variables and inequality using modern econometric methods. We are interested in finding factors affecting how inequality varies over time. While much of the literature concentrates on

investigating one factor at a time we look at various factors simultaneously. In this sense our approach is ambitious.[2]

However, it is not difficult to point out the limitations of our work. For each explanation discussed in the previous section we have chosen a small set of variables or one variable only.[3] Choice of another operationalisation might have given substantially different results. Furthermore, we are investigating the direct effects of various explanatory variables, not trying to take into account the complex interrelations which might exist between the variables by use of a structural model. There are also limitations concerning the dependent variable. We use the Gini-coefficient which is probably the inequality index used the most. But one cannot rule out the possibility that use of another index might have given different results. Finally, it should be mentioned that several countries are represented in the panel by observations for only a few points in time. Thus there should be clear possibilities for future work to improve our analysis.

/Table 1 about here/

Table 1 lists country covered, years of observation, source for the dependent variable and its mean. Generally the Gini-coefficients are computed from quintiles, assuming no inequality of income within each quintile.[4] For a country to be included in the data at least two observations

[2] Our modelling strategy has similarities with the one taken by Nielsen & Alderson (1995), through there are also differences. While their sample spans developing as well as industrialised countries our study concentrates on the latter group. From this follows differences in choice of explanatory variables. There is also a difference in choice of the dependent variable as we follow the modern approach of working with equivalent income and use individuals as the unit of analysis.

[3] For example we use the share of public consumption of GDP as the only indicator of the size of the public sector, thus not trying to capture public sector transfers.

[4] This is done since for some observations we rely on published results reported as quintiles or deciles.

Table 1. Countries Covered, Mean Values of the Gini-Coefficient and Data Sources

Country	Years of Observation	Mean	Source
Australia	1981, 1985, 1989	29.5	LIS-data
Belgium	1985, 1988, 1992	21.3	LIS-data
Canada	1975, 1981, 1987, 1991	28.1	LIS-data
Denmark	1987, 1992	24.1	LIS-data
Finland	1966, 1971, 1976, 1981, 1985-1994	20.3	Uusitalo, 1996
France	1979, 1981, 1984	28.3	LIS-data
Germany	1973, 1978, 1981, 1983, 1984, 1985, 1987, 1990	24.7	1973, 1978, 1981, 1983, 1984, LIS-data 1985, 1987, 1990, Hauser and Becker (1997)
Italy	1986, 1991	27.9	LIS-data
Netherlands	1983, 1987, 1991	28.2	LIS-data
New Zealand	1981, 1985	27.5	Saunders et al (1991)
Norway	1970, 1973, 1976, 1979, 1982, 1986	22.5	1970, 1973, 1976, 1982, Ringen (1991) 1979, 1986, LIS-data
Portugal	1980, 1989	29.2	Atkinson et al (1995)
Spain	1980, 1990	29.3	Atkinson et al (1995)
Sweden	1975, 1978, 1980-1991	19.3	Gustafsson and Palmer (1997)
United Kingdom	1969, 1974, 1977, 1986	27.5	LIS-data
United States	1969, 1974, 1979-1994	33.0	1969, 1974, 1979, 1986, 1991, 1994, LIS-data 1980-1985, 1987-1990, 1992, 1993, Gottschalk and Smeeding (1997)

(for which comparability is high) are required. In total our data covers not less than 16 industrialised countries and has 90 observations. For eight countries data comes from the Luxembourg Income Survey (LIS) exclusively and in an additional three cases observations from this dataset are linked to other sources using different observations for the same year. In LIS, income data at the household level has been assembled, harmonised and made available to analysts.[5] For other countries various publications provide the source. As stated in the introduction our target variable is equivalent income, and individuals are used as the unit of analysis.

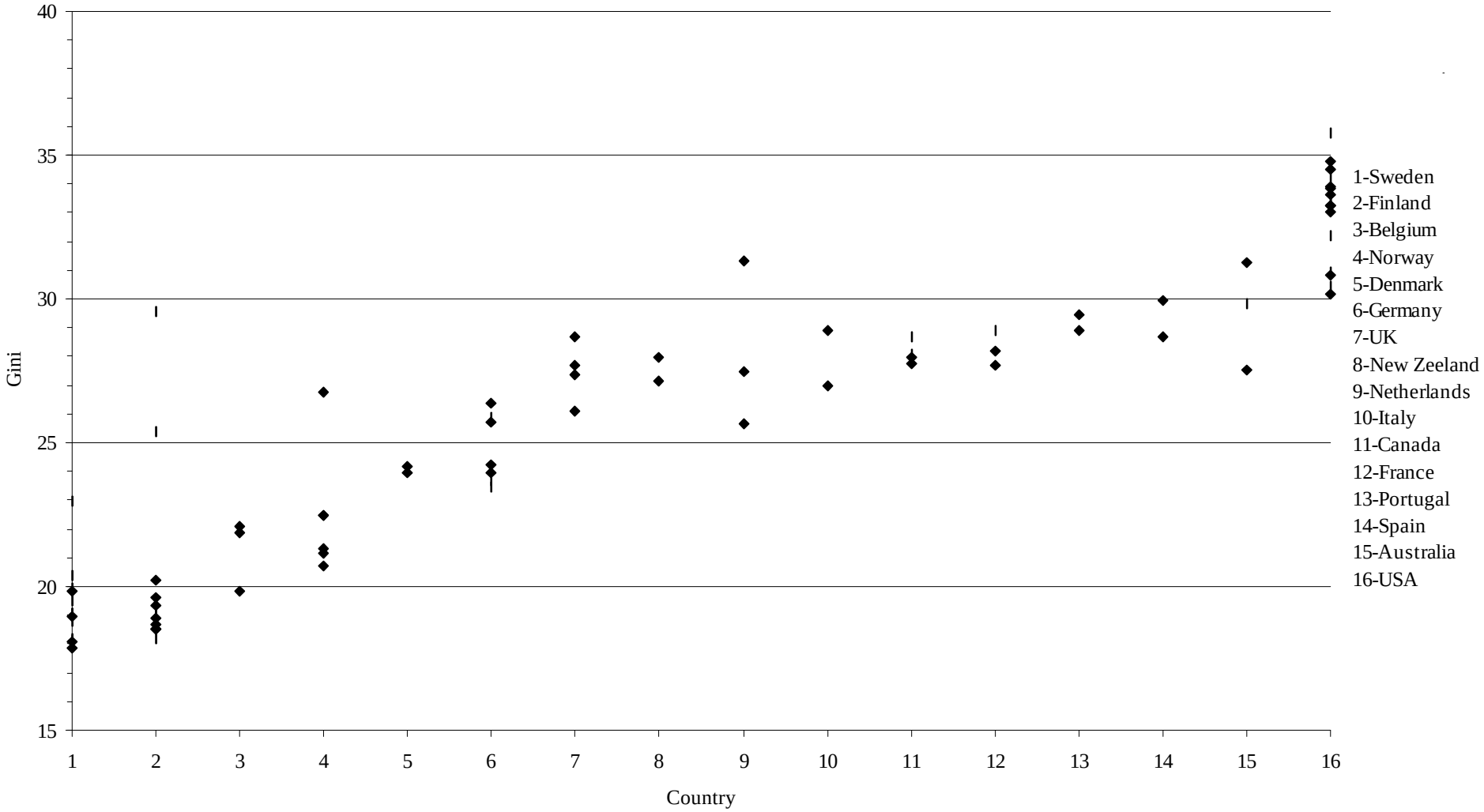
As can be seen in Table 1 the countries with most observations are (ordered after the number of observations) USA, Sweden, Finland, Germany, United Kingdom and Norway. A few observations refer to the second half of the 60s, a larger number to the 70s and the majority are from the 80s. In addition there are also observations from the 90s.

/Figure 2 about here/

In Figure 2 we plot Gini-coefficients for equivalent disposable income ordered after country starting with low inequality countries (Sweden followed by Finland and Belgium) in the left of the figure and show Gini-coefficients for high inequality countries (Spain, Australia and the United States) in the right part of the diagram. From the figure it can clearly be seen that inequality has changed over time in the countries included in the panel.

[5] When obtaining those estimates from the microdata we have used the same (frequently used) equivalence scale for all countries. A single adult person is assumed to have the expenditure needs of 1.0, a couple 1,7 units and for each child 0.5 units are added. For more information on LIS see its homepage: http://lissy.ceps.lu/index.htm

Figure 2. Countries and the Cini-coefficient for Equivalent Disposable Income



/Figure 3 about here/

All Gini-coefficients for equivalent income are plotted against the time-axis in Figure 3. Large variations cross-countries at one point in time are visible. However, the correlation between the observations and the time-variable is almost zero (- 0.05), and has a very low t-statistic.

/Table 2 about here/

Our explanatory variables are listed in Table 2 by definition and source. In most cases we have been able to take information from one source only thus minimising problems with comparability cross-countries and years. The main exception is the variable union density. Basic statistics and a correlation matrix are reported in the appendix. Not all correlation-coefficients between an explanatory variable and the dependent variable have high t-statistics. They are chosen for Figure 4 where observations are plotted along the variable and a fitted linear regression line also is shown. The strongest linear relation with the Gini-coefficient for equivalent income is observed for the variable union density (-0.90), followed by the variable size of the public sector (-0.64), share of the population 65 and older (-0.60), share of the population 0 - 14 years (0.50), import from Less Developed Country (0.44), female labour force participation (-0.42), GDP per capita (0.39) and unemployment (0.22). However, does a high correlation coefficient also mean causality? In order to investigate this we turn to modelling in the next section.

