ProfNet PlagiatService

-Prüfbericht-

für
Dr. Salvatore Barbaro
Uni Göttingen

Münster, den 23.03.2017

ProfNet PlagiatService - Zusammenfassung

Autor	Dr. Salvatore Barbaro
Titel	Equity and Efficiency Consider ...
Typ	Dissertation
Abgabetermin	19.04.2004
Hochschule	Uni Göttingen
Fachbereich	Wirtschaftswissenschaftliche Fakultät
Studiengang	
Fachrichtung	Pädagogik
1. Gutachter	Prof. Dr. Robert Schwager
2. Gutachter	Prof. Dr. Martin Kolmar
Prüfdatum	23.03.2017

Dateigröße	231.139
Seiten	126
Absätze	322
Sätze	1.789
Wörter	30.970
Zeichen	174.210
Abbildungen	0
Tabellen	1
Fußnoten	37
Literatur	0
Wörter (netto)	27.397

Abbildungsverzeichnis	X
Abkürzungsverzeichnis	
Anhang	
Eidesstattliche Erklärung	
Inhaltsverzeichnis	X
Literaturverzeichnis	X
Quellenverzeichnis	
Stichwortverzeichnis	X
Sperrvermerk	
Symbolverzeichnis	
Tabellenverzeichnis	X
Vorwort	X

Analysetyp	Indizien
Bauernopfer-Absatz	3
Eigenplagiat	201
Zitat-Veränderung	4

Anteil Fremdtexte (netto): 28 % (7.646 von 27.397 Wörtern)

Phrase-allgemein	58
Phrase-fachspezifisch	59
Phrase-Redewendung	1
Zitat-Fremdtext-ohne Quelle	14
Zitat-im Text-ohne Quelle	19

Anteil Fremdtexte (brutto): 32 % (9.935 von 30.970 Wörtern)

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ProfNet PlagiatService - Ergebnis Textanalyse (alle Analysen)

Kriterium	Dimension	Prüfdokument	Erstprüfer	Fachbereich	Hochschule	Fachrichtung	Hausarbeiten	Seminararbeiten	Bachelor Thesen	Diplomarbeiten	Master Thesen	Dissertationen	Habilitationen	alle
Dokumente	Anzahl	1	1	2	6	159	570	506	525	3567	380	26177	202	522615
Abbildungen	Anzahl (Durchschnitt)	0	0	0	0	11	2	2	8	7	3	5	7	1
Absätze	Anzahl (Durchschnitt)	322	322	1026	844	777	111	120	234	354	300	550	778	290
Fußnoten	Anzahl (Durchschnitt)	37	37	720	355	194	33	44	47	59	47	106	127	28
Literatur	Anzahl (Durchschnitt)	0	0	0	0	2	0	5	7	3	1	5	1	2
Sätze	Anzahl (Durchschnitt)	1789	1789	4591	3200	3577	484	495	961	1446	1297	2391	3480	954
Seiten	Anzahl (Durchschnitt)	126	126	246	202	234	33	31	72	104	93	163	202	58
Tabellen	Anzahl (Durchschnitt)	1	1	0	0	6	0	0	2	3	2	3	2	1
Wörter	Anzahl (Durchschnitt)	30970	30970	64607	48900	63559	7999	7804	15262	22624	21598	38569	56366	15907
Zeichen	Anzahl (Durchschnitt)	174210	174210	426806	348464	432085	52740	52058	100548	151925	137187	257228	387157	103614
Zitate	Anzahl (Durchschnitt)	58	58	696	444	585	72	64	95	154	142	218	337	94

Die statistischen Ergebnisse der Textanalyse des Prüfdokumentes werden mit den Ergebnissen aller analysieren Texte verglichen.

ProfNet PlagiatService - Ergebnis Textvergleich (alle Vergleiche)

Kriterium	Dimension	Prüfdokument	Erstprüfer	Fachbereich	Hochschule	Fachrichtung	Hausarbeiten	Seminararbeiten	Bachelor Thesen	Diplomarbeiten	Master Thesen	Dissertationen	Habilitationen	alle
Dokumente	Anzahl	1	1	2	6	141	92	43	486	3273	333	23661	187	46658
Mischpl.-eine	Anzahl (Durchschnitt)	0	0	2	1	1	0	5	0	0	0	1	1	2
Teilplagiat	Anzahl (Durchschnitt)	0	0	73	32	18	5	7	6	7	11	13	13	14
Mischpl.-mehrere	Anzahl (Durchschnitt)	0	0	16	7	5	1	1	1	1	2	3	2	3
Zitierungsfehler	Anzahl (Durchschnitt)	0	0	8	5	13	0	6	3	3	3	5	7	4
Bauernopfer	Anzahl (Durchschnitt)	3	3	2	2	6	0	0	2	2	3	5	3	3

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Die Textvergleichsergebnisse des Prüfdokumentes werden mit allen analysierten Texten verglichen. Die Plagiatswahrscheinlichkeit wird grob vom Programm automatisch berechnet.

Textstelle (Prüfdokument) S. 1

It has become part of the conventional wisdom in the economics of education that subsidies to higher education have a regressive distributional effect. Given that relatively more children from wealthier families enroll in higher education, many economists assume that these subsidies to higher education have an unwanted distributional impact. The nurse is being taxed to support the higher education of the dentist's son, as it is sometimes bluntly put. In Germany and possibly elsewhere, this reproach concerning fiscal activity in higher education is as old as the proposal to subsidize tuition fees. In 1875, the German Social Democratic Party (SPD) for the first time expressed

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the La Follette School of Public Affairs at the University of Wisconsin-Madison, where most of the paper was written. The usual disclaimer applies. 1 Introduction It has become part of the conventional wisdom in the economics of education that subsidies to higher education have a regressive distributional effect. Given that relatively more children from wealthier families enrol in higher education, many economists assume that these subsidies to higher education have an unwanted distributional impact. The nurse is being taxed to support the higher education of the dentist's son, as it is sometimes bluntly put. The huge empirical literature on that issue, however, provides at most only scant evidence for this thesis. The debate started with the work of Pechman (1970),

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 2

Textstelle (Prüfdokument) S. 1

government program that seems to us so inequitable in its effects, so clear an example of Director's Law, as the financing of higher education. In this area those of us who are in the middleand upper-income classes have conned the poor into subsidizing us on the grand scale yet we not only have no decent shame, we boast to the treetops of our selflessness and public -spiritedness. (Friedman and Friedman, 1979, p. 183) In fact, many textbook writers still refer to this thesis, even though empirical work on this issue is at best inconclusive. Moreover, the literature often

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Textstelle (Originalquellen)

well. A Bigger Bang for the Public Buck: Achieving Efficiency and Equity in Higher Education Jenny B. Wahl Those of us who are in the middle- and upper-income classes have conned the poor into subsidizing us on a grand scale yet we not only have no decent shame, we boast to the rooftops of our selflessness and publicspiritedness. -- Milton Friedman, Higher Schooling in America (1968) Income and prices affect choices. This is as true for decisions about higher

- **2** Wahl, Jenny B.: A Bigger Bang for t..., 2002, S. 5

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Textstelle (Prüfdokument) S. 2

and Friedman, 1979, p. 183) In fact, many textbook writers still refer to this thesis, even though empirical work on this issue is at best inconclusive. Moreover, the literature often confuses a cross-sectional analysis and a long-run view. It is interesting to note that almost all empirical studies are cross-sectional analyses. As such an analysis provides a snapshot of distributional impact at particular points in time, the studies can be criticized for ignoring the longitudinal dimension of the point at issue. This critique also applies to the distributional effect of higher-education subsidies (see e.g. McGuire, 1976; Bowman et al., 1986; Pechman, 1972; Beckmann, 2003). In analyzing that effect, we have to distinguish between an analysis of children from various household types, and an analysis of educated and non-educated individuals throughout their lives. For the former, a cross-sectional examination is the only alternative; for the latter, the related literature uses a long-run analysis.[1] The huge empirical literature on that issue, however, provides at most only scant evidence for this thesis. The debate started with the work of Pechman (1970), which contradicted the results provided by Hansen and Weisbrod (1969a). This disputation provoked a debate on the distributional effect that lasted nearly ten years, the "Hansen-Weisbrod-Pechman" debate (see Hansen and Weisbrod (1969a,b, 1971, 1978), Pechman (1970); Hartmann (1970); McGuire (1976); Conlisk (1977); Cohn et al. (1970)). Since then, a large number of studies are published. In Chapter [2] we present and review several examinations. Empirical evidence using GSOEP-data is provided in Chapter 3. The literature covering the longitudinal approach is inconclusive. For example, building on Griiske (1994), Garcia-Pehalosa and Walde (2000) argue that "[i]f the average tax payer has a lower lifetime income than the average university graduate [...], a subsidy to higher education financed from general taxation implies reverse lifetime redistribution, i.e. redistribution from the poor to the rich." Although the paper provides several very enlightening results, this approach can be critically assessed with respect to two aspects. First, it

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right to ask in surprise "How is it possible that so many commentators keep repeating the Hansen-Weisbrod results as if they were gospel truths?" It is interesting to note that almost all empirical studies are cross-sectional analyses. As such an analysis provides a snapshot of distributional impact at particular points in time, the studies can be criticized for ignoring the longitudinal dimension of the point at issue. This critique also applies to the distributional effect of higher-education subsidies (see, e.g., McGuire (1976); Bowman et al. (1986); Pechman (1972); Beckmann (2003)). In analyzing that effect, we have to distinguish between an analysis of children from various household types, and an analysis of educated and non-educated individuals throughout their lives. For the former, a cross-sectional examination is the only alternative; for the latter, the related literature uses a long-run analysis.2 The literature covering the long-run approach is inconclusive. For example, building on Griiske (1994), Garcia-Penalosa and Walde (2000) argue that "[i]f the average tax payer has a lower lifetime income than the average university graduate [...], a subsidy to higher education financed from general taxation implies reverse lifetime redistribution, i.e. redistribution from the poor to the rich". Although the paper provides several very enlightening results, this approach can be critically assessed with respect to two aspects. First, it does not distinguish sufficiently between the change of distribution between rich and poor, and that

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- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 2

Textstelle (Prüfdokument) S. 2

does not distinguish sufficiently between the change of distribution between rich and poor, and that between graduates and non-graduates throughout their lives. Second, Pareto-improving subsidies can also be identified as regressive using this approach,2 as shown in Sturn and Wohlfahrt (1999, 2000). However, the main question to which some papers address to is whether subsidies to higher education are granted at the expense of non-graduates. It is called inequitable if this question can be confirmed.

