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ABSTRACT

Public Funding and Enrolment into Higher Education in Europe*

In this paper we provide evidence for the impact of public funding on enrolment of students in college. We use a panel for European countries and apply instrumental variables techniques to find that public funding for schooling – regardless at what level – does increase college enrolment alike with an elasticity of about one. A second issue concerns the impact of tuition fees, which are found to reduce college enrolment.

JEL Classification: I22, I28

Keywords: College enrolment, public funding, tuition costs

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1. Introduction

In most European countries higher education is highly subsidized by the states. What impact has this public funding on educational choices of students? The theory underlying this relationship is the classical human capital model (Becker 1993), where an individual maximises his discounted stream of lifetime earnings net of the costs of education. Net-costs of education – aside from opportunity costs – consist of out-of-pocket costs like tuition fees and education material net of public subsidies. An individual will invest in schooling up to the point where the marginal cost of an additional year of schooling (foregone earnings plus net-costs) is equal to the marginal benefit (the discounted stream of earnings attributable to another year of school), being a function of an individuals' ability and time preference or discount rate.

Why is there any argument for public intervention concerning the private choice of education? In principle, three arguments can be made.¹ The first is a public good argument: a better educated population fosters civic participation, a stable democracy and a richer cultural life. As these benefits accrue to all members of society alike, they can be considered a public good. The second argument relies on liquidity constraints. The optimal schooling choice is dependent on a capital market being accessible for all individuals. Since ability cannot be used as collateral; students from poorer backgrounds may not be able to borrow to invest in their own education. Public funding, thus, can provide the necessary temporary liquidity by giving loans the credit market cannot provide. This argument is certainly more relevant for higher education. Finally, a more educated population can generate social externalities through complementarities in production or consumption. These externalities –

¹ See also Eissa (2000).

which are prominent in the new growth increasing returns literature – could arise, because people are more productive if they are around other clever people.²

Unfortunately not many studies on the impact of public funding on enrolment into higher education exist in Europe. On the other hand, the situation in the United States has been extensively studied. In order to profit from these insights, we provide a partial review of some of these studies in the next section. Section 3 describes the data and institutional details of funding. Section 4 presents the econometric model, which uses cross-country data over 14 European countries together with time variation in public funding of higher education. A special problem is possible endogeneity of public funding, which may be caused by rising student numbers as such. We use an instrumental variables approach to deal with these issues. Section 5 concludes.

2. Previous Research

2.1. European Studies

The few European contributions to evaluate the direct impact of public funding on education choices are of a time-series nature. Table 1 gives a short description of relevant studies. Frederiksson (1997) analyses the demand for university education in Sweden between 1967 and 1991. Exploiting variation over time he looks particularly at the impact of funding variables like grants and loans on national enrolment rates. University enrolment rates are measured as the ratio of students enrolled at University level relative to the number of qualified leavers from upper secondary level (graduates). The employed specification controls for the rate of graduates from

² See Rauch (1994), Winter-Ebmer (1994) and Acemoglu and Angrist (1999) for approaches to and problems of estimating external effects of education.

upper secondary levels in the population to account for shifts of schooling preferences. Furthermore dummies for institutional reforms affecting University enrolment are included besides a set of additional controls accounting for the evolution of marginal benefits of University degrees and opportunity costs of schooling³. In this highly aggregated specification Frederiksson finds a robust positive and significant impact of public funding of education through grants and loans on the enrolment rate of graduates of the upper secondary level in Sweden.

For the Netherlands Huijsman et al. (1986) found a significant impact of public funding of education on enrolment of males into higher education using also a time-series framework for the years 1950 to 1982. Moreover, they confirm that other factors like per capita income have a much higher impact on enrolment. The analysis of educational behaviour of young students in England and Wales by Whitfield and Wilson (1991) shows that government funding of human capital accumulation can lower enrolment in higher education if it takes the form of employment and training schemes (YOP, YTS), which are in fact increasing the attractiveness of alternatives to schooling; a feature which has to be taken into account in analysing public spending and enrolment patterns in a given country. The principal problem with these time-series studies is that it is difficult to disentangle funding effects from a general rising trend in education.

2.2. U.S. Studies

The main approach used in the U.S. literature consists in directly estimating the effect of public funding or the net-costs of education on the individual education decision or aggregate education outcomes. An overview of this literature up to the

³ Earnings net of taxes of University graduates and non-graduates, unemployment benefits after taxes, various unemployment rates.

beginning of the 1990s is given by McPherson and Schapiro (1991). They summarise a bulk of literature concerning cross-sectional analyses of the impact of price or net-cost of education on students' post-secondary education decisions in the United States mostly in the late 1970s and the 1980s. This review highlights that most of these studies - even when they differ widely in data sources and estimation techniques - tend to confirm a positive and considerable sensitivity of students' education decisions to the cost of education, whether these costs are influenced by tuition fees or student aid variations. Decisions about where to attend school also respond to relative prices of schooling alternatives. Furthermore, the predicted response varies greatly by family income group: enrolment of students of less-affluent families is found to be significantly more sensitive to either an increase in student aid (grants) or a variation in tuition fees than enrolment of students from more affluent families. To sum up, these estimates point to a substantial effect⁴ of public funding on individual enrolment decisions.

McPherson and Schapiro (1991) question this conventional wisdom as the aggregate education behaviour of students in the 1970s and 1980s in the United States seems to contradict them. Despite substantial variation in public funding of higher education over time⁵, average enrolment rate responses were not readily detected in national time-series data. Also the higher sensitivity of students of less-

⁴ Leslie and Brinkman (1988) calculated a consensus effect (based on 7 studies) of a price cut of US\$ 100 (1982-1983 academic year dollars) on national enrolment of 18-24 year-olds at about 1.8 percent, treating a cut of tuition fees and a grant increase of same magnitude as equal effects.