/Figure 4 about here/

Figure 3. Year and the Gini-coefficient for Equivalent Disposable Income

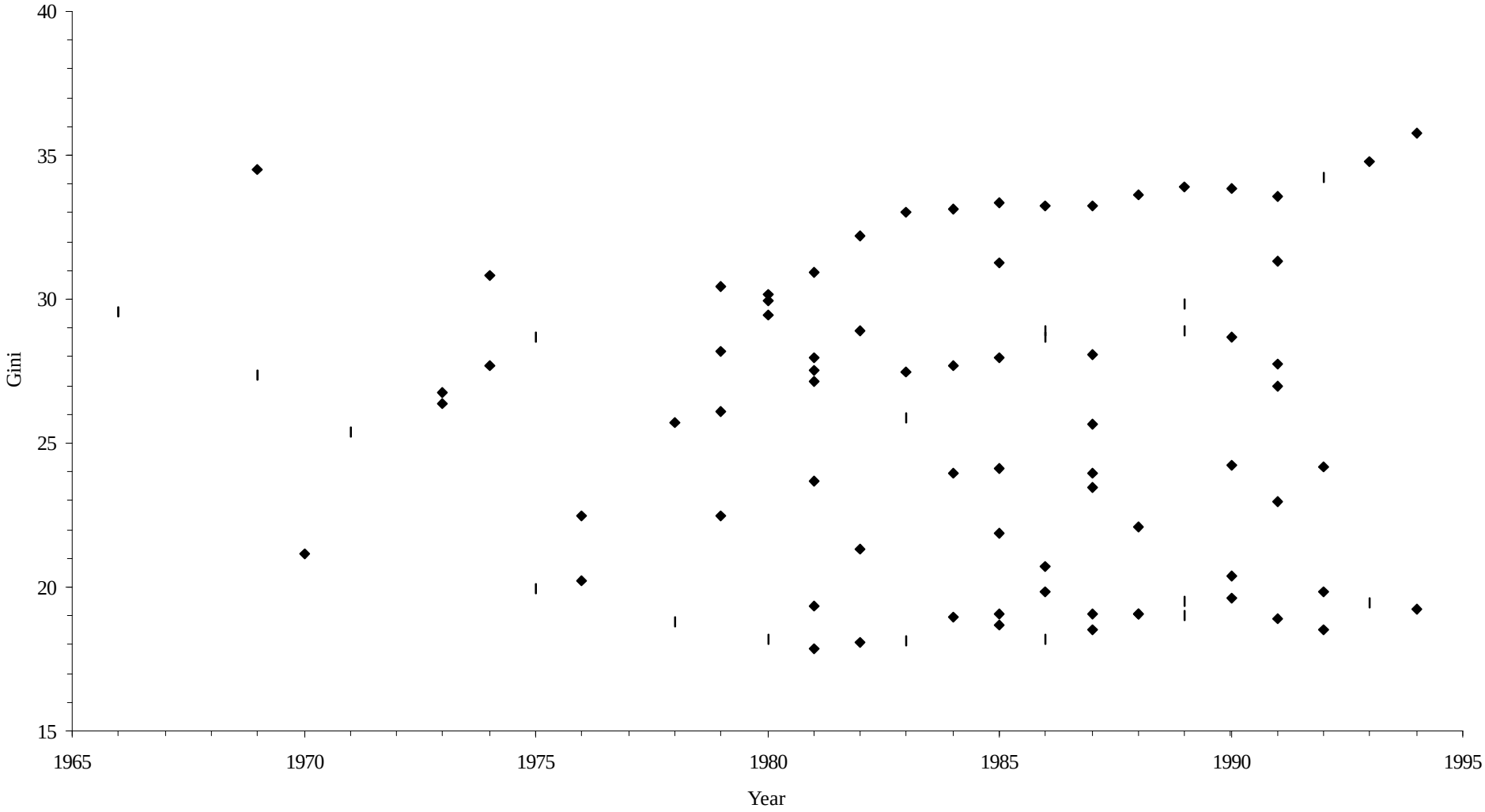
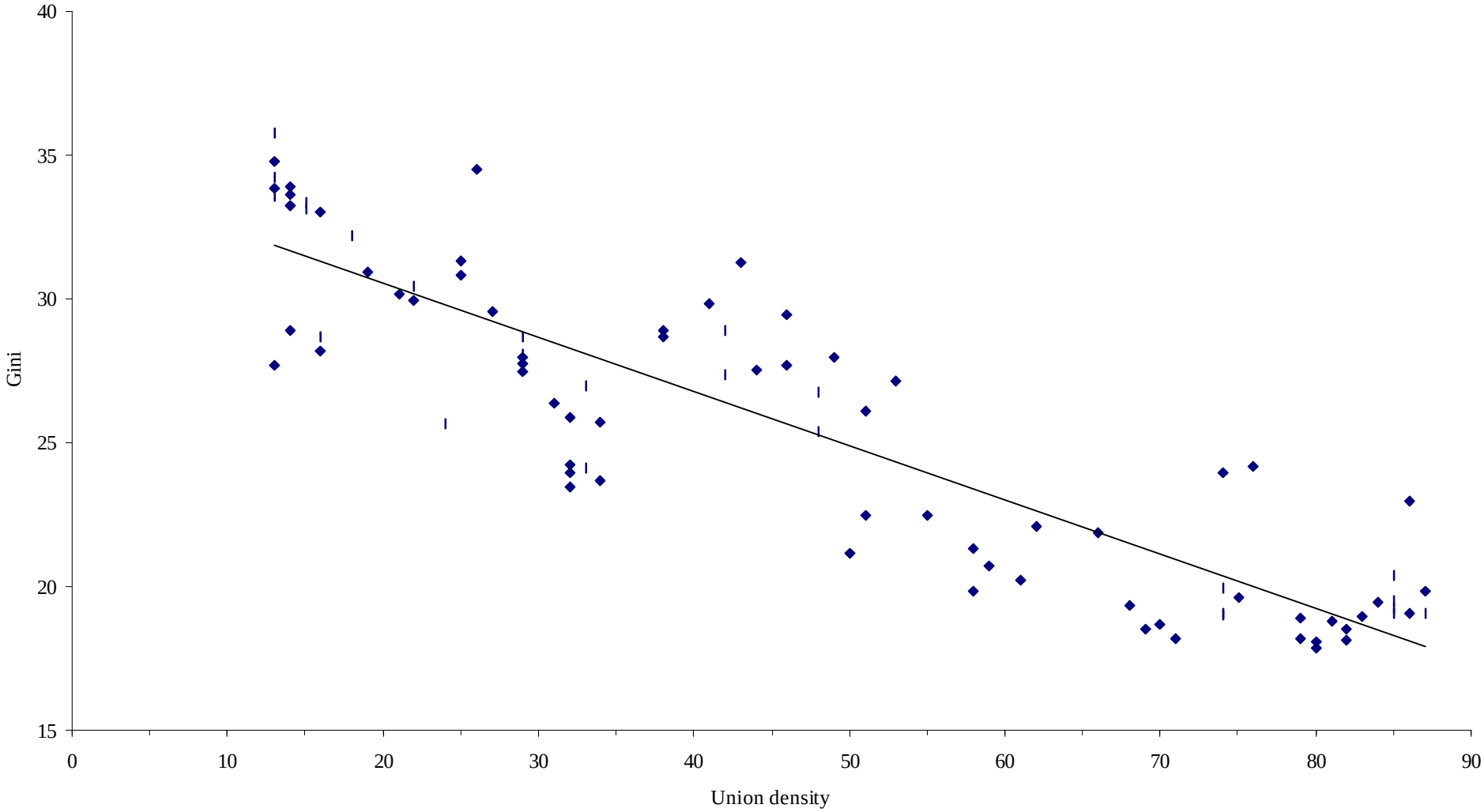