1 See e.g. (Atkinson and Stiglitz, 1985, p. 263) who argue that "[i]n empirical work,

2 In a subsection, Garcia-Penalosa and Walde (2000) also ask whether a particular

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poor to the rich". Although the paper provides several very enlightening results, this approach can be critically assessed with respect to two aspects. First, it does not distinguish sufficiently between the change of distribution between rich and poor, and that between graduates and non-graduates throughout their lives. Second, Pareto-superior subsidies can also be identified as "regressive" using this approach,3 1See Barbaro (2003) for a recent survey of the empirical literature 2See, e.g., (Atkinson and Stiglitz, 1985, p. 263) who argue that "[i]n empirical work, the unit of analysis is typically taken

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 2

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called inequitable if this question can be confirmed. Thus, we henceforth call subsidies equitable if also those not benefiting from such subsides directly because they do not attend higher education are better off. A second strand is directly concerned with Pareto-superiority of subsidies to higher education. For example, Johnson (1984); Poutvaara and Kanniainen (2000); Dur and Teulings (2003, 2004) and Bovenberg and Jacobs (2005) argue that, at least in closed economies, subsidies to higher education may be to the mutual advantage of both graduates and non-graduates. Johnson (1984) argues that unskilled individuals may also prefer a tax-financed subsidy to higher education, because they reap part of the gains due to complementarities between skilled and unskilled labor. The specification of the production process of the economy is that aggregate output is a linear-homogenous function of three types of labor (high-skilled, medium-skilled, and low-skilled labor). This specification implies that complementarities (may) exist so that the lowskilled group may also benefit, although indirectly, from the subsidies. If this is the case, the higher-education subsidies are equitable. This viewpoint is interesting because it highlights a simultaneous effect of efficiency-enhancing subsidies on both, equity and efficiency. If human capital is seen as an engine of economic growth, or if subsidies to higher education raise the human-capital stock to an efficient level, or compensate for existing inefficiencies, it is possible that those who finance the subsidies through their taxes can demand compensation from those who benefit from the subsidies directly during their lifetime.[4] If such compensation is possible, the goals of efficiency and equity can be in harmony, i.e. subsidies to higher education are Pareto-superior. Otherwise, there is a trade-off. Poutvaara and Kanniainen (2000) also deal with this argument. The main purpose of their paper is to study the possibility of a voluntary social contract benefiting all groups instead of a voting equilibrium where a minority is worse

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gap that this present paper wishes to bridge. as shown in Barbaro (2004) (for further discussions of this approach, see also Sturn and Wohlfahrt (1999, 2000)) . A second string is directly concerned with Pareto-superiority of subsidies to higher education. For example, Johnson (1984); Poutvaara and Kanniainen (2000); Dur and Teulings (2003, 2004) and Bovenberg and Jacobs (2001) argue that, at least in closed economies, subsidies to higher education may be to the mutual advantage of both graduates and non-graduates. Johnson (1984) argues that unskilled individuals may also prefer a tax-financed subsidy to higher education, because they reap part of the gains due to complementarities between skilled and unskilled labor. The specification of the production process of the economy is that aggregate output is a linear-homogenous function of three types of labor (high-skilled, middle-skilled, and low-skilled labor). This specification implies that complementarities exist so that the low-skilled group may also benefit, although indirectly, from the subsidies. If this is the case, the higher-education subsidies are equitable, where Johnson defines equity as follows: "The distribution of the burden of educational costs may be said to be equitable if both groups want the same size at the prevailing level of s. If the size is also efficient, this value of s is positive so long as low-skilled labor is not very much more complementary with medium- than which high-skilled labor", where s denotes a certain fraction of the total social costs of the higher-education

of economic growth, or if subsidies to higher education raise the human-capital stock to an efficient level or compensate for existing inefficiencies, it seems possible that those who finance the subsidies through their taxes can demand compensation from those who benefit from the subsidies directly during their lifetime.4 If such compensation is possible, the goals of efficiency and equity can be in harmony, i.e. subsidies to higher education are Pareto-superior. Otherwise, there is a trade-off. Poutvaara and Kanniainen (2000) also deal with this argument. The main purpose of their paper is to study the possibility of a voluntary social contract benefiting all groups instead of a voting equilibrium where the minority (i.e. the high-skilled agents) are worse off. The distribution of the gains created by such a social contract depends on relative power, where

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 3

Textstelle (Prüfdokument) S. 3

it might be that all agents are better off after a subsidy has been introduced. Unfortunately, they do not compare the two approaches, nor do they demonstrate the circumstances under which this is possible. This is a gap that this thesis wishes to bridge. 3 Johnson defines equity as follows: "The distribution of the burden of educational costs may be said to be equitable if both groups want the same size at the prevailing level of s. If the size is also efficient, this value of s is positive so long as low-skilled labor is not very much more complementary with medium than which high-skilled labor," where s denotes a certain fraction of the total social costs of the higher-education system. off. The distribution of the gains created by such a social contract depends on relative power, where the groups are engaged in Nash bargaining. However, free-rider behavior of the low-skilled agents in an open economy may undermine such a contract. Their willingness to commit to an educational subsidy vanishes as they anticipate the inflow of educated agents from abroad when the domestic rate of return on education exceeds that abroad. Similar to Johnson (1984), Dur and Teulings (2003, 2004) develop a framework with skilled and unskilled workers as production inputs. The literature on the ability bias in the return to education indicates that education and innate ability are

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the

family". 3In a subsection, Garcia-Penalosa and Walde (2000) also ask whether a particular individual is better or worse off if education is subsidized. They point out that it might be that all agents are better off after a subsidy has been introduced. Unfortunately, they do not compare the two approaches, nor do they demonstrate the circumstances under which this is possible. This is a gap that this present paper wishes to bridge. as shown in Barbaro (2004) (for further discussions of this approach, see also Sturn and Wohlfahrt (1999, 2000)) . A second string is directly concerned

that the low-skilled group may also benefit, although indirectly, from the subsidies. If this is the case, the higher-education subsidies are equitable, where Johnson defines equity as follows: "The distribution of the burden of educational costs may be said to be equitable if both groups want the same size at the prevailing level of s. If the size is also efficient, this value of s is positive so long as low-skilled labor is not very much more complementary with medium- than which high-skilled labor", where s denotes a certain fraction of the total social costs of the higher-education system. This viewpoint is interesting because it highlights a simultaneous effect of efficiency-enhancing subsidies on both

labor is not very much more complementary with medium- than which high-skilled labor", where s denotes a certain fraction of the total social costs of the higher-education system. This viewpoint is interesting because it highlights a simultaneous effect of efficiency-enhancing subsidies on both equity and efficiency. If human capital is seen as an engine of economic growth, or if subsidies to higher education raise the human-capital stock to an efficient level or compensate for existing inefficiencies, it seems possible that those who finance the subsidies through their taxes can demand compensation from those who benefit from the subsidies directly during their lifetime.4 If such compensation is possible, the goals of efficiency and equity can be in harmony, i.e. subsidies to higher education are Pareto-superior. Otherwise, there is a

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 2
- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 3

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complementarities (see e.g. Angrist and Krueger, 1991). They emphasize that subsidies to all levels of education particularly favor those workers of high ability. Then, if such complementarities apply, optimism on the distributional effect may be discounted. Bovenberg and Jacobs (2005) regard distribution and subsidies to education as Siamese twins. In this thesis, we emphasize the role of windfall gains that occur from subsidizing higher education. It is shown that the existence of windfall gains is likely to prevent subsidies from being Pareto-superior although they remain efficiency-enhancing. Non-graduates may be left worse off although aggregate net lifetime earnings the sum of the net lifetime earnings of those who can and those who cannot attend higher education are maximized when highereducation investments are subsidized up to an efficient level. This argument (i.e. that an equity-efficiency trade-off can occur due to windfall gains created by efficiency-enhancing subsidies) has been neglected in the literature so far. The reason windfall gains occur if subsidies to higher education are organized as unconditional grants is the lack of information about agents' abilities. Nevertheless, it can be shown that a voluntary graduate tax (a similar proposal has been put forth recently by Poutvaara (2004)) can be regarded as a revelation mechanism so that alternative funding schemes are likely to break down the equity-efficiency trade-off. We show that such a voluntary graduate tax is a better means of achieving both efficiency and equity goals. The necessary condition for Pareto-superior subsidies is the enhancement of efficiency. There would be no potential Pareto improvement by establishing public education in a first-best situation.