⁵ Since the introduction of the Pell Program (Basic Educational Opportunity Grant Program) in 1973 total federal spending on need-based grants to undergraduate students increased from roughly 0.3 to 1982-US\$ 3.5 billions by 1980 and those federal grants to students grew from less than 3 percent to 29 percent of total tuition revenue of U.S. colleges and universities in the same time period. But total enrolment rates in the seventies were roughly stable, even slightly decreasing. After 1980 grant programs showed little growth, the amount of subsidised loans was increased instead. But as tuition fees increased even more net-costs of education rose. Despite this evolution overall enrolment rates increased slightly in the eighties. For a detailed overview see Kane (1995) and Card (2000).

affluent families was not observed⁶. In their own estimates, they use a simple time-series approach, allowing for variation in other factors that might affect the demand for enrolment like overall economic conditions, changes in rates of return to higher education and in the opportunity costs of college enrolment. They use enrolment rates of white students from three family-income classes between 1974 and 1984 (Current Population Survey). The results confirm a negative and significant sensitivity of enrolment of less-affluent students to the net-costs of public schools, but no reaction of students from middle and high income-families. A more detailed analysis of this same approach exploiting cross- and within-state variation in public university tuition fees is undertaken by Kane (1995). He employs a fixed-effects specification to assure that the impact of state-averaged schooling costs on college attendance is correctly identified. His estimates confirm that tuition fees of public colleges affect enrolment rates negatively. Moreover, the effect of means-tested grants is found to be much higher than general tuition fees.

Card (2000) follows a similar approach exploiting also variation of tuition fees over time and U.S. states. He finds mixed evidence of the impact of schooling costs on college attendance. Enrolment rates estimated by CPS data indicate a weak negative reaction to average tuition. On the other hand, graduation rates calculated from Census data show a weak positive relationship to education costs. His analysis highlights the importance of other factors like cohort size and the earnings gain associated with a college degree for explaining the evolution of enrolment rates over time.

Dynarski's analysis (1999) focuses directly on the impact of eligibility for financial aid on college attainment. Taking the death of a parent (father) as proxy for

⁶ According to the "consensus estimates" of Leslie and Brinkman (1988) the Pell program should have raised lower-income enrolment by between 20 and 40 percent implying an increase in total enrolment of approximately 10-20 percent.

eligibility and exploiting an exogenous policy change in 1982 she uses data from the National Longitudinal Survey of Youth (NLSY). She finds a highly significant positive impact of aid eligibility on college attendance and completion and a significant negative impact of the policy shift in 1982, on the youth, whose eligibility for aid was affected. Furthermore she finds evidence for financial aid having a threshold effect implying that public funds are best used when they are generous for the first year of college and decreasing thereafter.

2.3. Does Parental Income Matter?

A recent approach goes one step back and questions the very existence of liquidity constraints: only if liquidity constraints exist, low current parental income can reduce enrolment probabilities of students in the first place. If parental income as such does not influence educational decisions, how should public subsidies be able to do so? To answer this problem, a new set of papers looks directly at parental resources. The difficult question is how to disentangle long-run family factors from short-term borrowing constraints.

Cameron and Heckman (1998) find a high correlation of family income to children's school enrolment at all levels, but the correlation weakens and disappears as soon as family background variables and especially a measure of students' IQ are introduced. They conclude that permanent family background – like ability or preferences for education – explains children's IQ and also school enrolment, and that there is no need to revert to liquidity constraints.⁷ Shea (2000) uses income variation due to luck – like having a union job, industry and job loss – to identify current income shocks: these income shocks do not influence children's educational

attainment in all families, nor in families living in poverty, but there is some positive influence for families with parents with less than 12 years of education.

Other studies find positive effects of current parental income on students' enrolment. Mayer (1997) finds that parental income like asset income or income from child support payments – income types which may be thought as being less correlated with parental abilities than labour income – has a positive and significant influence on children's years of schooling. Finally, Acemoglu and Pischke (2000b) use the dramatic drop in U.S. family incomes at the lower end of the income distribution over the past 30 years to arrive at an income change which is not correlated with changing abilities and attitudes towards education: their estimates lead to a large effect of parental resources on children's education.

One general problem with these studies may be the necessity to differentiate current income from permanent income: current income may not be uncorrelated with the permanent income components identified (i.e. family background) and therefore the identification strategy may not be valid. On the other hand, an extrapolation of the effects of current parental income to the effects of grants might be misleading: in-kind transfers like grants or tuition costs have been shown to have considerably different impacts as compared to parental resources in general.⁸

3. Data and econometric model

We use data from 14 European countries to investigate the impact of public funding on enrolment into higher education in the period 1980-1996 (see appendix for data

⁷ British evidence by Chevalier and Lanot (2000) produces similar results, although here parental (current) income has still small positive effects on children's enrolment decisions.

⁸ E.g., looking at children-related expenditures, like child clothes, it does matter if the father or the mother gets the child benefit (Lundberg, et al. 1997).

sources). Figures 1 and 2 show the time path of enrolment rates of 18-24 year old males and females in these countries. For males we can observe a similar rising trend over time, with the Nordic countries Finland and Norway on top and Portugal lagging behind. A similar picture evolves for females, but here Portugal and Switzerland are lagging.

Can this rising trend be explained by the huge increases in public funding during this period? Figures 3 and 4 show the time trend for real public funding, in Figure 3 for total education and in Figure 4 for higher education only. Here, we do not see this uniformity anymore. Real funding for education at large increased a lot in the Iberian countries, increased somewhat in Denmark and Finland, but remained constant in real terms – or even declined – in countries like Sweden, the Netherlands or Italy for some time periods. The picture is more uniform for expenditures for higher education: here, Portugal stands out for a very pronounced increase, but most countries experienced a doubling of public funding in real terms – with the notable exception of the Netherlands, Switzerland and the UK.

Of course, this rising trend in expenditures for higher education will also be caused by the rising participation of students. In the econometric model it will be necessary to look at this problem of reverse causality very carefully in order to assess the causal impact of public funding on enrolment. Institutions in Europe differ widely in terms of enrolment regulation, tuition fees and student grants. Unfortunately it was not possible to get consistent information on the generosity of student grants and subsidized loans over time⁹. Insofar, as these public subsidies are part of the educational budget, their effect is already included in the public funding variables themselves. Moreover, systems of *numerus clausus* (direct enrolment

⁹ One problem is that the average amount of grants in the budget may not be a good measure of generosity, because selective rules often allow only a small portion of students to take advantage of these grants. The marginal effect of these grants with respect to the enrolment decision can therefore only be positive for potentially eligible students.

rationing at the tertiary level) in the different countries did not change over time, so they will be picked up by the country fixed effect.