Table 2. List of Variables and Sources

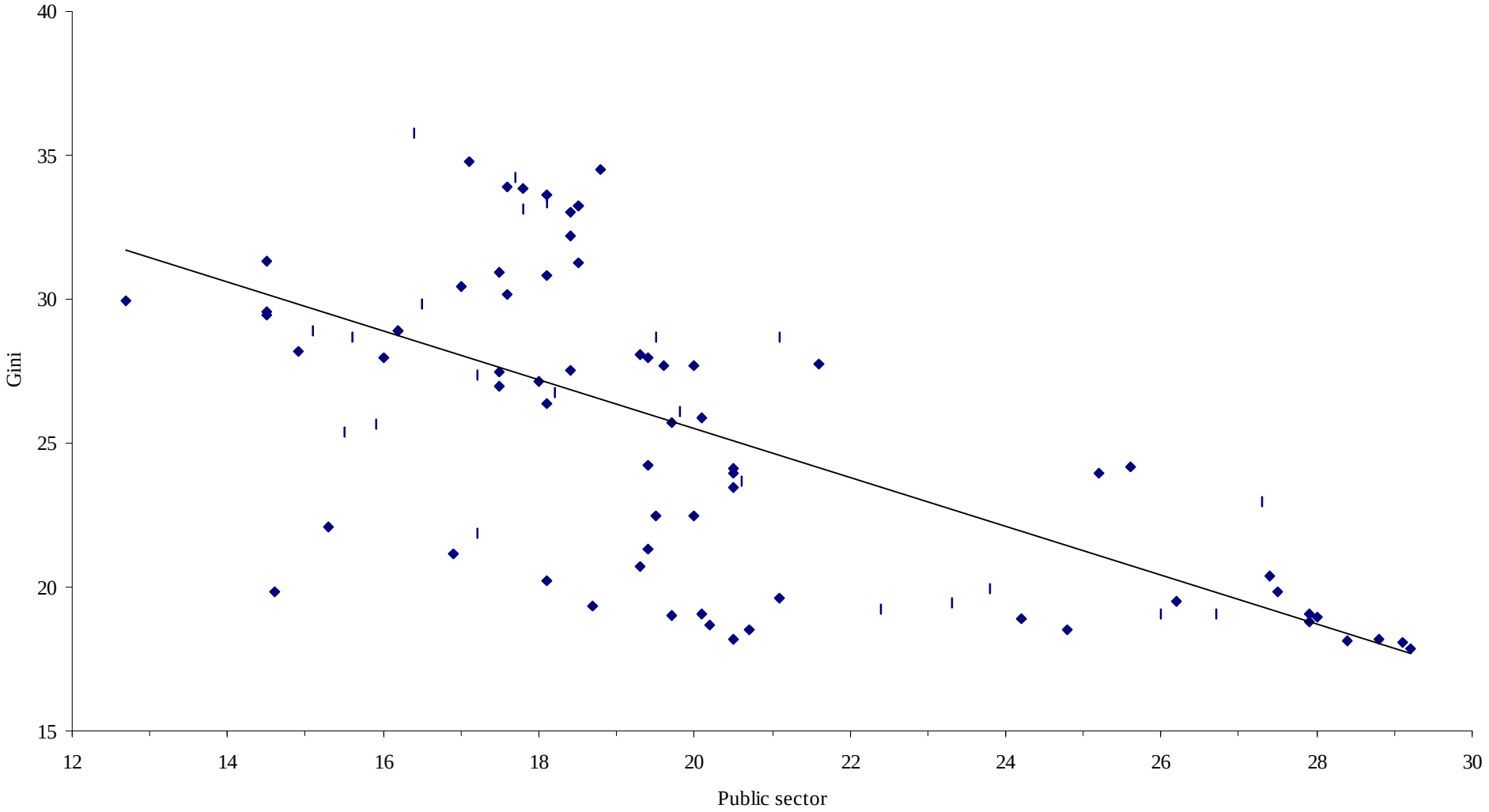
Variable	Definition	Sources*
Gini-coefficient	Gini-coefficient (multiplied by 100)	See table 1
Unemployment	Unemployment as percentage of total labour force	OECD: Labour Force Statistics
Inflation	Percentage change in CPI	OECD: Economic Outlook, Historical Statistics
Share 0-14 years	Share of population 0-14 years old	OECD: Labour Force Statistics
Share 15-64 years	Share of population 15-64 years old	OECD: Labour Force Statistics
Share 65- years	Share of population 65 years or older	OECD: Labour Force Statistics
GDP PPP	Size of GDP per capita (purchase power parity adjusted) in 1990 years prices divided by 1000)	OECD: National Accounts and OECD: Economic Outlook, Historical Statistics
Long run GDP-change	Mean change in GDP per capita over last 10 years	OECD: National Accounts
Imports from LDCs	Imports from less developed countries (excluding oil-exporting countries) as share of GDP	IMF: Direction of trade statistics and OECD: National accounts
Public sector	Current disbursments, gross capital formation and purchases of land and intangible assets by government as percentage of GDP	OECD: Economic Outlook, Historical Statistics
Union density	Share of total civilan labour force organized in labour unions	Bain and Price: Profiles of Union Growth Bean: International Labour Statistics Bureau of Labor Statistics: Monthly Labor Review Galenson: Trade Union Growth and Decline LIS-data LO: Den fackliga organisations-graden i Sverige och i andra länder OECD: Labour Force Statistics Statistical Yearbook of Denmark Statistical Yearbook of Finland Statistical Yearbook of Germany Statistical Yearbook of the Netherlands Statistical Yearbook of Norway Statistical Yearbook of Sweden
Female labour force participation	Female labour force as percentage of females 15 to 64 years of age	OECD: Labour Force Statistics
Agriculture	Employment in agriculture as a percentage of civilian employment	OECD: Labour Force Statistics
Industry	Employment in industry as a percentage of civilian employment	OECD: Labour Force Statistics
Service	Employment in service as a percentage of civilian employment	OECD: Labour Force Statistics

* Various years

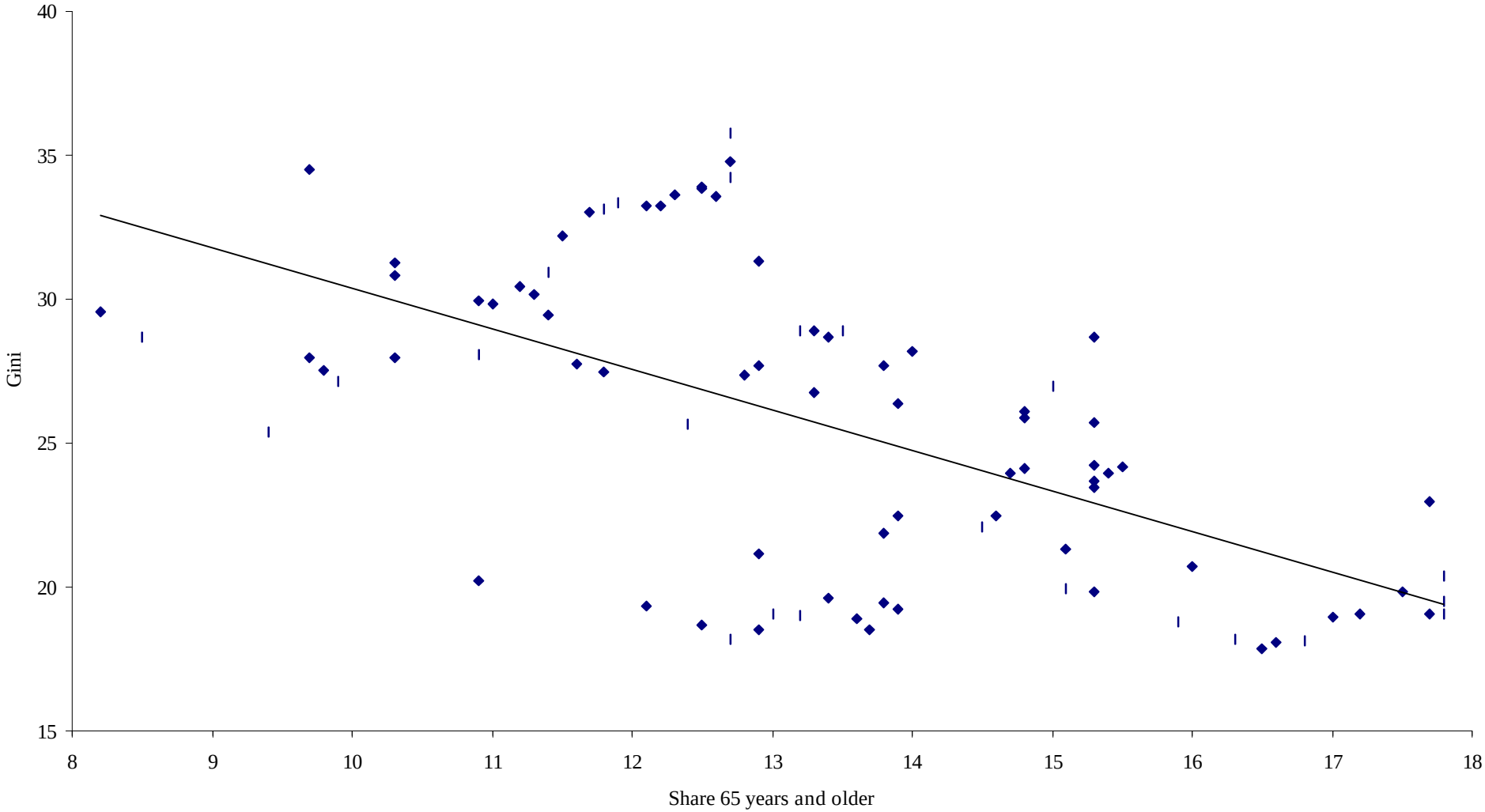
4a. Union Density and the Gini-coefficient for Equivalent Disposable Income



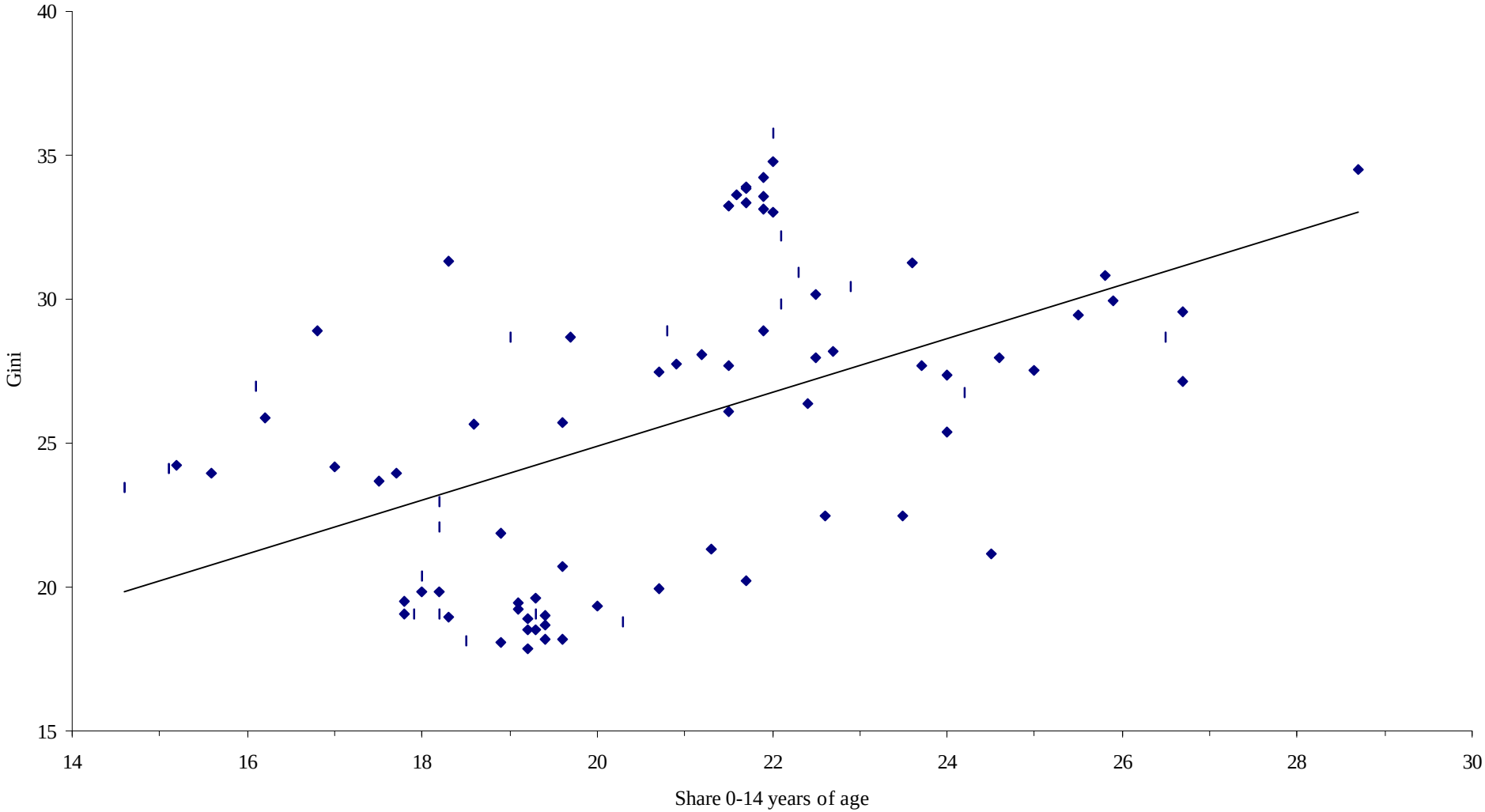
4b. Public Sector and the Gini-coefficient for Equivalent Disposable Income