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trade-off. Poutvaara and Kanniainen (2000) also deal with this argument. The main purpose of their paper is to study the possibility of a voluntary social contract benefiting all groups instead

and unskilled workers as production inputs. The literature on the ability bias in the return to education indicates that education and innate ability are complementary (see, e.g., Angrist and Krueger (1991)). They emphasize that subsidies to all levels of education particularly favor those workers of high ability. Then, if such complementarities apply, optimism on the distributional effect may be discounted. Bovenberg and Jacobs (2001) regard distribution and subsidies to education as Siamese twins. 4The basic intuition for that has been put forth very clearly by (Baran and Sweezy, 1966, p. 150): "If what government takes would otherwise not have been produced

as a means to enhance efficiency. We will, therefore, not confine ourselves to the distributional impact but also consider some aspects of efficiency. In this paper, we emphasize the role of windfall gains that occur from subsidizing higher education. It is shown that the existence of windfall gains is likely to prevent subsidies from being Pareto-superior although they remain efficiency enhancing. Non-graduates may be left worse off although aggregate net lifetime earnings the sum of the net lifetime earnings of those who can and those who cannot attend higher education are maximized when higher-education investments are subsidized up to an efficient level. This argument (i. e., that a equity-efficiency trade-off can occur due to windfall gains created by efficiency-enhancing subsidies) has been neglected in the literature so far. The reason why windfall gains occur if subsidies to higher education are organized as unconditional grants is the lack of information about agents' ability. Nevertheless, it can be shown that a voluntary graduate tax (a similar proposal has been put forth recently by Poutvaara (2004)) can be regarded as a revelation mechanism so that alternative funding schemes are likely to break down the equity-efficiency trade-off. We show that such a voluntary graduate tax is a better means of achieving both efficiency and equity goals. The necessary condition for Pareto-superior subsidies is the enhancement of efficiency. There would be no potential Pareto improvement by establishing

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 3
- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 4

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As there are no imperfections, the laissez-faire outcome is Pareto-optimal. In summary, the main argument of this literature is that the distributional effects are not necessarily inequitable (in the sense that they do not leave non-graduates worse off) because the agents can negotiate about the value-added. This argument, however, assumes that public higher education can be regarded as a means to enhance efficiency. We will, therefore, not confine ourselves to the distributional impact, but also consider some aspects of efficiency. In the last decades, advocates of public activities in the education sector have particularly referred to externalities, credit constraints, and distributional issues.[5] The discussion about externalities gained more importance in the 1980s and 1990s, particularly because of the seminal paper of Haveman and Wolfe (1984) and because of new developments in growth theory, following the dismissal of earlier explanations based on neoclassical marginal productivity theory (cf. (Blaug, 1970, pp. 112ff)). However, the empirical evidence for positive externalities is scant at best (see Acemoglu and Angrist (2000); Bils and Klenow (2000); Krueger and Lindahl (2001) for recent contributions). The importance of credit constraints is disputable as well. Capital-market imperfections, so the argument goes, may hinder poor agents financing the costs of obtaining higher education (see Saint-Paul and Verdier (1993); Perotti (1993); Benabou (2000, 2002)). However, there is little empirical evidence (see, e.g. Carneiro and Heckman, 2002; Cameron and Heckman, 2001; Keane and Wolpin, 2001). Friedman (1962) and others (see Epple and Romano (1998) for an overview) have persuasively argued that vouchers or student loans, for example, are a better means to compensate for unwanted effects that result from credit constraints. However, even if all classical arguments in favor of public subsidization cannot be dismissed as a whole, most economists argue that these arguments cannot justify the wide prevalence of education subsidies in many countries, in particular in Europe. While earlier discussions were centered around the expenditure side of the budget, recent[6]

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public education in a first-best situation, according to the First Fundamental Theorem of Welfare Economics. As there are no market imperfections, the laissez-faire outcome is Pareto optimal. Advocates of public activities in the sector of education have, in particular, referred to externalities, credit constraints, and distributional aspects. The discussion about externalities gained more importance in the 1980s and 1990s, particularly due to Haveman and Wolfe (1984) and to new developments in growth theory, after earlier attempts at explanation using neoclassical marginal productivity theory had been dismissed (cf. (Blaug, 1970, pp. 112ff)). However, the empirical evidence for positive externalities is scant at best (see Acemoglu and Angrist (1999); Bils and Klenow (2000); Krueger and Lindahl (2000) for recent contributions). The importance of credit constraints is, in principle, indisputable. Capital-market imperfections, so the argument

As there are no market imperfections, the laissez-faire outcome is Pareto optimal. Advocates of public activities in the sector of education have, in particular, referred to externalities, credit constraints, and distributional aspects. The discussion about externalities gained more importance in the 1980s and 1990s, particularly due to Haveman and Wolfe (1984) and to new developments in growth theory, after earlier attempts at explanation using neoclassical marginal productivity theory had been dismissed (cf. (Blaug, 1970, pp. 112ff)). However, the empirical evidence for positive externalities is scant at best (see Acemoglu and Angrist (1999); Bils and Klenow (2000); Krueger and Lindahl (2000) for recent contributions). The importance of credit constraints is, in principle, indisputable. Capital-market imperfections, so the argument goes, may hinder poor agents financing the costs of obtaining higher education (see Saint-Paul and Verdier (1993); Perotti (1993); Benabou (2000, 2002)). However, there is little empirical evidence (see, e.g., Carneiro and Heckman (2002); Cameron and Heckman (2001); Keane and Wolpin (2001)). Friedman (1962) and others (see Epple and Romano (1998) for an overview) have persuasively argued that vouchers or student loans, for example, are a better means to compensate for unwanted efects that result from credit constraints. However, even if all classical arguments in favor of public

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 4

Textstelle (Prüfdokument) S. 5

contributions increasingly focus on revenue. The impact of taxes on human-capital accumulation has become the central element in the recent literature. Trostel (1993, 1996) has shown that taxation has a negative impact on human capital investments and that education subsidies should primarily be seen and justified as a compensation for this tax distortion. In making this argument, Trostel uses an econometric model with a proportional tax rate, and it is assumed that the direct costs of obtaining higher education are not tax-deductible. Dupor et al. (1998) analyzed the distorting impact of progressive taxation based on US tax law in 1970. The findings show that progressivity led to an approximately 5-percent decline in human-capital investment in 1970. Based on data from 1990, the impact differed considerably depending on the choice of schooling, and lay between close to zero and 22%. Sturn and Wohlfahrt (2000) referred to the foregone smoothing benefit. Due to tax progression, combined with annual tax assessment, graduates pay more taxes than nongraduates with the same net lifetime earnings because graduates accumulate their income in a shorter period of time.[7] In summary, recent contributions have focused more on the inefficiencies created by taxation than on the positive externalities created by human-capital investment. In these recent contributions and also in previous examinations (e.g. Heckman, 1976; Eaton and Rosen, 1980), investment in education is a continuous decision, i.e. homogenous agents optimize the time devoted to education. In practice, however, we observe that the investment decision in favor of higher education is made by some agents whereas others avoid higher education. In this

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subsidization cannot be dismissed as a whole, most economists argue that these arguments cannot justify the wide prevalence of education subsidies in many countries, in particular in Europe. While earlier discussions were centered around the expenditure side of the budget, recent5 5Previous examinations of the effect of taxation on human-capital accumulation are, e.g., Heckman (1976), and Eaton and Rosen (1980). In both works, labor-income taxation was found to have a neutral effect, but contributions focus more on revenue. The impact of taxes on human-capital accumulation has become the central element in the recent literature. Trostel (1993, 1996) has shown that taxation has a negative impact on human capital investments and that education subsidies should primarily be seen and justified as a compensation for this tax distortion. In making this argument, Trostel uses an econometric model with a proportional tax rate, and it is assumed that the direct costs of obtaining higher education are not tax-deductible. Dupor et al. (1998) analyzed the distorting impact of progressive taxation based on US tax law in 1970. The findings show that progressivity led to an approximately 5-percent decline in human-capital investment in 1970. Based on data from 1990, the impact differs considerably depending on the choice of schooling, and lies between close to zero and 22%. Sturn and Wohlfahrt (2000) refer to the foregone smoothing benefit. Due to tax progression combined with the annual tax assessment, graduates pay more taxes than

Based on data from 1990, the impact differs considerably depending on the choice of schooling, and lies between close to zero and 22%. Sturn and Wohlfahrt (2000) refer to the foregone smoothing benefit. Due to tax progression combined with the annual tax assessment, graduates pay more taxes than non-graduates with the same net lifetime earnings because graduates accumulate their income in a shorter period of time. In summary, recent contributions focus more on the inefficiencies created by taxation than on the externalities created by human-capital investment. In these papers and in previous examinations (Heckman (1976); Eaton and Rosen (1980)), investment in education is a continuous decision, i.e., homogenous agents optimize the

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 4
- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 5

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thesis, we show that equity effects of education subsides differ remarkably if the educational-investment decision is discrete. The reason is that here the tax distortion affects only a fraction of the population instead of the whole, as in the aforementioned studies. This thesis is organized as follows. Part I deals with the distributional implications which arise in the cross-sectional perspective. It presents an overview over several previous studies (Chapter 2). Then, a new empirical analysis for Germany is provided