Our econometric specification is in general in logs. It relates enrolment rates to Universities (Univ) to public funding at large (FundT) as well as public funding for higher education (FundH). This specification tests, if public funding for higher education has a larger impact on enrolment as funding for secondary schooling. Other explanatory variables are the extent of entry exams (Entry) in the high school system, where we can observe if entry exams are important in no schools, some schools or most schools. Likewise, we have an indicator for the existence of tuition fees in the countries (Tuit).¹⁰ As rational students will react to discounted lifetime income differentials, higher returns to education should influence enrolment positively. We use estimates for returns to years of education which are based on uniform specifications across countries (see Harmon et al. 2001), separately for males and females (Return). Finally, opportunity costs of potential students are influenced by current unemployment rates for young workers (Unemp).

$$(1) \text{Ln}(\text{Univ}_{it}) = a + b \text{Ln}(\text{FundT}_{it}) + c \text{Ln}(\text{FundH}_{it}) + d \text{Entry}_{it} + e \text{Tuit}_{it} + f \text{Return}_{it} + g \text{Ln}(\text{Unemp}_{it}) + \alpha_i + \beta_t + \varepsilon_{it}$$

α_i and β_t are, respectively, country and time fixed effects to control for country-specific effects as well as time-trends which are unobservable. In the empirical specification we will gradually enlarge the model; starting with a specification without fixed effects, we include first country and then also year effects to test for robustness of our results. The most important issue concerns potential endogeneity of the funding variables. If funding rises because more students enrolled at universities,

¹⁰ Again, a better indicator would be the amount of tuition a student has to pay. As these figures vary a lot within countries, no consistent variable could be constructed.

our coefficients b and c could be purely spurious, reflecting this reverse causation. Our solution is an instrumental variables strategy: we try to find instruments which are influencing public expenditures for education, but not enrolment as such. As instruments we use information on the government, its form and its ideology – together with demographic data for young people. These political instruments should influence spending decisions.

In Table 2 we show that the instruments are in fact relevant in explaining public expenditures for education; especially government ideology is highly significant both for total spending for education as well as in the case of spending for higher education. Interestingly, centre governments spend less on education as both left- and right-wing governments. The form of the government is less important for total education, but in the case of higher education, single party governments spend significantly more as compared to coalition or minority governments. The F-test for the inclusion of the instruments is significant at the 1%-level in both cases. Another measure for the relevance of the instruments is the marginal R^2 once the instruments are added to the other exogenous variables in the first stage regression (Bound et al. 1995). This marginal contribution of the instruments is relatively low (0.0012 and 0.0037), but could not possibly be much higher, because the time and country dummies drive the R^2 already up to 0.99. As we have several instruments, over-identification tests for instrumental validity can be performed later.

4. Results

Results for the enrolment equations – separately for male and female youth – are contained in Tables 3 and 4. Column (1) shows the basic OLS specification, in Columns (2) and (3) we add a set of country and time dummies to control for unobservable fixed effects like a rising trend of educational enrolment over time.

Column (4) is our preferred specification using instrumental variables and including both time and country dummies.¹¹

We find that a 1% increase in public funding of education at large increases male enrolment by almost 1%, whereas no additional impact of funding for higher education can be detected. It has to be noted, that funding for higher education is already included in the total, so that only additional effects are measured by our second variable. Funding effects are significant for both OLS and IV specifications; the IV results are even slightly higher than the OLS estimates. It seems, that public money spent on education has the same impact on college enrolment whether it is spent on universities themselves or on secondary-level schooling, preparing students for college.

Organization of the secondary schooling system has some impact on college enrolment: the stricter are entry conditions in secondary schools, the less college enrollees there are; the picture is less pronounced and consistent for males. Tuition fees at the college level, in turn, reduce enrolment. The effects are quite large, up to 40% lower enrolment if there is a tuition fee in the country. For females, the effect is significant in the fixed-effects specifications, but not in the IV regressions. Given the somewhat shaky character of this variable, which does not take the amount of tuition into account, one has to interpret these coefficients with care. Further variables concern, cost and returns calculations of prospective students. To represent opportunity costs for studying we use the unemployment rate of young workers below age 30. Unemployment risk for young workers does not seem to influence college enrolment in a consistent pattern. Although the opportunity cost aspect of youth unemployment would speak for a positive coefficient, liquidity constraints' effects for the youth themselves but also their parents – youth unemployment rates

¹¹ The over-identification test cannot reject the null of validity of the instruments both for males at the 3% level and for females at the 6% level.

tend to correlate also with adult rates – might counteract. Finally we included rates of returns to education – separately for males and females – in our equations. For males, returns to education have a positive and significant impact on enrolment; this effect is not significant any more in the IV specification.¹² Likewise, Acemoglu and Pischke (2000a) are unable to show that recent increases in returns to education in the U.S. lead to significant rises in college enrolment across states.

5. Conclusions

The importance of public funding for the enrolment of college students is an important public finance topic, which has not had enough attention at the European level. We try to evaluate the “effectiveness” of public funding using data for 14 countries in the period 1980-1996. Public funding for the education system matters regardless if the funding is for universities as such or for the secondary schooling system, which is preparing youth for studying. On the other hand, students react quite heavily to tuition costs with reduced enrolment. Especially concerning the impact of tuition, more research at an individual level is necessary to enlarge this broad-brush picture with a more detailed analysis taking the many special features of the tuition and grant system in Europe into account.

¹² Brunello et al. (2002) find that student’s expectations of returns to college education correlate heavily with actual returns to college.

Table 1: Previous Studies on Enrolment

Study / Data		Outcome Variable	Public Funding Variable	Impact
Card, 2000 CPS, 1972-92	USA	Enrolment rates ¹⁾	Tuition fees	-
Census' 1960/70/80/90	USA	Graduates rates	Tuition fees	+
		Years of schooling		+
McPherson, Schapiro, 1991 CPS 1974-84	USA	Enrolment rates (by 3 income classes)	Net-costs ²⁾	- ³⁾ + ⁴⁾
Kane, 1995 IPEDS 1980-92 ⁷⁾ CPS, 1977-93	USA	Enrolment rates (by income quartiles)	Tuition fees ⁵⁾ Grants ⁶⁾	- +
		Enrolment rates (by income quartiles)	Tuition fees ⁵⁾ Grants ⁶⁾	-/+ ⁸⁾ +
Dynarski, 1999 NLSY 1979-96	USA	Enrolment probability ⁹⁾	Aid eligibility ¹⁰⁾	+
Frederiksson, 1997 Stat. SW, LFS 1967-91 ¹¹⁾	SW	Enrolment rates	Grants NPV ¹²⁾	+
				+
Huijsman et al., 1986 1950-1982	NL	Enrolment rates	Tuition fees Grants / stipends	-/+ ⁸⁾ + ¹³⁾
Whitfield, Wilson, 1990 1955-1986 ¹⁴⁾	UK	Enrolment rates ¹⁵⁾	YTS ¹⁶⁾	-

1) Enrolment in college or university.