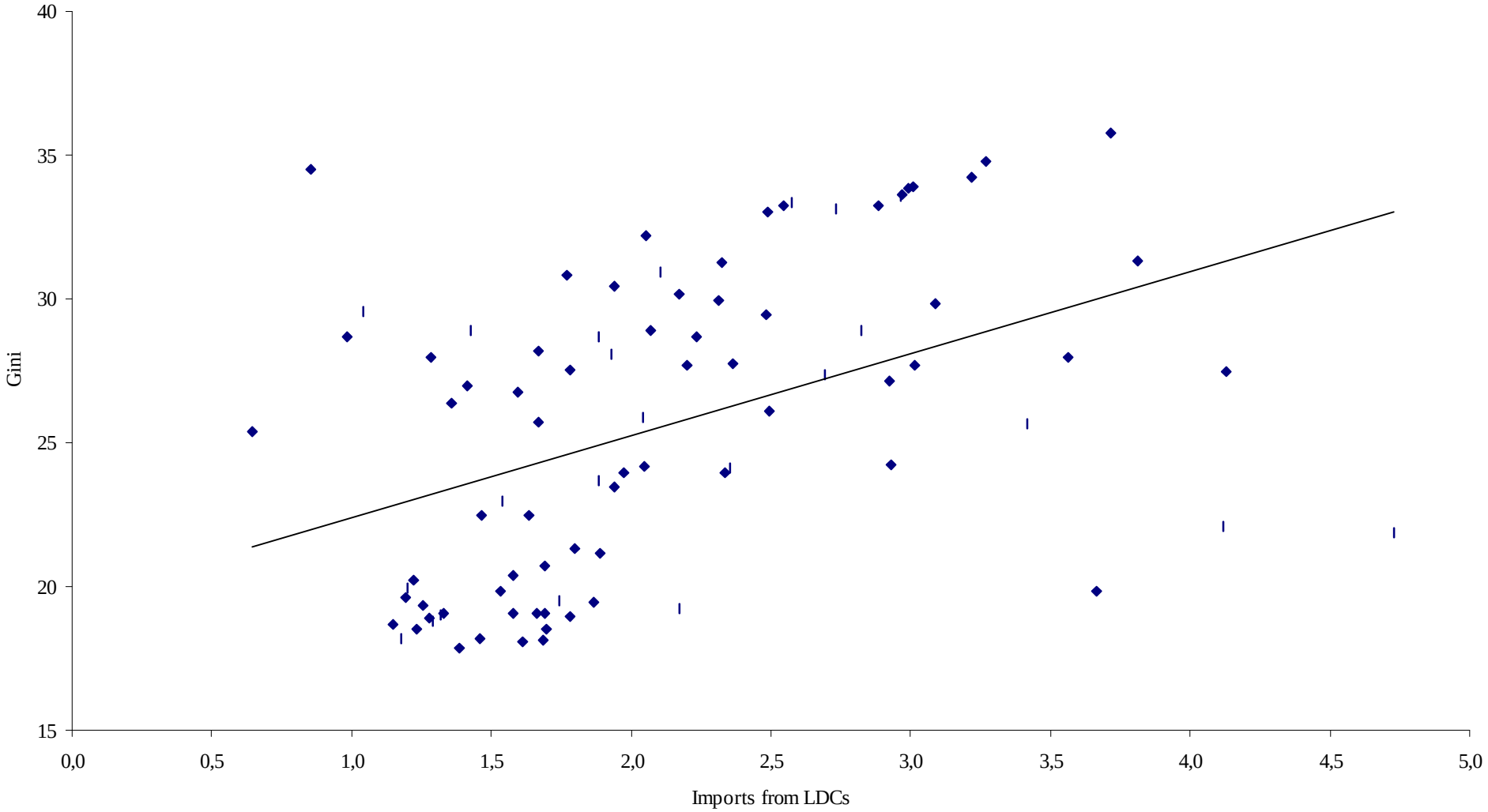
4c. Share of Population 65 Years and Older and the Gini-coefficient for Equivalent Disposable Income



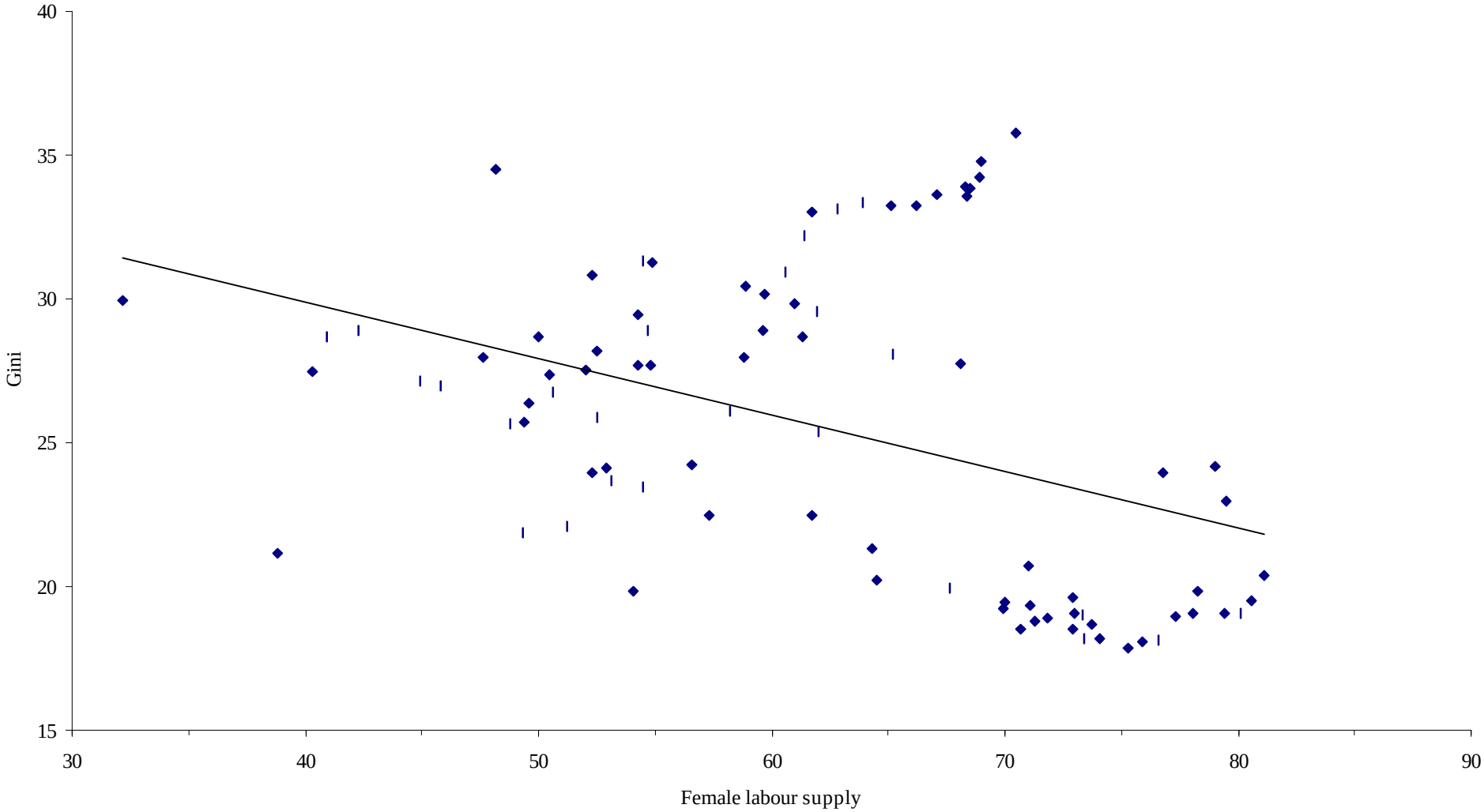
4d. Share of Population 0-14 Years of Age and the Gini-coefficient for Equivalent Disposable Income