4 The basic intuition for that has been put forth very clearly by (Baran and Sweezy, 1966, p. 150): "If what government takes would otherwise not have been produced

5 See Barbaro (2003a) for a survey of empirical works on the issue.

6 Previous examinations of the effect of taxation on human-capital accumulation

7 In addition, Wigger (2004) supported the implications of the above research in

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time devoted to education. In practice, however, we observe that the investment decision in favor of higher education is made by some agents whereas others avoid higher education. In this paper, we show that equity effects of education subsides differ remarkably if the educationalinvestment decision is discrete. The reason is that here the tax distortion affects only a fraction of the population instead of the whole, as in the aforementioned studies. This paper is organized as follows: we present the model in which our analysis takes place in subsection [2] . Sections 3 and 4 deal with the efficiency and equity

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 5

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loans. In Section 7.1 however, a new scheme for higher-education funding is presented (and proposed): a voluntary graduate tax. It will be shown that this scheme is likely to achieve both aims, equity and efficiency, much better than the current practice in many European countries. Part III is related to efficient subsidies to higher education under progressive taxation. Chapter 10 summarizes and concludes with political implications. Part IV provides an appendix with further information and proofs. income taxes la Sheshinski (1972), but social welfare

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is certain, the differences from a loan with income-related repayment vanish. Furthermore, this scheme is much more likely to achieve both goals, equity and efficiency, than the current practice in many European countries, as will be shown in the next subsection. 5.1 A voluntary graduate tax In the preceding section it was emphasized that unwanted distributional consequences of public subsidization

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 15

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effect, called the "Hansen-Weisbrod-Pechman" debate, which lasted nearly ten years (see Hansen and Weisbrod (1969a,b, 1971, 1978), Pechman (1970); Hartmann (1970); McGuire (1976); Conlisk (1977); Cohn et al. (1970)). Pechman was the first to oppose Hansen and Weisbrod's thesis. He argued, "At no point do Hansen and Weisbrod compare the benefits and costs of public higher education at different levels, as they seem to suggest. Their comparison is between benefits and taxes paid on the average by families with and without children enrolled in the California system." (Pechman, 1970, p. 361). Furthermore, he demonstrates that Hansen and Weisbrod's data can be reworked to turn their results upside down, so that the distributional effect becomes clearly progressive. A similar procedure, based on Hansen and Weisbrod' s data (updated

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als Familien ohne Kinder an diesen Hochschulen (Hansen/Weisbrod 1969:76). Jedoch, und darauf hat Pechman (1970) in einer grundlegenden Kritik an den Ausführungen von Hansen/Weisbrod hingewiesen, "at no point do Hansen and Weisbrod compare the benefits and costs of public higher education at different income levels, as they seem to suggest. Their comparison is between benefits and taxes paid on the average by families with and without children enrolled in the California system. When the benefits and costs are distributed by income levels, using their own figures, it turns out that their conclusion is reversed, that is,

- **3** Barbaro, Salvatore: Gibt es eine Umverteilung von den A..., 2001, S. 4

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equivalence incomes and a net-transfer calculation was done by St urn and Wohlfahrt (1999) for Austria in 1994. They concluded that public subsidization had a clearly progressive effect. Regardless of the fact that empirical evidence is at least inconclusive, international research initiatives and textbooks often refer to the thesis of a regressive distributional impact, and many models take it for granted. Blaug (1982) was certainly right to ask in surprise: "How is it possible that so many commentators keep repeating the Hansen-Weisbrod results as if they were gospel truths?" Next, we present and assess several previous studies on the distributional effect of public higher education in Germany. These studies are of special interest because we will provide new empirical evidence from Germany in Chapter 3. 2.3 Griiske's Cross-Section Study The cross-sectional view in this and other similar papers is concerned

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nearly ten years, the "Hansen-Weisbrod-Pechman" debate (see Hansen and Weisbrod (1969a,b, 1971, 1978), Pechman (1970); Hartmann (1970); McGuire (1976); Conlisk (1977); Cohn et al. (1970)). Although empirical evidence is at best inconclusive,1 international research initiatives and textbooks often refer to the thesis of a regressive distributional impact, and many models take it for granted. Blaug (1982) was certainly right to ask in surprise "How is it possible that so many commentators keep repeating the Hansen-Weisbrod results as if they were gospel truths?" It is interesting to note that almost all empirical studies are cross-sectional analyses. As such an analysis provides a snapshot of distributional impact at particular

of a "perverse distribution of income" (Milton Friedman). Nevertheless, a methodological analysis of these studies unveils some problems. As the following paper tries to show, the empirical studies on the distributional effect of public higher education funding are not able to confirm the prima-facia plausibility of the thesis mentioned above. Therefore, an alternative approach to ascertaining the incidence in the

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 2
- **3** Barbaro, Salvatore: Gibt es eine Umverteilung von den A..., 2001, S. 2

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tend to underestimate (or overestimate) their family income. Part II The Distributional Impact of Subsidies to Higher Education in the Long Run 4 Previous Related Literature 4.1 Some Preliminary Remarks on Methodology It is interesting to note that almost all empirical studies are cross-sectional analyses. Since such an analysis provides snapshots of the incidence at particular points of time, they can be criticized due to the fact that they ignore the longitudinal dimension of the point at issue. This critique also applies to the distributional effect of higher-education subsidies. In analyzing that effect, we have to distinguish between an analysis of children from various household types and an analysis of educated and non-educated individuals going through their life cycle. For the former, a cross-sectional examination is the only possibility; for the latter, a long-run analysis might be helpful. One question related to longitudinal analysis that needs to be addressed is whether or not graduates actually pay back their received benefits from public subsidization within their lifetime (see, for example, Griiske (1994) and confer also the discussion in Chapter 4.2). Another related question is how public higher education affects

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is it possible that so many commentators keep repeating the Hansen-Weisbrod results as if they were gospel truths?" It is interesting to note that almost all empirical studies are cross-sectional analyses. As such an analysis provides a snapshot of distributional impact at particular points in time, the studies can be criticized for ignoring the longitudinal dimension of the point at issue. This critique also applies to the distributional effect of higher-education subsidies (see, e.g., McGuire (1976); Bowman et al. (1986); Pechman (1972); Beckmann (2003)). In analyzing that effect, we have to distinguish between an analysis of children from various household types, and an analysis of educated and non-educated individuals throughout their lives. For the former, a cross-sectional examination is the only alternative; for the latter, the related literature uses a long-run analysis.2 The literature covering the long-run approach is inconclusive. For example, building on Griiske (1994),

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 2

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public higher-education funding, redistribution can be ascertained. Despite this problem, however, the procedure proposed by Griiske has been often accepted in the related literature. For instance, Garcia-Pehalosa and Walde (2000) put forth that: If the average tax payer has a lower lifetime income than the average university graduate [...], a subsidy to higher education financed from general taxation implies reverse lifetime redistribution, i.e. redistribution from the poor to the rich. This is a good example for what has been mentioned above. The literature often confuses results obtained from cross-sectional analyses and those from longitudinal ones. Moreover, it is not clear why a lower lifetime income is

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literature uses a long-run analysis.2 The literature covering the long-run approach is inconclusive. For example, building on Griiske (1994), Garcia-Penalosa and Walde (2000) argue that "[i]f the average tax payer has a lower lifetime income than the average university graduate [...], a subsidy to higher education financed from general taxation implies reverse lifetime redistribution, i.e. redistribution from the poor to the rich". Although the paper provides several very enlightening results, this approach can be critically assessed with respect to two aspects. First, it does not distinguish sufficiently

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 2

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skilled workers throughout their lives. It is assumed that all persons work the same fixed number of hours during their lifetime and that this fixed number is not affected by the tax and transfer system. The production process of the economy is that aggregate output, is, is a linear-homogenous function of the three types of labor, v = F (Lu, Lm, Lh), (4.1) where Ft > 0, i (u,m,h) and Fa < 0. The wages (wi) are determined by Wj = Fi and V; ir, L,=v applies (Euler-Theorem). A government is assumed to influence

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prefer a tax-financed subsidy to higher education, because they reap part of the gains due to complementarities between skilled and unskilled labor. The specification of the production process of the economy is that aggregate output is a linear-homogenous function of three types of labor (high-skilled, middle-skilled, and low-skilled labor). This specification implies that complementarities exist so that the

1 Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 3

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Time Inconsistency and Open Economies An interesting examination which deals with the point at issue has been recently provided by Poutvaara and Kanniainen (2000). Their main question is whether it is in the interest of the non-graduates to subsidize students through the public budget. They approve this question in a model with positive externalities in education and complementarity in production between human capital and labor supplied by the low-ability individuals. The paper's aim is to study the possibility of a voluntary social contract benefiting all groups instead of a voting equilibrium where the minority (i.e. the high-skilled agents) is worse-off. The distribution of the gains created by such a social contract depends on the relative power, as the groups are engaged in Nash bargaining. The intuition so far is the same as expressed by Baran and Sweezy (1966) and Johnson (1984). The distributional implications are not necessarily regressive because the agents can negotiate on the value added. Hitherto, there is no

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and away from non-graduates who contributed their taxes to finance these subsidies. This paper focuses on whether it is in the interest of the non-graduates to subsidize investments in higher education. We show that subsidies to higher education may be Pareto-superior, benefiting all agents rather than the minority of graduates alone.