2) Net-costs: tuition costs - value of student aid.

3) A negative impact of net-costs of education for students from low income families.

4) A positive impact of net-costs of education for students from middle or high income families.

5) Tuition fees from 2-year and 4-year public colleges.

6) State need-based grants / 15-24 year old population (1991-US\$ 1000 / youth).

7) IPEDS: Integrated Post-secondary Education Data System, obtained from the U.S.

Department of Education census of all post-secondary institutions in the U.S.

8) Impact is statistically not significant.

9) Difference-in-differences analysis of the enrolment probability for the students eligible for aid and others.

10) Eligibility for Social Security Student Benefits, e.g. in the case of the death of a parent.

11) Two data sets are used, giving comparable results: Statistics Sweden, Labor Force Survey.

12) NPV: Net present value of stipends and repayable loans.

13) Significant at 5 percent level for males only.

14) Various statistical sources, see Whitfield and Wilson (1990, 1987).

15) Enrolment in full-time education after the minimum school-leaving age, in England and Wales.

16) Percentage of total 16 years old in population involved in Youth Training Scheme (YTS).

Table 2: Instrumental Relevance

	Ln (total public expenditure for education)	Ln (public expenditure for higher education)
ln (male pop. 18-24)	4.498 (1.617) **	-3.200 (1.891)
ln (female pop. 18-24)	-4.297 (1.664) *	3.975 (1.935) *
Election-year (0,1)	-0.005 (0.020)	0.010 (0.022)
Government form (base: single party)		
Coalition (0,1)	0.034 (0.053)	-0.201 (0.079) *
Minority (0,1)	0.019 (0.048)	-0.327 (0.080) **
Taking Care (0,1)	0.065 (0.109)	-0.067 (0.130)
Government ideology (base: centre)		
Right Wing (0,1)	0.113 (0.039) **	0.098 (0.046) *
Centre-Right (0,1)	0.223 (0.058) **	0.269 (0.073) **
Centre-Left (0,1)	0.145 (0.054) **	0.242 (0.063) **
Left Wing (0,1)	0.152 (0.053) **	0.165 (0.061) **
F-test (1% critical value)	3.070 (2.32)	7.110 (2.32)
Marginal R-squared for inclusion of instr.	0.0012	0.0037
Observations	198	198
Adjusted R-squared	0.99	0.99

The regressions include also all the variables from Table 2 including the time and country dummies.

Standard errors in parentheses.

* significant at 5%; ** significant at 1%

Table 3: Enrolment into Higher Education: Males

	ols	ols	ols	iv
ln (public expenditure total edu)	0.987 (0.130) **	0.634 (0.079) **	0.541 (0.077) **	1.018 (0.262) **
ln (public expenditure higher edu)	-0.106 (0.116)	0.212 (0.042) **	0.030 (0.053)	-0.069 (0.165)
entry exams in high school (base: no schools)				
some schools (0,1)	-0.322 (0.070) **	-1.668 (0.121) **	-1.069 (0.159) **	-0.269 (0.311)
most schools (0,1)	-0.290 (0.112) *	-1.034 (0.133) **	-0.691 (0.052) **	0.789 (0.590)
tuition fees (0,1)	0.174 (0.078) *	-0.488 (0.049) **	-0.435 (0.048) **	-0.562 (0.072) **
ln (unemployment rate young workers)	0.395 (0.043) **	0.014 (0.020)	0.030 (0.021)	0.039 (0.031)
returns to education males (% per year)	0.110 (0.017) **	0.025 (0.012) *	0.028 (0.012) *	0.014 (0.014)
country effects	no	yes	yes	yes
year effects	no	no	yes	yes
overid-test (p-value)				0.023
Observations	197	197	197	197
Adjusted R-squared	0.88	0.99	0.99	0.99

LHS variable: log(enrolment rate), standard errors in parentheses.

* significant at 5%; ** significant at 1%

Table 4: Enrolment into Higher Education: Females

	ols	ols	ols	iv
ln (public expenditure total edu)	0.600 (0.132) **	0.854 (0.104) **	0.615 (0.087) **	1.100 (0.284) **
ln (public expenditure higher edu)	0.130 (0.120)	0.380 (0.056) **	0.022 (0.058)	-0.103 (0.182)
entry exams in high school (base: no schools)				
some schools (0,1)	-0.400 (0.080) **	0.849 (0.138) **	-0.578 (0.185) **	0.106 (-0.350)
most schools (0,1)	-0.513 (0.130) **	1.623 (0.142) **	0.675 (0.152) **	-1.545 (0.410) **
tuition fees (0,1)	0.156 (-0.089)	-1.066 (0.066) **	-0.972 (0.053) **	-0.732 (0.641)
ln (unemployment rate young workers)	0.474 (0.049) **	0.011 (0.029)	-0.009 (0.025)	0.020 (0.039)
returns to education females (% per year)	-0.170 (0.332)	-0.306 (0.112) **	0.037 (0.095)	-0.106 (0.121)
country effects	no	yes	yes	yes
year effects	no	no	yes	yes
overid-test (p-value)				0.058
Observations	182	182	182	182
Adjusted R-squared	0.85	0.99	0.99	0.99

LHS variable: log(enrolment rate), standard errors in parentheses.

* significant at 5%; ** significant at 1%

Appendix: Data sources

Enrolment into higher Education, Real Public Funding, Population 18-24: UNESCO Institute for Statistics (2000).

Government form: Waldendays et al. (1998).

Unemployment rates: ILO yearbook of labor statistics, various years.

Returns to education: Harmon et al. (2001), consistent specifications are used for all countries and time periods.

Entry exams, tuition: Personal information from country members of the PuRE project.