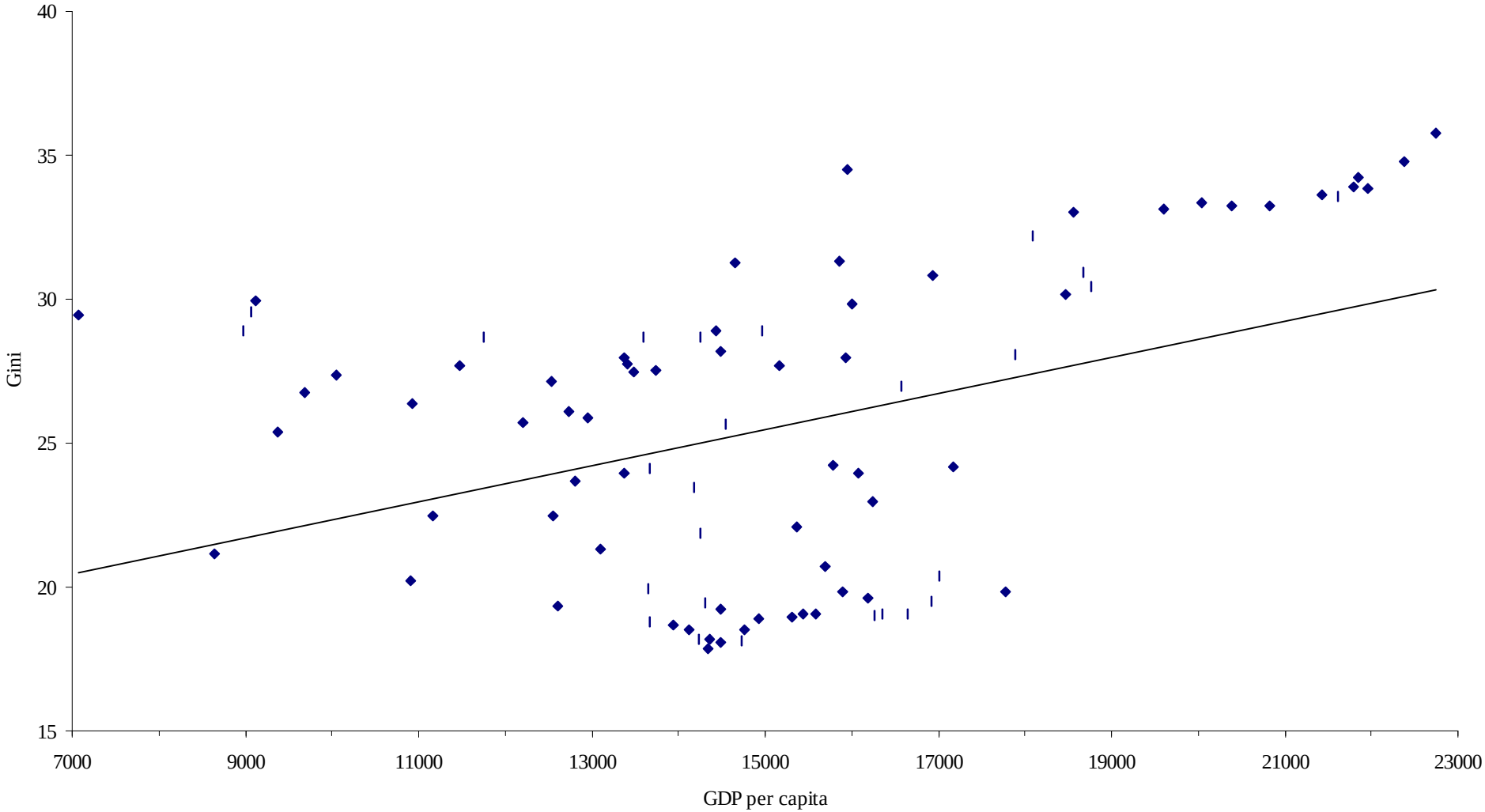
4e. Imports from Less Developed Countries and the Gini-coefficient for Equivalent Disposable Income



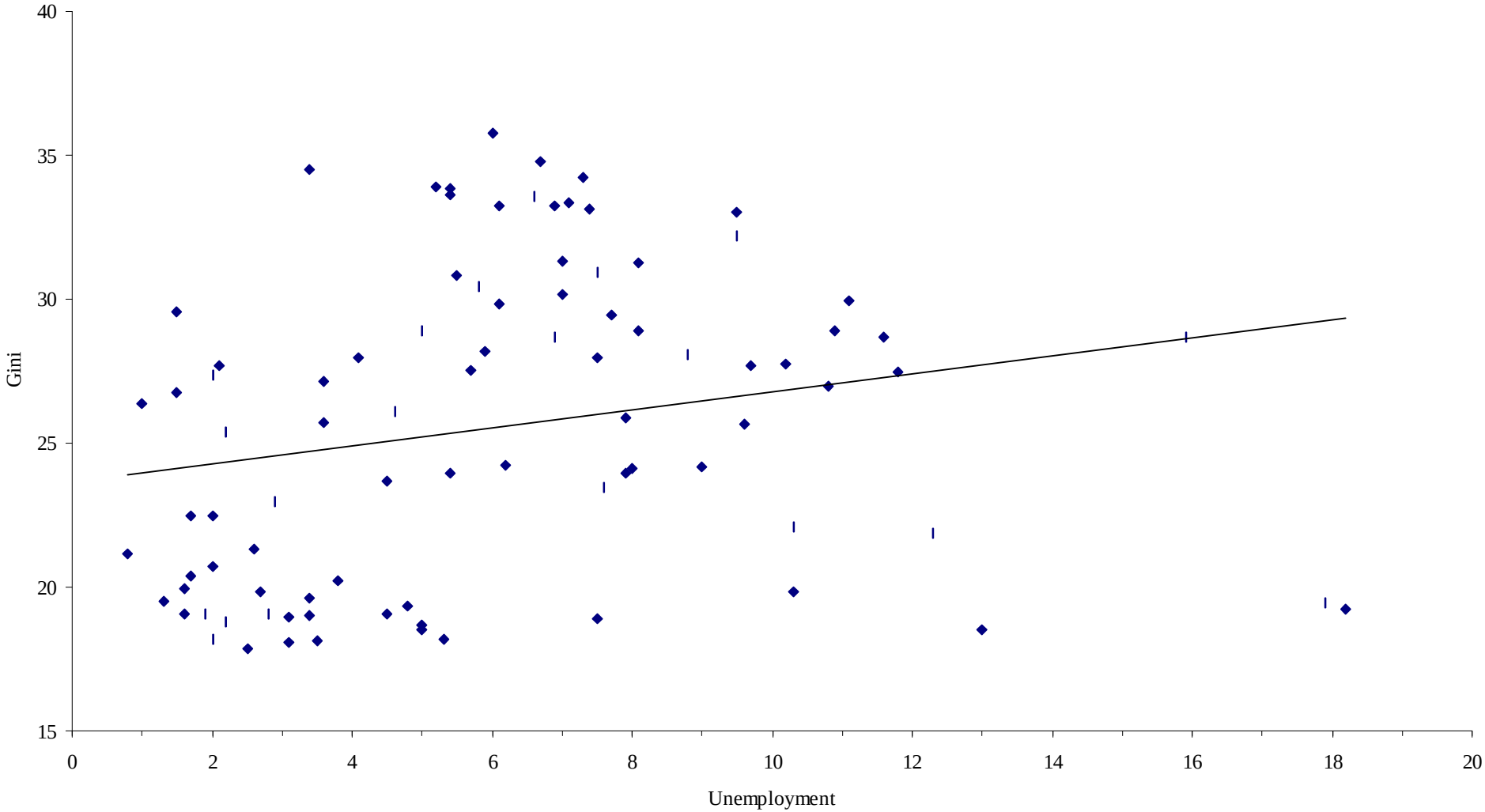
4f. Female Labour Force Participation and the Gini-coefficient for Equivalent Disposable Income



4g. GDP per Capita and the Gini-coefficient for Equivalent Disposable Income



4h. Unemployment and the Gini-coefficient for Equivalent Disposable Income



4. Panel data methods

When analysing panel data, the structure of the disturbance term may consist of time-serial disturbances, cross-section disturbances, and a combination of both. If using OLS when analysing panel data, one assumes all unexplained variation to be both cross-sectional and time-serial and that no individual effect can be separated out. Homogenous intercepts can be estimated for the whole sample.

Differences between groups (in this study countries) may give rise to heterogenity.[6] This heterogenity may seriously affect the OLS-estimates. One way to deal with this problem is to estimate a so-called one-way error component model, which may be specified as:

$$y_{it} = \alpha + X_{it}'\beta + u_{it} \qquad \begin{matrix} i=1,\ldots,N \\ t=1,\ldots,T \end{matrix} \qquad (1)$$

with *i* denoting the countries and *t* denoting time. α is a scalar, β is $K \times 1$ and X_{it} is the *it*th observation on K explanatory variables. In a one-way error component model the disturbance term, u_{it}, is defined as:

$$u_{it} = \mu_i + \nu_{it} \qquad (2)$$

[6] Of course, differences between time-periods also may give rise to heterogenity. In order to correct for this, it is possible to specify a so-called two-way error component model, or catch up the time-effect through a time-trend. In our model shown below, however, there seems to be country specific effects, but there is little evidence for any time specific effects. Therefore we will concentrate on one-way error component.

where μ_i is time-invariant and denotes any country specific effect not included in the regression, and ν_{it} denotes the remainder disturbance. By assumption $E(\nu_{it})=0$ and $Var(\nu_{it})=\sigma_\nu^2$.

The panel data can be estimated as fixed effects (FE) or random effects (RE) models. FE models assume that the country specific effects, μ_i, are fixed and correlated with the regressors. FE models are suitable to use when the number of countries is small, inference is made with respect to the behaviour of the sample and, most importantly, when u_{it} is correlated with X_{it}. The Within and Between models are two estimating strategies to specify a FE model. When using a Within model, one assumes heterogenous intercepts for different countries, but homogenous slopes. The data is transformed by subtracting country specific means from the original data for each variable. The OLS regression on the transformed variables eliminates the individual effects and captures only the variation that is not purely country specific.

In Between models, the variation over time is eliminated by replacing each observation by the mean value over time for each country. These models will therefore only capture country specific variation.

In this study, we are mostly interested in trends over countries and, thus, only estimates Within models.

RE models assume that μ_i are random and uncorrelated with the regressors. RE models are suitable to use when dealing with a large number of countries, inference is made with respect to the behaviour of the population. The RE model is asymptotically efficient relative to the FE

model. However, the RE model assumes the country effects to be uncorrelated with the other regressors. If this is not the case - i.e. if correlation is present - the RE model may suffer from inconsistency due to omitted variables.

GLS models, which is a way to estimate RE models, consist of a matrix weighted average of the within-country and the between-country estimates. The weight, ψ, refers to the between-country variation. If $\psi \rightarrow 0$, the GLS estimator for β approaches the within estimate. OLS corresponds to $\psi=1$, where the within-group and between-group variations are just added up. GLS equations may thus be seen as a solution intermediate between treating μ_i all as different and treating μ_i all as equal.