to higher education are Pareto-superior. Otherwise, there is a trade-off. Poutvaara and Kanniainen (2000) also deal with this argument. The main purpose of their paper is to study the possibility of a voluntary social contract benefiting all groups instead of a voting equilibrium where the minority (i.e. the high-skilled agents) are worse off. The distribution of the gains created by such a social contract depends on relative power, where the groups are engaged in Nash bargaining. However, free-rider behavior of the low-skilled agents in an open economy may undermine such a contract. Their willingness to commit to an educational subsidy

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 1
- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 3

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expressed by Baran and Sweezy (1966) and Johnson (1984). The distributional implications are not necessarily regressive because the agents can negotiate on the value added. Hitherto, there is no reason why a social contract shall not come off. However, a free-rider behavior of the low-skilled agents in an open economy may undermine such a contract. Their willingness to commit to an educational subsidy vanishes as they anticipate the inflow of educated agents from abroad when the domestic rate of return on education exceeds that abroad. In turn, the rational behavior of the educated will become socially inefficient as well due to the possibility of time inconsistency. This problem arises if the educated migrate because their after-tax income is higher abroad than domestically. The argument is similar to the large amount of literature on tax competition, hence it is

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are worse off. The distribution of the gains created by such a social contract depends on relative power, where the groups are engaged in Nash bargaining. However, free-rider behavior of the low-skilled agents in an open economy may undermine such a contract. Their willingness to commit to an educational subsidy vanishes as they anticipate the inflow of educated agents from abroad when the domestic rate of return on education exceeds that abroad. Similar to Johnson (1984), Dur and Teulings (2003, 2004) develop a framework with skilled and unskilled workers as production inputs. The literature on the ability bias in the return

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 3

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of it to deal with the distributional effect of public subsidization in the long-run, i.e. we ask whether non-graduates are likely to become better off if higher-education investments are subsidized so that such subsidies to higher education are Pareto-superior. The Creedy-Frangois Model of Higher-Education Economics as the Basic Framework for our Analysis Creedy and Frangois (1990) developed a framework in which the following analysis takes place. The framework is a two-period cohort model with

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those who benefit from the subsidies directly during their lifetime.4 If such compensation is possible, the goals of efficiency and equity can be in harmony, i.e. subsidies to higher education are Pareto-superior. Otherwise, there is a trade-off. Poutvaara and Kanniainen (2000) also deal with this argument. The main purpose of their paper is to study the possibility of a

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 3

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with respect to individual ability characteristics (endowments), denoted by yi, is assumed. These endowments are crucial for the individual productivity and for the decision in favor or against pursuing a university degree. Two periods are considered. In the first period, each individual faces the decision whether to persue a degree or, alternatively, to start working as non-educated. In the second period, all individuals work. An individual chooses higher education if her net-lifetime earnings with a university degree exceed the lifetime earnings in case that she does not invest in higher education. The degree causes direct (and non tax-deductible) costs, c, for each individual. The total costs consist of the direct costs (e.g. teaching aids, tuition fees) and the foregone earnings. Basic incomes equal the individual endowment, yi. Students have the opportunity to work even in the first period and, thus, earn the portion h of the income earned without higher education. Therefore, the total costs of obtaining higher education amount to (l-h)yi + c. (5.1) Individuals who have completed a degree in the first period will raise their income in the second period due to the rate of return to education. To simplify matters, it is assumed that the individual rate of return to education, ,Sj, is proportional to the individual endowment: sI = u-yi. (5.2) As noted above, in the first period each individual faces the decision whether to persue a degree or, alternatively, to start working without a university degree. The share's size of those choosing higher education depends on the exogenously given distribution of y. It is assumed that graduates cause an externality benefiting (also) nongraduates, because this externality, denoted by g, raises all incomes. Furthermore, it is assumed that g depends on the graduation rate, denoted by p, and by an exogenously

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simplify matters, it is assumed that the individual rate of return to education, sj, is proportional to the individual endowment: Si = u yj. (2) As noted above, in the first period each individual faces the decision of whether to enrol in a degree or, alternatively, to start working without a university degree. The share of those choosing higher education depends on the exogenously

and its corresponding distribution function, F(y). A constant and exogenously given tax rate, t, with 0 < t < 1, is levied on all income. An individual chooses higher education if his or her net lifetime earnings with a university degree would exceed the lifetime earnings if he or she did not invest in higher education. The degree causes direct (and non tax-deductible) costs, c, for each individual, where a proportion p with 0 < p < 1 is borne by the taxpayers. The government knows only the distribution of the innate abilities, but cannot observe the endowment of each

The total costs, therefore, consist of the direct costs, such as teaching aids and tuition fees, and earnings foregone. Basic incomes equal the innate endowment, Students have the opportunity to work even in the first period and, thus, earn the portion h of the income earned without higher education. Therefore, the total cost of obtaining higher education amounts to (1 h)yi(1 t) + c(1 p). (1) Individuals who have completed a degree in the first period will raise their income in the second period because of the rate of return to education. To simplify matters, it is assumed that the individual rate of return to education, sj, is proportional to the individual endowment: Si = u yj. (2) As noted above, in the first period each individual faces the decision of whether to enrol in a degree or, alternatively, to start working without a university degree. The share of those choosing higher education depends on the exogenously given distribution of y. The present values of the net lifetime income of educated agents, VE, and of non-educated ones, VN, are given by V? = (l-t)hvi-c(l-p)+(1-t)Vf + UVi)+K (3) 1 + r and

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 6

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and by an exogenously given parameter,[1] i) specified as S = tf-T , (5-3) 1+p so that g increases from zero, when no investment in human capital takes place, to 0.5 A The lifetime earnings of educated agents, VE, and the lifetime earnings of non-educated ones, VN are given by V ky,-c(i-P)+-(l + llf - (5.4) and V + (5.5) 1 + r where r G K++ represents the discount rate. It is possible to find an ability level corresponding to that of an agent who is indifferent to investing in higher education, by setting (5.4)=(5.5). This ability level is defined to be educational-choice margin (ECM), y. An individual i makes a decision in favor of higher education if her net-lifetime earnings as a graduate exceed those of being a

1 We use i? instead of S in the original source.

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of those choosing higher education depends on the exogenously given distribution of y. The present values of the net lifetime income of educated agents, VE, and of non-educated ones, VN, are given by V? = (l-t)hvi-c(l-p)+(1-t)Vf + UVi)+K (3) 1 + r and by V,N = (l-t)yl+(- + H. (4) It is straightforward to find an ability level corresponding to that of an agent who is indifferent to investing in his or her higher education by setting (3) = (4). The agent's endowment is denoted by y and is henceforth referred to as the educational-choice margin (ECM). It

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 7

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the Role of Tax Distortions 5.3.1 The Role of Externalities The normative justification of subsidies to education has been discussed for decades. In the last decades, advocates of public activities in the education sector have particularly referred to externalities, credit constraints, and distributional issues.[4] The discussion about externalities gained more importance in the 1980s and 1990s, particularly because of the seminal paper of Haveman and Wolfe (1984) and because of new developments in growth theory, following the dismissal of earlier explanations based on neoclassical marginal productivity theory (cf. Blaug, 1970, pp. 112ff). However, the empirical evidence for positive externalities is scant at best (see Acemoglu and Angrist, 2000; Bils and Klenow, 2000; Krueger and Lindahl, 2001) for recent contributions. The importance of credit constraints is disputable as well. Capital-market imperfections, so the argument goes, may hinder poor agents financing the costs of obtaining higher education (see Saint-Paul and Verdier (1993); Perotti (1993); Benabou (2000, 2002)). However, there is little empirical evidence (see, e.g. Carneiro and Heckman (2002); Cameron and Heckman (2001); Keane and Wolpin (2001)). Friedman (1962) and others (see Epple and Romano (1998) for an overview) have persuasively argued that vouchers or student loans, for example, are a better means to compensate for unwanted effects that result from credit constraints. However, even if all classical arguments in favor of public subsidization cannot be dismissed as a whole, most economists argue that these arguments cannot justify the wide prevalence of education subsidies in many countries, in particular in Europe. The justification which refers to externalities plays a crucial role. As noted above, it is hard to dismiss that higher education is concerned with positive externalities. However, there are two main problems. First, it is not

4 See Barbara (2003a) for a survey of empirical works on the issue.

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As there are no market imperfections, the laissez-faire outcome is Pareto optimal. Advocates of public activities in the sector of education have, in particular, referred to externalities, credit constraints, and distributional aspects. The discussion about externalities gained more importance in the 1980s and 1990s, particularly due to Haveman and Wolfe (1984) and to new developments in growth theory, after earlier attempts at explanation using neoclassical marginal productivity theory had been dismissed (cf. (Blaug, 1970, pp. 112ff)). However, the empirical evidence for positive externalities is scant at best (see Acemoglu and Angrist (1999); Bils and Klenow (2000); Krueger and Lindahl (2000) for recent contributions). The importance of credit constraints is, in principle, indisputable. Capital-market imperfections, so the argument goes, may hinder poor agents financing the costs of obtaining higher education (see Saint-Paul and Verdier (1993); Perotti (1993); Benabou (2000, 2002)). However, there is little empirical evidence (see, e.g., Carneiro and Heckman (2002); Cameron and Heckman (2001); Keane and Wolpin (2001)). Friedman (1962) and others (see Epple and Romano (1998) for an overview) have persuasively argued that vouchers or student loans, for example, are a better means to compensate for unwanted efects that result from credit constraints. However, even if all classical arguments in favor of public subsidization cannot be dismissed as a whole, most economists argue that these arguments cannot justify the wide prevalence of education subsidies in many countries, in particular in Europe. While earlier discussions were centered around the expenditure side of the budget, recent5 5Previous examinations of the effect of taxation on human-capital accumulation are, e.g.,