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Figure 1:

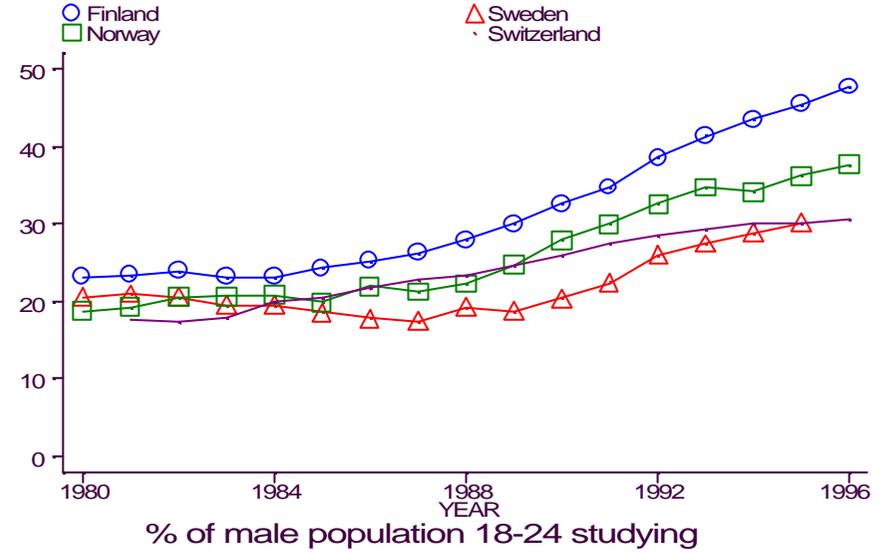
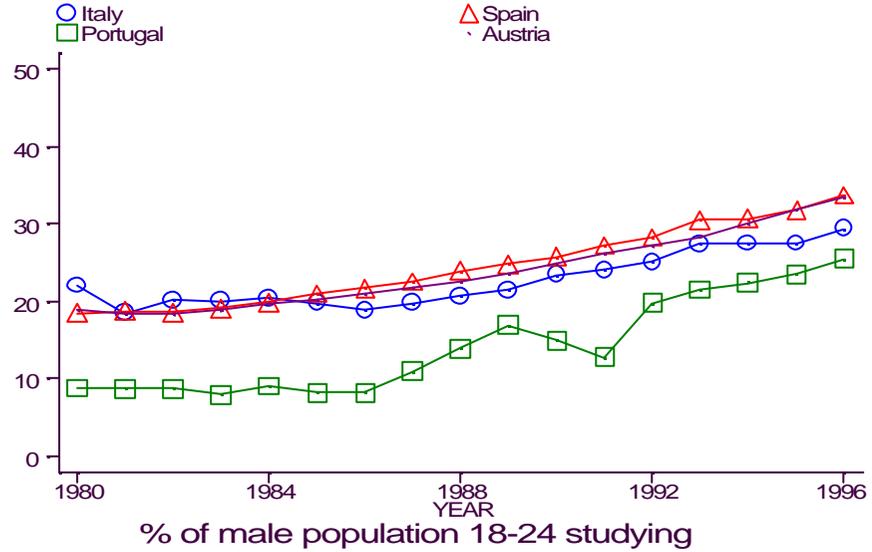
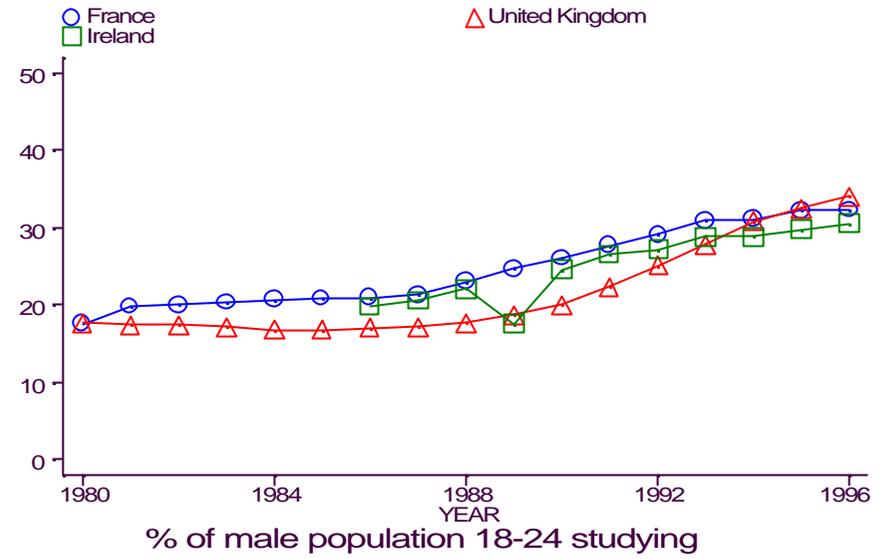
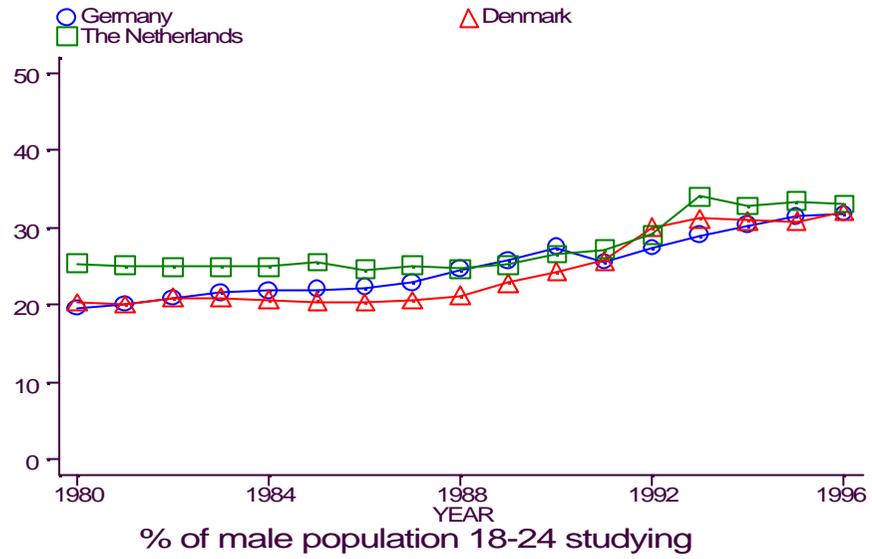