5. Model estimates

In this section we report results from estimating models, starting with what might be labelled Blinder-Esaki models, named after the writers. These models look at the effects of the unemployment-rate and inflation on inequality in the income distribution. The motivation for using these models is that they have been widely applied, and therefore it is interesting to investigate their explanatory power before moving on to more complete models.

/Table 3 about here/

Table 3 shows parameter estimates with high t-statistics in most columns for the variables unemployment and inflation. In both cases the signs are negative which when it comes to the variable unemployment, is definitively not what was expected. Only when including two

Table 3. Estimates of Blinder-Esaki models (standard erors in parentheses)

Variable	1. Within[a]	2. Generalized Least Squares	3. Within[a]	4. Generalized Least Squares
Intercept		30.630***		34.725***
		(1.295)		(1.413)
Unemployment	-0.267***	-0.215***	-0.150***	-0.101
	(0.110)	(0.072)	(0.051)	(0.068)
Inflation	-0.196***	-0.150**	-0.149**	-0.104
	(0.067)	(0.063)	(0.074)	(0.064)
Trend			-0.648***	-0.670***
			(0.192)	(0.124)
$Trend^2$			0.017***	0.018***
			(0.005)	(0.004)
R^2 (adj.)	0.1511	0.9197	0.3771	0.9272
F-value	9.007	344.798	14.623	230.181

***-Significant at 1%-level **-Significant at 5%-level

[a] Parentheses give White´s (1980) heteroscedasticity-consistent standard errors

variables measuring time in the specification and using GLS are the t-statistics for unemployment low.

We now turn to modelling using all explanatory variables. To get the GLS models we follow the procedure suggested by Baltagi and Griffin (1988).

To select the models, we started with the full model (model 1 Table 4), then reduced it. To make sure that the omitted variables had no joint effect on the regression, we conducted an F-test[7]. The test gave the value of 0.62 for model 2 which means that we can't reject the hypothesis of no effects of the omitted variables. Thus, we conclude that the omitted variables have no joint effect on the regression.

In order to test if there are any country-specific effects of omitted variables we follow Baltagi (1995, p.163) and conduct a Breusch-Pagan test for the unbalanced panel data case. We test the hypothesis of no country-specific effects against the alternative hypothesis that there are country-specific effects. The test-statistic is distributed as χ^2_1 and turned out to be 24.89 (for model 2 in table 4), thus rejecting the hypothesis of no country-specific effects of omitted variables. [8]

As there seem to be country-specific effects, it is appropriate to specify a one-way error correction model. The question still remains, however, of which model should be preferred - a fixed effect or a random effect. As mentioned above, in the random effect model μ_i is

[7] See Pindyck and Rubinfeld (1981), p. 117-120.
[8] The same test was conducted for time effects. In this case the test statistic became 0.06. This means that it is not possible to reject the hypothesis of no time-specific effects.

assumed to be uncorrelated to the exogenous variables, while the fixed effect models allow correlation between the exogenous variables and η_i. This may be tested by a so-called Hausman test, where the hypothesis is that there is no correlation.[9] In this case, the test statistic, *m*, is calculated to *m*=4.45, which is too low to reject the hypothesis that η_i is uncorrelated with the exogenous variables. This means that we can use a random effect model.[10]

/ Table 4 about here /

Returning to the discussion of different causes discussed in the literature the estimates give the following picture: Starting with economic development and sector structure of the economy we find clear support for the latter. We report a negative coefficient for the share of the population in the industry sector having high t-statistics. However, turning to the coefficient estimates for the variables measuring GDP and long run changes in GDP we find that both are reported with low t-statistics.

The estimates give some support for the view that inequality is affected by the volume of imports from developing countries. The estimated coefficient has the expected sign, but it is not significantly different from zero at the conventional 5-percent level, only at the 10 percent level in the full model and disappears when we reduce the model.

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[9] The test statistic is being specified as: $m = q'[\text{var}(q)]^{-1} q$, where q=β_{within}-β_{GLS} and var(q)=var(β_{GLS})-var(β_{within}). The test statistic, *m*, is distributed as χ^2_k , where *k* denotes the dimension of slope vector β, see Baltagi (1995), p. 68.

[10] In this case magnitude of ψ will be between 0.01 and 0.11. Thus, the GLS estimates make use of the within group variation and about 1-11% of the between group variation depending on the number of time periods observed for each country.

Table 4. Generalized Least Squares Estimates of the Gini-Coefficient on Selected Exogenous variables (standard errors in parentheses)

Variable	1. Full Model	2. Reduced Model
Intercept	27.685** (11.177)	34.620*** (2.803)
Unemployment	-0.012 (0.085)	
Inflation	-0.126** (0.048)	-0.120*** (0.045)
Share 0-14 years	0.618*** (0.149)	0.550*** (0.090)
Share 65- years	0.220 (0.231)	
GDP per capita	-0.218 (0.195)	
Long run GDP-change	0.300 (0.378)	
Imports from LDCs	0.733* (0.376)	
Public sector	-0.278** (0.134)	-0.277*** (0.102)
Union density	-0.093*** (0.027)	-0.101*** (0.021)
Female labour force participation	0.020 (0.054)	
Industry	-0.277** (0.132)	-0.312*** (0.064)
Service	0.022 (0.107)	
R^2 (adj.)	0.9815	0.9384
F-value	367.892	229.429

***-Significant at 1%-level **-Significant at 5%-level *-Significant at 10%-level

After taking part of the content in Table 3 it comes as no great surprise that we cannot report results showing that the unemployment-rate positively affects inequality. The coefficient reported in Table 4 has a very low t-statistic. However, the result of a negative sign having a high t-statistic for the inflation-variable found in the specification reported in Table 3 carries over to estimates reported in Table 4.

Both for the coefficient for the variables measuring the size of the public sector and for the coefficient of the variable measuring trade union density we can report expected negative signs. In both cases the estimated coefficients have high t-statistics. Thus there is clear evidence that reasons for inequality changes are affected by circumstances outside a strictly defined market sphere.

Turing to estimates of coefficients for variables measuring the age-composition of the population we find positive coefficients in both cases. However, it is only for the variable measuring the proportion of the population aged less than 15 years that the t-statistic is high.

Finally, we note that the coefficient for the variable female labour force participation is estimated with a low t-statistic. Our study then does not give support for the view that the gender distribution of paid labour is something which explains how income inequality at the household level changes.

/Table 5 about here/

Table 5. Generalized Least Squares Estimates of the Gini-Coefficient on Selected Exogenous Variables (standard errors in parentheses)

Variable	1. Excluding Scandinavian countries	2. Excluding non-European countries	3. Excluding years before 1980
Intercept	25.272*** (2.679)	35.077*** (3.800)	34.213*** (4.238)
Inflation	-0.137*** (0.049)		
Share 0-14 years	0.381*** (0.108)	0.548*** (0.126)	0.336*** (0.097)
Long run GDP-change	1.264*** (0.335)		
Imports from LDCs	1.011*** (0.311)		1.052** (0.407)
Public sector		-0.287** (0.124)	-0.310*** (0.111)
Union density		-0.098*** (0.026)	-0.104*** (0.023)
Industry	-0.255*** (0.074)	-0.349*** (0.082)	-0.248*** (0.086)
No. of observations	54	63	70
R^2 (adj.)	0.9773	0.9650	0.9812
F-value	388.808	348.454	608.784

*** - Significant at 1%-level ** - Significant at 5%-level * - Significant at 10%-level

To what extent are the results reported in Table 4 robust with respect to the sample? We investigate the sensitivity by omitting from the sample observations a) Based on the Scandinavian countries. b) Based on Non-European countries c) Based on years before 1980. In the appendix the corresponding within-estimates are reported. Using the same procedure as above we report in Table 5 the preferred specifications.

The results show that two variables come through with the same sign as in Table 4 and with high t-statistics for all sub-samples, the variable measuring the share of persons aged less than 15 and the variable measuring the share of the labour force in the industrial sector.

An interesting bit of information in Table 5 is that the positive coefficient for the variable measuring import from LDC has a high t-statistic in two of the three columns. It is when non-European countries are excluded from the sample that indications of an effect are not present.[11] Thus the sensitivity analysis indicates that this force has explanatory power, but also that it is not general.

The same conclusion that the explanatory power seems not to be general applies to inflation which is eliminated when non-European countries are omitted from the sample as well as years before 1980. Lack of generality also applies to the variables public sector and trade union density when the Scandinavian countries are excluded from the sample. Finally, in Table 5 we can see that when the Scandinavian countries are omitted from the sample, long run GDP change enters the specification with a positive sign and a high t-statistic.

[11] As reported in the appendix also when excluding observations made before 1980 and using within-estimates the t-statistics is low.

/Figure 5 about here/

Finally we explore how well the estimated models track the real development by concentrating on the three countries which have contributed with the largest number of observations. Using estimates reported in the last column of Table 4, Figure 5 shows predicted values for Finland, Sweden and the United States. The figures also show the observed values.[12] The general conclusion, which also applies to the other specifications, is that the estimated model tracks the real development well. The main exceptions are under-prediction of inequality for the last year in the Swedish time-series and that the initial decrease of inequality in the United States is far from fully reflected.

We can now use the model-estimates to throw light on the following question: During the 80s Finland, Sweden and the United States experienced different developments in inequality. Inequality increased rapidly in the United States, substantially in Sweden, but was more or less constant in Finland. What is the main reason for the different developments cross-countries?

Common to all three countries and the 80s was a change in the sector structure of the economy which taken separately would have meant increases in inequality. For Finland this was counterbalanced by several forces: an increased public sector, increased trade union density and (to a somewhat lesser extent) changed age-structure of the population.[13] The main

[12] For the ease of comparsion, we are not showing the predicted GLS-values. Instead we re-estimate the predicted GLS-values so that they conform to the originally observed values.

[13] The rapid decrease in inequality in Finland from the mid 60s to the beginning of the 80s is according to the model-estimates explained by (1) Changed sector-structure working towards more equality (Finland industrialised later than United States and Sweden). (2) A more rapid change in age-structure than during the following episode. (3) A more rapid increase in trade union density than during the following episode.