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 4

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and many other papers in the field of the economics of education (see Haveman and Wolfe (1984) for an overview) is its inclusion of the externality in the specified form expressed in equation (5.3). In this thesis, we neglect the existence of externalities. A justification for fiscal activities is given by a distortion created by income taxation. 5.3.2 The Role of Tax Distortions in the Recent Literature While earlier discussions were centered around the expenditure side of the budget, recent" contributions focus more on revenue. The impact of taxes on human-capital accumulation has become the central element in the recent literature. Trostel (1993, 1996) has shown that taxation has a negative impact on human capital investments and that education subsidies should primarily be seen and justified as a compensation for this tax distortion. In making this argument, Trostel uses an econometric model with a proportional tax rate, and it is assumed that the direct costs of obtaining higher education are not tax-deductible. Dupor et al. (1998) analyzed the distorting impact of progressive taxation based on US tax law in 1970. The findings show that progressivity led to an approximately 5-percent decline in human-capital investment in 1970. Based on data from 1990, the impact differed considerably depending on the choice of schooling, and lay between close to zero and 22%. Sturn and Wohlfahrt (2000) referred to the foregone smoothing benefit. Due to tax progression, combined with annual tax assessment, graduates pay more taxes than non- J Previous examinations of the effect of taxation on human-capital accumulation are, e.g. Heckman (1976), and Eaton and Rosen (1980). In both works,

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and on an externality created by those who attend higher [2] education. [2] Our framework differs from the model of Creedy and Francois (1990) in two particulars. First, [2] we neglect the existence of externalities. A justification for fiscal activities is given by a distortion [2] in both papers only the opportunity costs of obtaining higher education are considered. [2] 5 [3] 3 Subsidization and efficiency [3] Starting from the benchmark case (p = t = 0), there would be no

be dismissed as a whole, most economists argue that these arguments cannot justify the wide prevalence of education subsidies in many countries, in particular in Europe. While earlier discussions were centered around the expenditure side of the budget, recent5 5Previous examinations of the effect of taxation on human-capital accumulation are, e.g., Heckman (1976), and Eaton and Rosen (1980). In both works, labor-income taxation was found to have a neutral effect, but contributions focus more on revenue. The impact of taxes on human-capital accumulation has become the central element in the recent literature. Trostel (1993, 1996) has shown that taxation has a negative impact on human capital investments and that education subsidies should primarily be seen and justified as a compensation for this tax distortion. In making this argument, Trostel uses an econometric model with a proportional tax rate, and it is assumed that the direct costs of obtaining higher education are not tax-deductible. Dupor et al. (1998) analyzed the distorting impact of progressive taxation based on US tax law in 1970. The findings show that progressivity led to an approximately 5-percent decline in human-capital investment in 1970. Based on data from 1990, the impact differs considerably depending on the choice of schooling, and lies between close to zero and 22%. Sturn and Wohlfahrt (2000) refer to the foregone smoothing benefit. Due to tax progression combined with the annual tax assessment, graduates pay more taxes than

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- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 4
- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 5

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laborincome taxation was found to have a neutral effect, but in both papers only the opportunity costs of obtaining higher education are considered. graduates with the same net lifetime earnings because graduates accumulate their income in a shorter period of time.6 In summary, recent contributions have focused more on the inefficiencies created by taxation than on the externalities created by human-capital investment. In these recent papers and in previous examinations (Heckman (1976); Eaton and Rosen (1980)), investment in education is a continuous decision, i.e. homogenous agents optimize the time devoted to education. In practice, however, we observe that the investment decision in favor of higher education is made by some agents whereas others avoid higher education. In this paper, we show that equity effects of education subsidies differ remarkably if the educational-investment decision is discrete. The reason is that here the tax distortion affects only a fraction of the population instead of the whole, as in the aforementioned studies. Our amended version of the C-F-model includes an inefficiency created by taxation which can be counteracted by subsidization. Such a subsidization also has a distributional dimension which we also address. Creedy and Francois create their model in a

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progression combined with the annual tax assessment, graduates pay more taxes than non-graduates with the same net lifetime earnings because graduates accumulate their income in a shorter period of time. In summary, recent contributions focus more on the inefficiencies created by taxation than on the externalities created by human-capital investment. In these papers and in previous

the budget, recent5 5Previous examinations of the effect of taxation on human-capital accumulation are, e.g., Heckman (1976), and Eaton and Rosen (1980). In both works, labor-income taxation was found to have a neutral effect, but contributions focus more on revenue. The impact of taxes on human-capital accumulation has become the central element in the recent literature. Trostel (1993, 1996) has shown that taxation has a negative impact on human capital investments and that education subsidies should primarily be seen and justified as a compensation for this tax distortion. In making this argument, Trostel uses an econometric model

taxes than non-graduates with the same net lifetime earnings because graduates accumulate their income in a shorter period of time. In summary, recent contributions focus more on the inefficiencies created by taxation than on the externalities created by human-capital investment. In these papers and in previous examinations (Heckman (1976); Eaton and Rosen (1980)), investment in education is a continuous decision, i.e., homogenous agents optimize the time devoted to education. In practice, however, we observe that the investment decision in favor of higher education is made by some agents whereas others avoid higher education. In this paper, we show that equity effects of education subsides differ remarkably if the educationalinvestment decision is discrete. The reason is that here the tax distortion affects only a fraction of the population instead of the whole, as in the aforementioned studies. This paper is organized as follows: we present the model in which our analysis takes place in subsection [2] . Sections 3 and 4 deal with the efficiency and

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 5
- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 4
- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 5

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Distributional Effect of Public Subsidization Among Graduates and Non-Graduates The Life-Cycle Perspective 6.1 Introduction In this chapter, we will use an amended version of the Creedy-Francois model in order to discuss our point. In our model, a tax is levied on agents' income, thereby assuming a constant tax rate to be exogenously given. The resulting revenue is spent on redistribution and subsidization purposes. Each agent receives an identical lump-sum transfer, whose amount depends on the tax base, the tax rate, and the amount of costs devoted to finance higher-education subsidies. At this point, the trade-off becomes evident. The more is spent to support higher education through an unconditional grant, the lower the proportion of the whole revenues devoted to redistribution. On the other hand, the tax base might be positively affected by subsidization so that two effects work in an opposite direction. If no subsidization takes place, however, the entire revenue is earmarked uniformly among all individuals. Such a redistribution policy is progressive, because it rewards the lowability agents while the mean earner neither gains nor loses in contrast to those with an income above the mean who

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better means to achieve both equity and efficiency. Section 6 then concludes. created by income taxation according to the recent literature cited in the introduction. Second, in our model a tax is levied on agents' incomes, thereby assuming a constant tax rate to be exogenously given. The resulting revenue is spent on redistribution and subsidization purposes. Each agent receives an identical lump-sum transfer, denoted by H, whose amount depends on the tax base, the tax rate, and the amount devoted to financing higher-education subsidies. At this point, a trade-off becomes evident. The more that is spent to support higher education through an unconditional grant, the lower the proportion of all revenue devoted to the redistribution policy. On the other hand, the tax base might be positively affected by subsidization so that two effects work in an opposite direction. If no subsidization takes place, however, the entire revenue is distributed uniformly among all individuals. In contrast to the lump-sum transfer, the effect of income taxation is twofold. It allows the described redistribution policy,

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 6

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the mean earner neither gains nor loses in contrast to those with an income above the mean who are the losers. The assumption of a lump-sum transfer towards all agents simplifies the analysis, because it has no impact on the educational-choice margin. In contrast to the lump-sum transfer, the effect of income taxation is twofold. It allows it to finance the described redistribution policy, but it distorts the choice between education and work in the first period. According to the recent literature (see Section 5.3), this distortion calls for efficiencyenhancing subsidies. The efficiency gains created by a (partial) subsidization are potentially Pareto superior. This chapter is organized as follows. Section 6.2 presents a general framework in which our analysis is put forth. Section 6.3 discusses the distortionary effects of taxation and analyzes the amount of subsidization which is required to counteract the efficiency loss. Section 6.4 then deals with the

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that agents behave atomistically, neglecting the impact of their investment on aggregate income and total tax revenue. As can be seen, the lump-sum transfer has no impact on the educational-choice margin. This is because the lump-sum transfer is granted to both types of agents uniformly and, therefore, does not distort the choice of educational investment. For the ongoing discussion, it is useful to define a benchmark equilibrium. For this, we take the

the entire revenue is distributed uniformly among all individuals. In contrast to the lump-sum transfer, the effect of income taxation is twofold. It allows the described redistribution policy, but it distorts the choice between education and work in the first period. This distortion calls for efficiency-enhancing subsidies. The efficiency gains created by a (partial) subsidization are potentially Pareto-superior. Assume that a population is heterogeneous with respect to innate endowment, yi, with 0 < yi < y. Population size is normalized to unity. As in Creedy and Frangois (1990), we

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 7
- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 6