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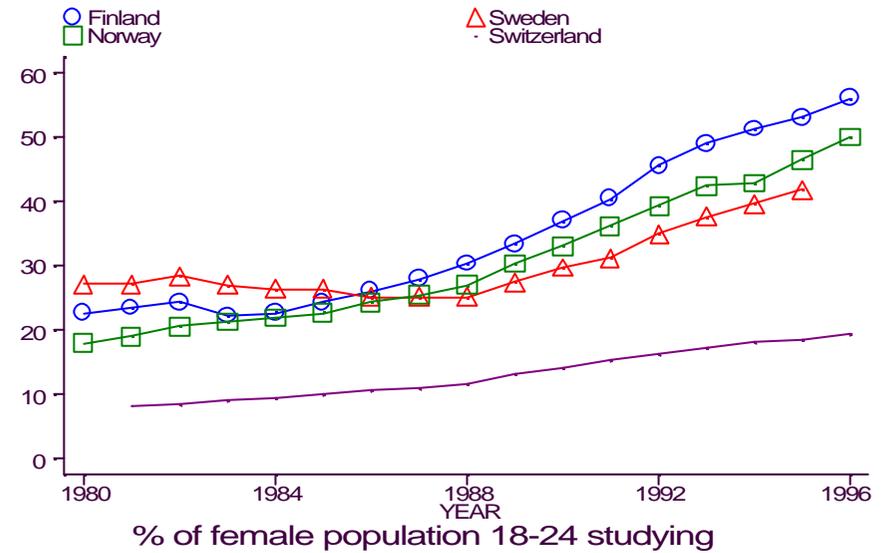
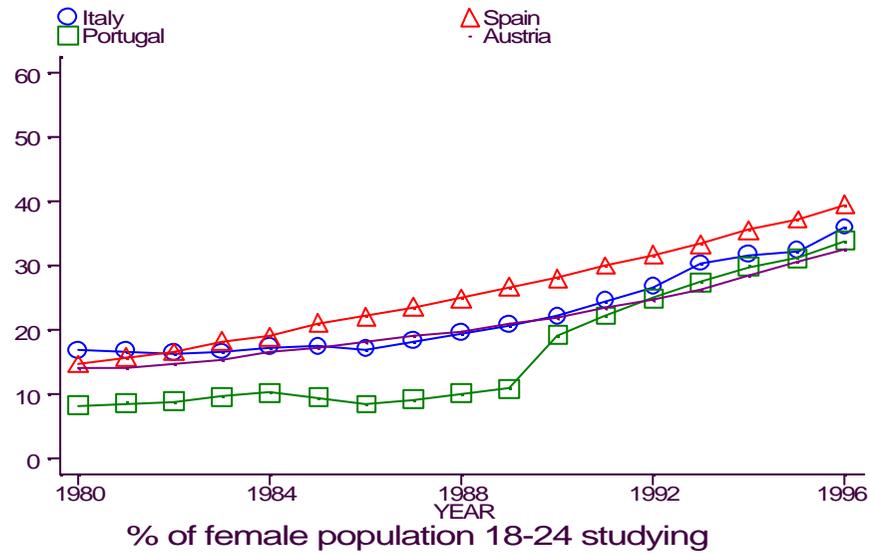
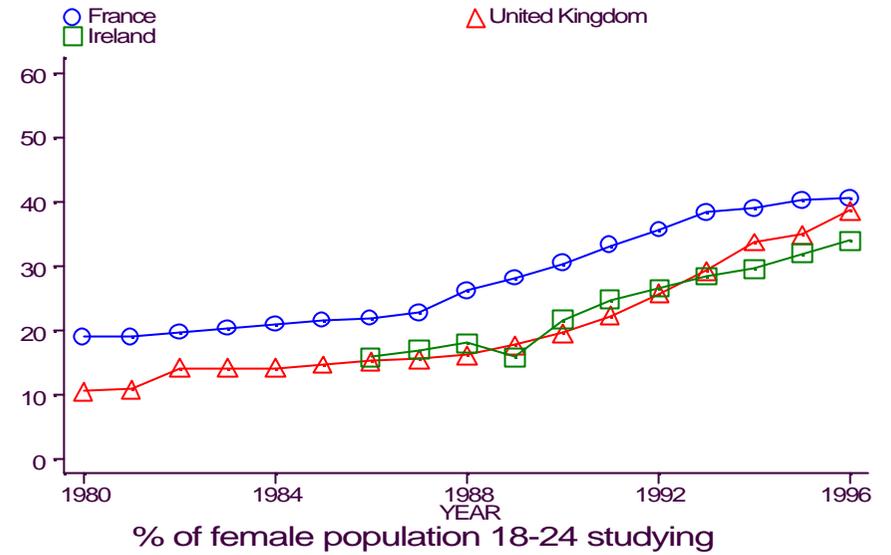
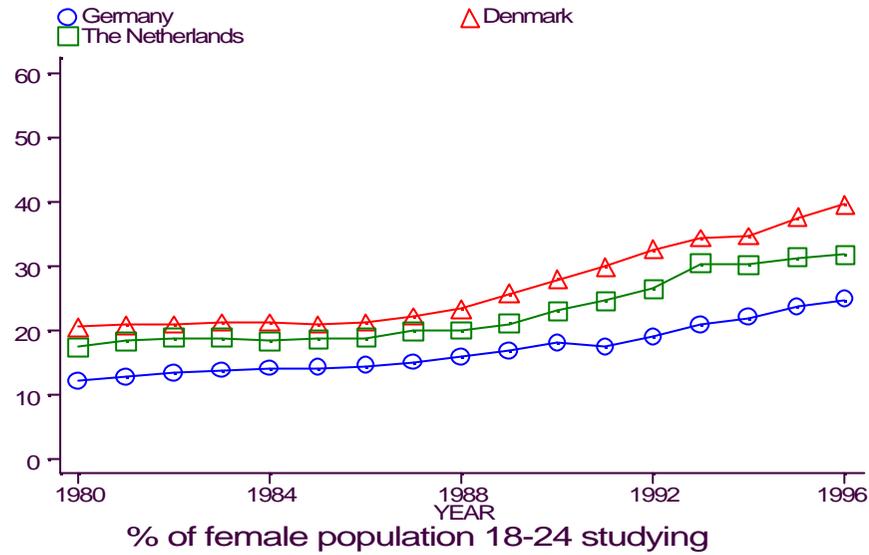


Figure 3:

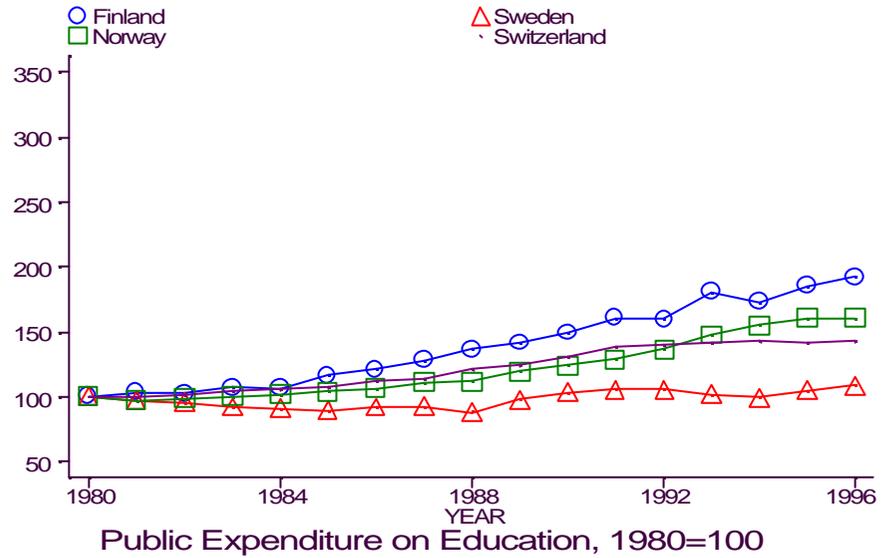
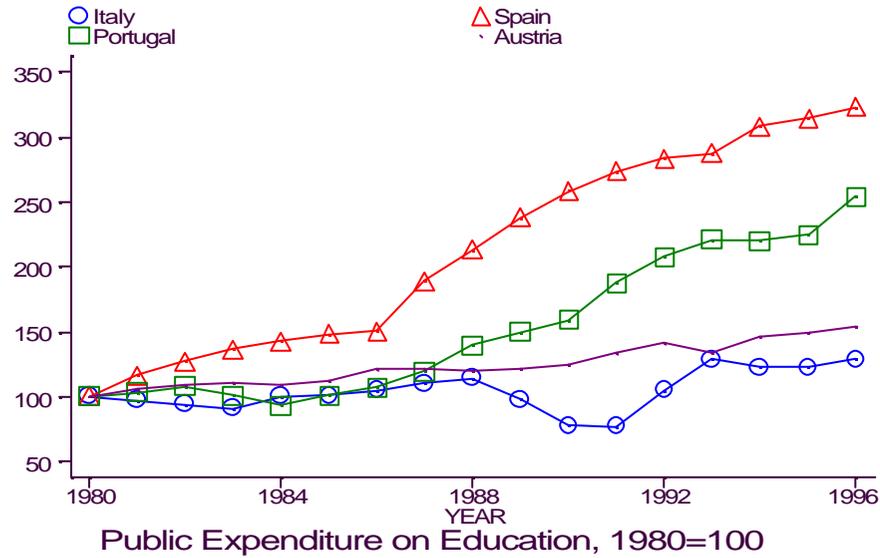
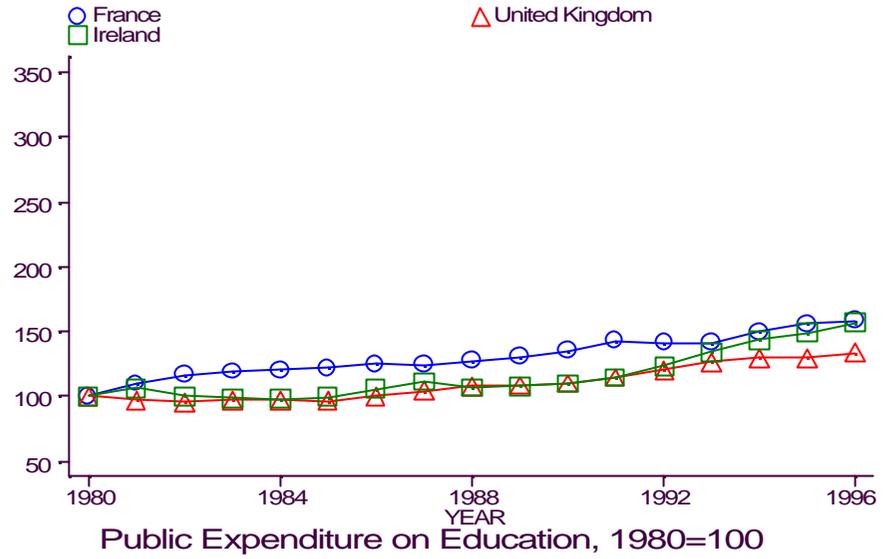
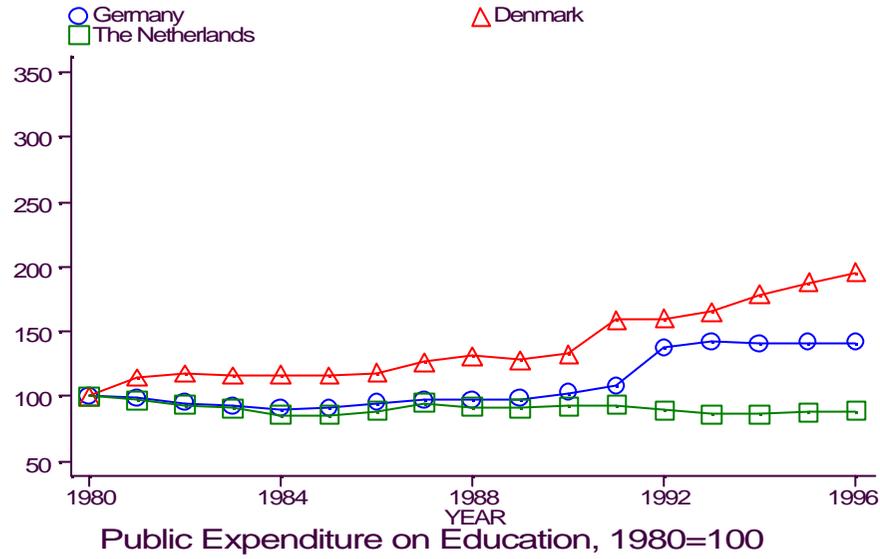
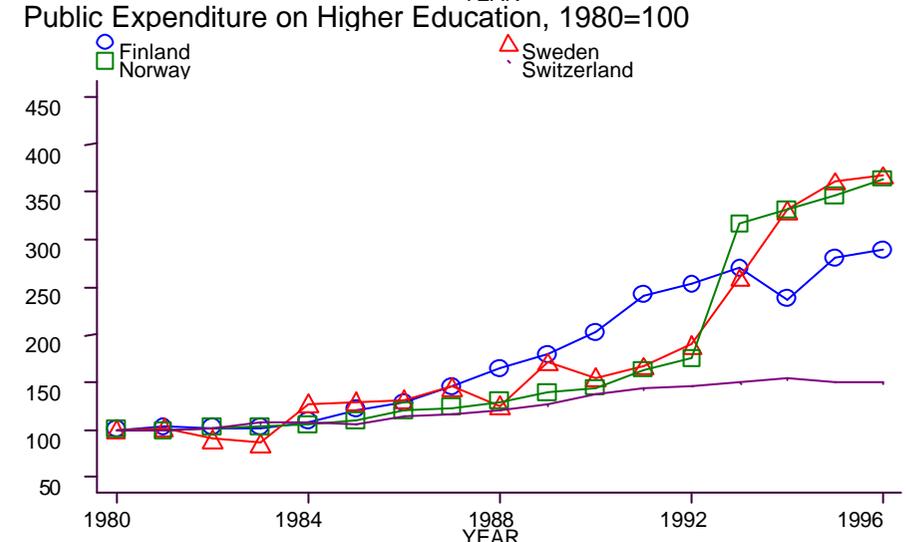