Figure 5a. Observed and Predicted Values for the Gini-coefficient for Equivalent Disposable Income, Sweden

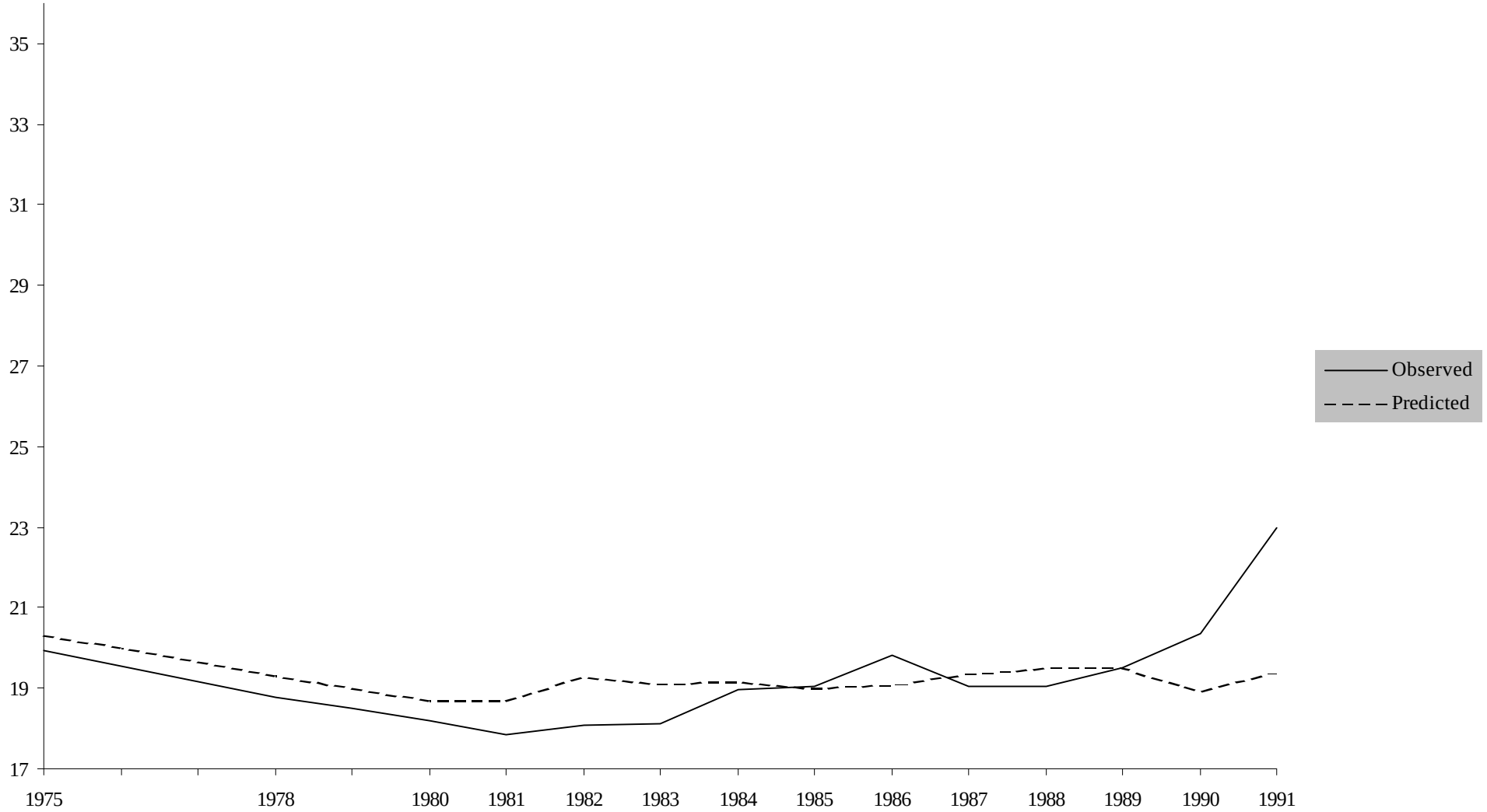


Figure 5b. Observed and Predicted Values for the Gini-coefficient for Equivalent Disposable Income, Finland

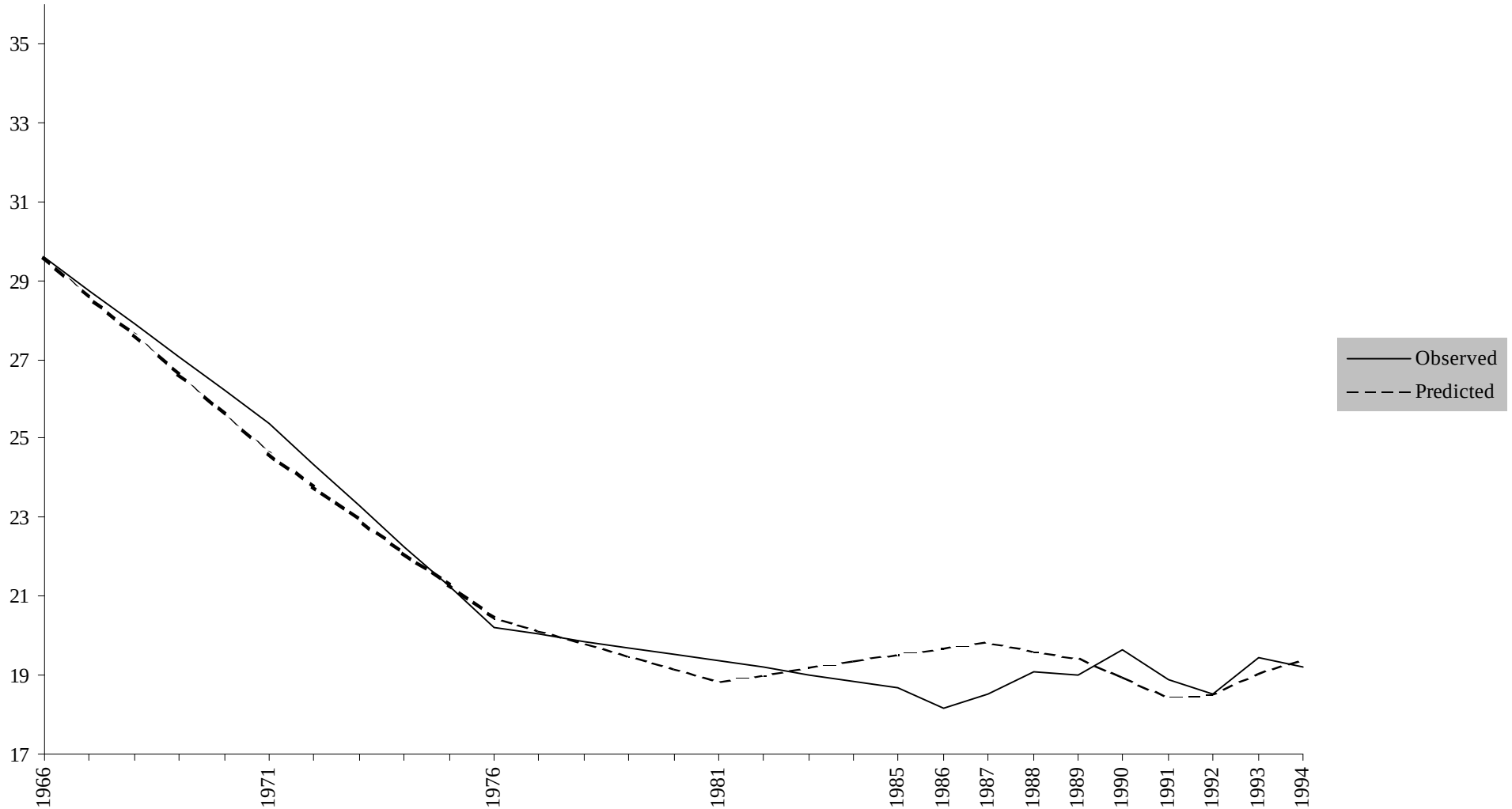
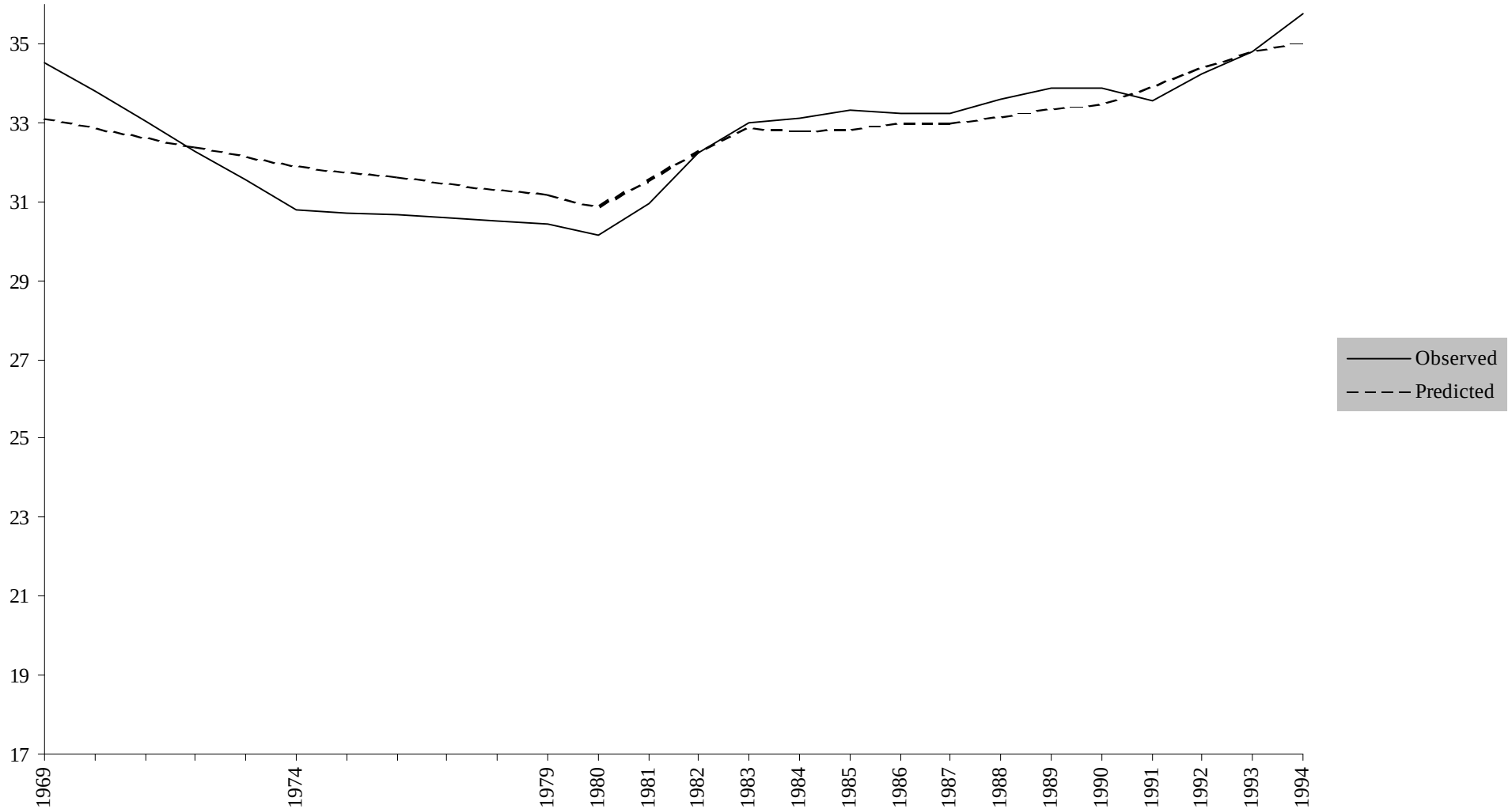