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counteract the efficiency loss. Section 6.4 then deals with the question whether the efficiency gains can be used to compensate the non-graduates for their renouncement of a higher transfer and highlight the role of windfall profits. 6.2 The Model To make our point, we use an amended version of the model presented by Creedy and Frangois (1990). Their model consists of a population of agents who differ with respect to their innate endowment. It is a two-period model. In the first period, all agents face the decision of whether to enroll in a degree program or not. In the second period, all agents work, either as graduates or as non-graduates. The government is assumed to raise taxes. The entire public revenue is spent financing subsidies to higher education, and for a publicly-provided good. The graduation rate depends on the tax rate, the rate of subsidization, and on an externality created by those who attend higher education (see the preceding section). Our framework differs from the model of Creedy and Frangois (1990) in two respects. First, we neglect the existence of externalities. A justification for fiscal activities is given by a distortion created by income taxation according to the recent literature cited in Subsection 5.3.2. Secondly, in our model a tax is levied on agents' incomes, thereby assuming a constant tax rate to be exogenously given. The resulting revenue is spent on redistribution and subsidization purposes. Each agent receives an identical lump-sum transfer, denoted by H G K+, whose amount depends on the tax base, the tax rate, and the amount devoted to financing higher-education subsidies. At this point, a trade-off becomes evident. The more is spent to support higher education through an unconditional grant, the lower the proportion of all revenue devoted to the redistribution policy. On the other hand, the tax base might be positively affected by subsidization so that the two effects work in opposite directions. If no subsidization takes place, however, the entire revenue is distributed uniformly among all individuals. In contrast to the lump-sum transfer, the effect of income taxation is twofold. It allows the described redistribution policy, but it distorts the choice between education and work in the first period. This distortion calls for efficiency-enhancing subsidies. The efficiency gains created by a (partial) subsidization are potentially Pareto-superior.

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square root and the first term are B Solving equation (9) Differentiatiri W yields yip)-y'ip)f(y l-uyv\ .~h +cf(y)-y'(p) = 0n~ ,2_U y'f(y) - h) - y2 j+z] =0 öd - - 2(i+o+ L = (i> + 2 + w) If and only if t = p, then y[l L 0 political economics perspective. January 2004[2] 2 The model [2] To make our point, we use an amended version of the model presented by Creedy and Francois [2] (1990) . Their model consists of a population of agents who differ with respect to their innate [2] endowment. It is a two-period model. In the first period, all agents face the decision of whether [2] to enrol in a degree or not. In the second period, all agents work, either as graduates or as nongraduates. The government is assumed to raise taxes. The entire public revenue is spent financing [2] subsidies to higher education, and for a publicly provided good. The graduation rate depends on [2] the tax rate, the rate of subsidization, and on an externality created by those who attend higher [2] education. [2] Our framework differs from the model of Creedy and Francois (1990) in two particulars. First, [2] we neglect the existence of externalities. A justification for fiscal activities is given by a distortion [2] in both papers only the opportunity costs of obtaining higher education are considered. [2] 5 [3] 3 Subsidization and efficiency [3] Starting from the benchmark case (p = t = 0), there would be no potential for Pareto improvement [3] through the establishment of public education, according

better means to achieve both equity and efficiency. Section 6 then concludes. created by income taxation according to the recent literature cited in the introduction. Second, in our model a tax is levied on agents' incomes, thereby assuming a constant tax rate to be exogenously given. The resulting revenue is spent on redistribution and subsidization purposes. Each agent receives an identical lump-sum transfer, denoted by H, whose amount depends on the tax base, the tax rate, and the amount devoted to financing higher-education subsidies. At this point, a trade-off becomes evident. The more that is spent to support higher education through an unconditional grant, the lower the proportion of all revenue devoted to the redistribution policy. On the other hand, the tax base might be positively affected by subsidization so that two effects work in an opposite direction. If no subsidization takes place, however, the entire revenue is distributed uniformly among all individuals. In contrast to

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. #P#then y[l L 0
- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 6

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We do not ask why a distortionary taxation exists. We instead assume that a non-distortionary tax system is politically not feasible, so that policy aim is to implement a second-best means to offset the distortion. Assume that a population is heterogeneous with respect to the innate endowment yt 6 [0,y] C K. Population size is normalized to unity. As in Creedy and Frangois (1990), we consider that the cohort lives in two periods. In the first period, each agent can choose between higher education and work. In the second period, the entire population works. An individual's gross income is determined by her individual innate endowment and her return from higher education (if obtained) . The distribution of the initial endowments is represented by the twice differentiable density function, f(y), and its corresponding distribution function, F(y). A constant and exogenously given tax rate, t G [0,1) C R, is levied on all income. An individual chooses higher education if his or her net lifetime earnings with an university degree would exceed the lifetime earnings if he or she did not invest in higher education. The degree causes direct (and non tax-deductible) costs, c for each individual, where a proportion p G [0,1] C K is borne by the taxpayers. The government knows only the distribution of the innate abilities, but cannot observe the endowment of each agent. Accordingly, the government can not establish individual-specific subsidies. It is important to note that the costs of higher education, c, are not taxdeductible. The total costs, therefore, consist of the direct costs, such as teaching aids and tuition fees, and earnings foregone. Basic incomes equal the innate endowment, yi. Students have the opportunity to work even in the first period and, thus, earn the portion h G [0,1] c M of the income earned without higher education. Therefore, the total cost of obtaining higher education amounts to (l~h)yi(l't)+c(l-p). (6.1) Individuals who have completed a degree in the first period will raise their income in the second period because of the rate of return to education. To simplify matters, it is assumed that the individual rate of return to education, Si, is proportional to the individual endowment: s.i = uyi. (6.2) As noted above, in the first period each individual faces the decision of whether to enroll in a degree program or, alternatively, to start working without a university degree. The share of those choosing higher education depends on the exogenously given distribution of y. The present values of the net lifetime income of educated agents, VE, and of non-educated ones, VN, are given by

84% Einzelplagiatswahrscheinlichkeit

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the lump-sum transfer, the effect of income taxation is twofold. It allows the described redistribution policy, but it distorts the choice between education and work in the first period. This distortion calls for efficiency-enhancing subsidies. The efficiency gains created by a (partial) subsidization are potentially Pareto-superior. Assume that a population is heterogeneous with respect to innate endowment, yi, with 0 < yi < y. Population size is normalized to unity. As in Creedy and Frangois (1990), we consider that the cohort lives in two periods. In the first period, each agent can choose between higher education and work. In the second period, the entire population works. An individual's gross income is determined by its individual innate endowment and its return to higher education (if obtained). The distribution of the initial endowments is represented by the density function, f (y), and its corresponding distribution function, F(y). A constant and exogenously given tax rate, t, with 0 < t < 1, is levied on all income. An individual chooses higher education if his or her net lifetime earnings with a university degree would exceed the lifetime earnings if he or she did not invest in higher education. The degree causes direct (and non tax-deductible) costs, c, for each individual, where a proportion p with 0 < p < 1 is borne by the taxpayers. The government knows only the distribution of the innate abilities, but cannot observe the endowment of each agent. Accordingly, the government can not establish individual-specific subsidies. It is important to note that the costs of higher education, c, are not tax-deductible. The total costs, therefore, consist of the direct costs, such as teaching aids and tuition fees, and earnings foregone. Basic incomes equal the innate endowment, Students have the opportunity to work even in the first period and, thus, earn the portion h of the income earned without higher education. Therefore, the total cost of obtaining higher education amounts to (1 h)yi(1 t) + c(1 p). (1) Individuals who have completed a degree in the first period will raise their income in the second period because of the rate of return to education. To simplify matters, it is assumed that the individual rate of return to education, sj, is proportional to the individual endowment: Si = u yj. (2) As noted above, in the first period each individual faces the decision of whether to enrol in a degree or, alternatively, to start working without a university degree. The share

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 6

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Vf = (1 - t)hyt - c(l - P) + a-W + ttK) + H (6.3) 1 + r and by ViN = (l-t)yi+(\ -+ H. (6.4) 1 + r It is straightforward to find an ability level corresponding to that of an agent who is indifferent to investing in his or her higher education by setting (6.3) = (6.4). The agent's endowment is denoted by y and is henceforth referred to as the educational-choice margin (ECM). It is y[p] = +WV2+w- (6. 5) where tp = [1] ~ft2 1+r) and u> = ~ (1 -t-r).1 We assume that agents behave atomistically, neglecting the impact of their investment on aggregate income and total tax revenue. As can be seen, the lump-sum transfer has no impact on the educationalchoice margin. This is because the lump-sum transfer is granted to both types of agents uniformly and, therefore, does not distort the choice of educational investment. For the ongoing discussion, it is useful to define a benchmark equilibrium. For this, we take the non-interventionist, redistribution-free equilibrium, where the government does not implement any income policy, so that the educational-choice margin is fully determined by market forces. This benchmark case is determined by p = t = 0. The educational-choice margin is then given by y[bm] = + + w. (6.6) The second case considers a (flat) tax on income (0 < t < 1) and investments in higher education are not subsidized (p = 0). As noted above, we assume that the direct cost of obtaining higher education is not effectively tax-deductible. This assumption, which holds for a wide range of countries (see Trostel (1993)), is the driving force in Trostel (1993, 1996). In those papers, Trostel argues that a subsidy to higher education may be regarded as a means to compensate for the distorting nature of taxation. The educationalchoice margin in this case is given by As can be seen, the higher t, the higher the educational-choice margin and, consequently, the lower the graduation rate. On the other hand, the educational-choice margin is lowered if part of the cost of obtaining higher education is borne by the state. This can be seen by comparing (6.5) and (6.7). To assess the distortionary effects of taxation on educational choice careful differentiation between different groups of individuals has to be conducted.