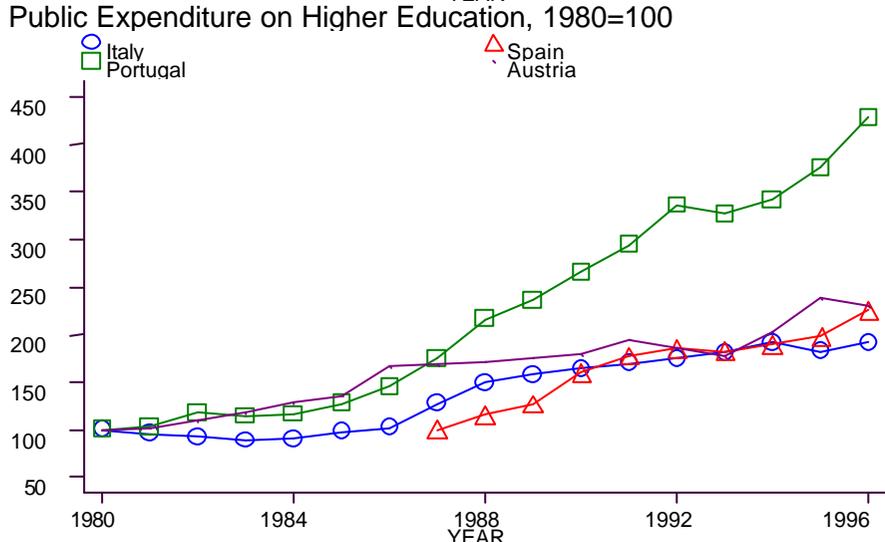
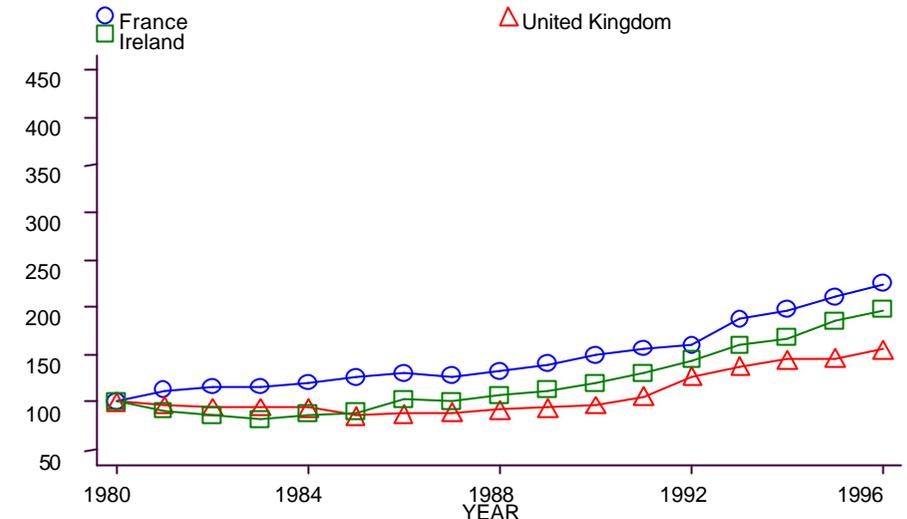
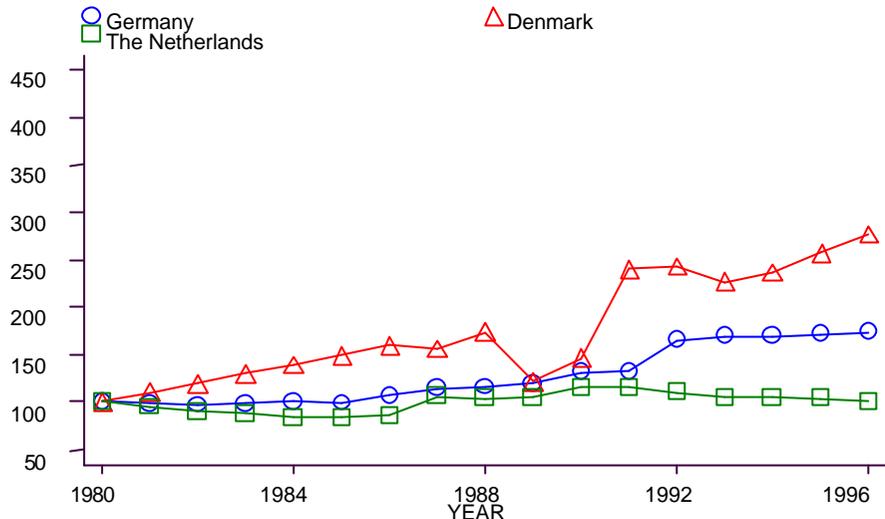


Figure 4:



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