Figure 5c. Observed and Predicted Values for the Gini-coefficient for Equivalent Disposable Income, USA



exception explaining the difference for Sweden´s performance in inequality changes during the 80s was that its public sector did not expand.[14]

Why did inequality increase more rapidly in the United States than in Sweden? According to estimates of the reduced model reported in Table 4 trade union density in Sweden (as in Finland) continued to increase counterbalancing other forces working towards increased inequality: this was not the case in the United States where trade union density actually decreased. [15]

6. Conclusions

Analysing an unbalanced panel covering 16 OECD-countries from the mid 60s to the mid 90s we have tried to throw light on which factors that causes income inequality at the household level to vary over time. The income variable under study is equivalent disposable income and we have used individuals as the unit of analysis. We have used panel-methods for the statistical analysis.

A general conclusion from our work is that we have not found a smoking gun. Instead the results clearly point to the distribution of income being influenced by many factors. Some reasons seem to be general, while the existence of others seems to be dependent on countries or years included in the analysis.

[14] From the mid 70s to the beginning of the 80s the Swedish public sector was expanding, and its changed development can according to the estimated model explain why inequality in Sweden changed from moving towards greater inequality to moving towards more inequality in the beginning of the 80s.

[15] The model estimates reported in Table 5 add different development in import from developing countries cross the three countries to the explanaton. For the United States this factor pushed inequality up during the 80s, it had a weaker inequality-increasing effect in Finland and was without importance for the development of inequality in Sweden.

One set of factors affecting inequality in the distribution of income is strictly economic. Our results clearly support the premise that the sector composition of the economy is important. The decreased industrial sector seems to be a force generally fostering inequality. This result is considerably more clear than a (negative) relation with inflation and the size of GDP.

Further we found some support for the view that increases in trade from developing countries increases inequality. However, signs of such a relation disappear entirely when observations from countries outside Europe are taken out of the sample investigated. We could also report signs of inflation having a negative effect on inequality but even those did not appear generally.

Another set of factors affecting inequality in the distribution of income is found outside a strictly defined market-sphere. Low inequality is found when a large proportion of the labour force belongs to a trade union and there is a large public sector. However, these results were not obtained when omitting the Scandinavian countries from the sample.

We have also been able to report that demographic circumstances are of importance for how inequality develops, since the proportion of the population aged less than 15 was found to have a positive effect on inequality. This finding was found to be robust with respect to the sample investigated and we think it deserves more attention in future research.

While according to our results several factors affect how income inequality varies, the analysis did not support them all. One example is that we could not establish a relation between female

labour force participation and inequality. The perhaps most interesting negative result was the inability to establish a positive relation between the unemployment-rate and inequality in models including other explanatory variables as well. Why was this the case? Increased unemployment at the macro-level starts other processes which counterbalance income-losses of the unemployed. One obvious example is payment of unemployment benefits, another is the increased labour supply of other family members. In addition there is the possibility that family-formation and fertility are affected.

When evaluating the result of lack of a relation between unemployment and inequality it should also be remembered that we have investigated the instant relation between the unemployment rate and inequality. Large increases in unemployment for the countries covered in the analysis trigger payments of unemployment compensation which in turn have to be financed. Unemployment-shocks might therefore later result in, for example, lower benefits to families with children, thereby increasing income inequality.

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Table A1. Correlations and basic statistics for variables in the analysis

	Variable															
Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Gini-coefficient	1.000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2. Unemployment	0.216	1.000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3. Inflation	-0.041	-0.353	1.000	-	-	-	-	-	-	-	-	-	-	-	-	-
4. Share 0-14 years	0.504	-0.191	0.476	1.000	-	-	-	-	-	-	-	-	-	-	-	-
5. Share 15-64 years	-0.035	0.527	-0.521	-0.611	1.000	-	-	-	-	-	-	-	-	-	-	-
6. Share 65- years	-0.602	-0.213	-0.151	-0.735	-0.088	1.000	-	-	-	-	-	-	-	-	-	-
7. GDP per capita	0.393	0.137	-0.383	-0.160	0.198	0.036	1.000	-	-	-	-	-	-	-	-	-
8. Long run GDP change	-0.119	-0.452	0.238	0.270	-0.226	-0.145	-0.494	1.000	-	-	-	-	-	-	-	-
9. Imports from LDCs	0.441	0.363	-0.214	-0.017	0.152	-0.108	0.314	-0.466	1.000	-	-	-	-	-	-	-
10. Public sector	-0.638	-0.282	-0.016	-0.461	-0.143	0.702	0.071	-0.286	-0.421	1.000	-	-	-	-	-	-
11. Union density	-0.895	-0.262	0.093	-0.384	-0.128	0.590	-0.283	0.001	-0.390	0.732	1.000	-	-	-	-	-
12. Female labour part.	-0.415	-0.297	-0.154	-0.359	-0.021	0.469	0.403	-0.187	-0.298	0.714	0.571	1.000	-	-	-	-
13. Agriculture	-0.125	-0.074	0.342	0.341	-0.097	-0.348	-0.680	0.543	-0.341	-0.311	0.092	-0.209	1.000	-	-	-
14. Industry	-0.149	-0.273	0.246	-0.007	-0.102	0.096	-0.629	0.442	-0.247	-0.103	-0.037	-0.451	0.249	1.000	-	-
15. Service	0.174	0.222	-0.373	-0.212	0.128	0.158	0.829	-0.622	0.371	0.262	-0.034	0.421	-0.786	-0.794	1.000	-
16. Trend	-0.047	0.479	-0.450	-0.595	0.507	0.315	0.558	-0.526	0.363	0.157	0.117	0.396	-0.349	-0.585	0.593	1.000
Mean	25.6	6.1	6.8	20.7	65.9	13.4	15.1	2.1	2.1	20.0	46.5	62.0	7.0	31.6	61.4	18.9
Standard deviation	5.3	3.7	4.1	2.9	2.0	2.3	3.3	0.8	0.8	4.0	25.4	11.3	5.1	5.1	8.0	6.3
Minimum	17.8	0.8	-0.7	14.6	61.5	8.2	7.1	0.6	0.6	12.7	13.0	32.2	2.5	23.2	36.1	1.0
Maximum	35.8	18.2	16.6	28.7	70.1	17.8	22.7	3.9	4.7	29.2	87.0	81.1	28.8	47.5	73.2	29.0

Table A2. Within Estimates of the Gini-Coefficient on Selected Exogenous variables (White´s heteroscedasticity-consistent standard errors in parentheses)

Variable	Within 1	Within 2
Unemployment	-0.054 (0.074)	
Inflation	-0.111*** (0.047)	-0.107*** (0.040)
Share 0-14 years	0.662*** (0.115)	0.660*** (0.075)
Share 65- years	-0.267 (0.268)	
GDP per capita	-0.383* (0.196)	
Long run GDP-change	0.362 (0.373)	
Imports from LDCs	0.657* (0.376)	
Public sector	-0.409*** (0.139)	-0.357*** (0.092)
Union density	-0.085*** (0.030)	-0.086*** (0.016)
Female labour force participation	0.016 (0.052)	
Industry	-0.332*** (0.104)	-0.392*** (0.073)
Service	0.224* (0.133)	
R^2 (adj.)	0.6610	0.6605
F-value	15.621	36.019

***-Significant at 1%-level **-Significant at 5%-level *-Significant at 10%-level

Table A3. Within Estimates of the Gini-Coefficient on Selected Exogenous Variables (White´s heteroscedasticity-consistent standard errors in parentheses)

	1. Excluding Scandinavian countries	2. Excluding non-European countries	3. Excluding years before 1980
Inflation	-0.144***		
	(0.043)		
Share 0-14 years	0.383***	0.654***	0.473***
	(0.096)	(0.093)	(0.107)
GDP per capita			
Long run	1.232***		
GDP-change	(0.426)		
Imports from LDCs	1.082***		0.804
	(0.262)		(0.567)
Public sector		-0.389***	-0.383***
		(0.115)	(0.104)
Union density		-0.081***	-0.064**
		(0.019)	(0.027)
Industry	-0.239***	-0.446***	-0.328**
	(0.047)	(0.077)	(0.143)
No. of observations	54	63	70
R^2 (adj.)	0.5298	0.6497	0.4083
F-value	13.168	30.209	10.660

***-Significant at 1%-level **-Significant at 5%-level *-Significant at 10%-level