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of those choosing higher education depends on the exogenously given distribution of y. The present values of the net lifetime income of educated agents, VE, and of non-educated ones, VN, are given by V? = (l-t)hvi-c(l-p)+(1-t)Vf + UVi)+K (3) 1 + r and by V,N = (l-t)yl+(- + H. (4) It is straightforward to find an ability level corresponding to that of an agent who is indifferent to investing in his or her higher education by setting (3) = (4). The agent's endowment is denoted by y and is henceforth referred to as the educational-choice margin (ECM). It is yipi + 1/ 2 + w. (L_|) (5) where ip = (-1~/ 1+r') and u = (1 + r).6 We assume that agents behave atomistically, neglecting the impact of their investment on aggregate income and total tax revenue. As can be seen, the lump-sum transfer has no impact on the educational-choice margin. This is because the lump-sum transfer is granted to both types of agents uniformly and, therefore, does not distort the choice of educational investment. For the ongoing discussion, it is useful to define a benchmark equilibrium. For this, we take the non-interventionist, redistribution-free equilibrium, where the government does not implement any income policy, so that the educational-choice margin is fully determined by market forces. This benchmark case is determined by p = t = 0. The educational-choice margin is then given by y[bm] = i> + V 2 + oj. (6) The second case considers a distortionary taxation (0 < t < 1) and investments in higher education are not subsidized (p = 0). As noted above, we assume that the direct cost of obtaining higher education is not effectively tax-deductible. This assumption, which holds for a wide range of countries (see Trostel (1993)), is the driving force in Trostel (1993, 1996). In those papers, Trostel argues that a subsidy to higher education may be regarded as a means to compensate for the distorting nature of taxation. The educational-choice margin in this case is given by A As can be seen, the higher t the higher the educational-choice margin and, consequently, the lower the graduation rate. On the other hand, the educational-choice margin is lowered if part of the 6As slopes quadratically, there is a second solution. It is given by ip yV2 + (i-tj s w> Pi and t are all nonnegative, and 0 < p < 1,0 < t < 1, this second solution is negative because the square root exceeds Hence, (5) is unique in the relevant range. cost of obtaining higher education

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 6
- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 7

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The first group consists of those agents with an innate endowment below 7/[bml. They would not invest, in higher education in the benchmark case and would be even less likely to if a distorting tax system would be introduced. The proportion of these agents is henceforth denoted by n\ = F (y). The second group consists of those agents who would invest in their higher education in the benchmark case, but are deterred from doing so because of the establishment of a distorting income tax. A subsidy is then required to give them an 59 incentive to correct their investment decision. If agents invest in higher education because of a government compensation for existing distortions, then we call this decision extrinsic. We denote the fraction of agents investing in higher education extrinsically by n^2 = F (j/jf') ni- For tne third group of agents, it is worthwhile investing in higher education although this investment is discouraged by income taxation. Their investment is said to be intrinsically motivated. The fraction of agents investing intrinsically is denoted by 713 = 1 n\ ri2- y, with j (1, 2,3) denoting the mean endowment of agents in group j, and V(yj) the variance of their innate endowments. In the next section, we will analyze the combined effect of taxation and subsidization of human-capital formation. By doing so, we derive the condition for efficiency-enhancing subsidies given the existence of the distorting nature of taxation. 6.3 Subsidization and Efficiency Starting from the benchmark case (p = t = 0), there would be no potential for Pareto improvement through the establishment of public education. As there are no tax distortions or other market failures, the outcome is Pareto optimal. Subsidization financed by a non-distorting tax2 would always lead to a redistribution. The more reasonable case, however, is that where a distorting income tax is imposed. Hence, starting from y \ we are interested in the effect of various p-values on the educational-choice margin. In particular, we wish to infer the optimal rate of subsidization if y equals the educational-choice margin in the benchmark case, y[

80% Einzelplagiatswahrscheinlichkeit

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is borne by the state. This can be seen by comparing (5) and (7). In the case of taxation without subsidization, three groups have to be considered. The first group consists of those agents with an innate endowment below y[6m]. They would not invest in higher education in the benchmark case and would be even less likely to if a distorting tax system were introduced. The proportion of these agents is henceforth denoted by n 1 = F (y[p]). The second group consists of those agents who would invest in their higher education in the benchmark case, but are deterred from doing so because of the establishment of a distorting income tax. A subsidy is then required to give them an incentive to correct their investment decision. If agents invest in their higher education because of a government compensation for existing distortions, then we call this decision extrinsic. We denote the fraction of agents investing in higher education extrinsically by n2 = F [y0 j n\. For the third group of agents, it is worthwhile investing in higher education although this investment is discouraged by income taxation. Their investment is said to be motivated intrinsically. The fraction of agents investing intrinsically is denoted by n^3 = 1 n n2. yj with j = (1,2,3) denoting the mean endowment of agents in group j, and V(yj) the variance of their innate endowments. In the next section, we will analyze the combined effect of taxation and subsidization of humancapital formation. By doing so, we derive the condition for efficiency-enhancing subsidies given the existence of the distorting nature of taxation. y [Pi Figure 1: for various p- and t-values Figure 1 shows the ECMs that result from various p- and t-values. As can be seen along the p-axis, the higher the rate of subsidization, the lower the educational-choice margin. The opposite holds for the tax rate, except for one special case. This special case arises if the costs of obtaining higher education are totally borne by the government. Proposition 2 If the direct costs of obtaining higher

are no tax distortions or other market failures, the outcome is Pareto [3] optimal. Subsidization financed by a non-distorting tax7 would always lead to a re distribution. [3] The more reasonable case, however, is that where a distorting income tax is imposed. Hence, [3] starting from y0 J, we are interested in the effect of various p-values on the educational-choice margin. [3] In particular, we

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 8

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fcml. The subsidy to higher education is said to be efficient (Pareto-improving) if it leads to increased aggregate income. Proposition 6.1. Under proportional taxation, a fiscal activity, which consists of the combination of revenue and spending policy, is optimal if the rate of subsidization equals the tax rate. If the rate of subsidization exceeds the tax rate, the educational-choice margin falls and p rises. In the opposite case, p falls if f < 1. Proof. If = 1, it follows that the term przfj" = 1 an(h hence, y = tp + VV2 + ui = See also Appendix G.2. ? Fig. 6.1. y'p' for various p- and revalues Figure 6.1 shows the ECMs that result from various p- and t-values. As can be seen along the p-axis, the higher the rate of subsidization, the lower the educational-choice margin. The opposite holds for the tax rate, except for one special case. This special case arises if the costs of obtaining higher education are totally borne by the government. Proposition 6.2. // the direct costs of obtaining higher education are completely borne by the state (p = 1), t has no effect on p. Proof. If p 1, it follows that y' pl = 2ip = 1~fc|f1+r and, thus, is independent oft. ? The intuition is as follows: The only distortion in this simple case of a proportional tax system arises from the non-deductibility of the direct cost of obtaining higher education. However, if the direct costs of higher education are completely borne by the state, the distortionary effect of non-deductibility does not play any role, because in that case the agents would have nothing to deduct. Optimality implies that aggregate net lifetime earnings the sum of the net lifetime earnings of those who do and those who do not invest in higher education are maximized when subsidization completely countervails the tax distortion. As we do not consider any disincentives from taxation on the labor market (i.e. substitution effects on leisure) in our framework, aggregate net lifetime income equals aggregate gross income minus the aggregate costs of obtaining higher education. We denote aggregate income by W, so that W [1] 1 + r ydF(y) + 1 1 + r

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wish to infer the optimal rate of subsidization if y0J equals the educational-choice [3] margin in the benchmark case, y[bm]. The subsidy to higher education is said to be efficient (Pareto [3] optimal) if it leads to increased aggregate income. [3] Proposition 1 Under proportional taxation, fiscal activity, which consists of the combination of [3] revenue and spending policy, is optimal if the rate of subsidization equals the tax rate. If the rate of [3] subsidization exceeds the tax rate, the educational-choice margin falls and p rises. In the opposite [3] case, p falls if | < 1. [3] Proof. If | = 1, it follows that the term jjzfj" = 1 arL(i, hence, y = tp + \A/>2 + oj = y brn . m [3] 7Optimal-tax theory states that the optimal tax is a lump-sum tax (see, e.g., (Eaton and Rosen, 1980, [3] p. 706)). We can prove

doing so, we derive the condition for efficiency-enhancing subsidies given the existence of the distorting nature of taxation. y [Pi Figure 1: for various p- and t-values Figure 1 shows the ECMs that result from various p- and t-values. As can be seen along the p-axis, the higher the rate of subsidization, the lower the educational-choice margin. The opposite holds for the tax rate, except for one special case. This special case arises if the costs of obtaining higher education are totally borne by the government. Proposition 2 If the direct costs of obtaining higher education are completely borne by the state (p = 1), t has no effect on p. Proof. If p = 1, it follows that y = 2ip = (-1~fe 1+r') and, thus, is independent of t. m The intuition is as follows: The only distortion under this simple case of a proportional tax system arises from the non-deductibility of the direct cost of obtaining higher education. However, if the direct costs of higher education are completely borne by the state, the distortionary effect of non-deductibility does not play any role, because in that case the agents would have nothing to deduct. Optimality implies that aggregate net lifetime earnings the sum of the net lifetime earnings of those who do and those who do not invest in higher education are maximized when subsidization completely countervails the tax distortion. As we do not consider any disincentives from taxation on the labor market (i.e., substitution effects on leisure) in our framework, aggregate net lifetime income equals aggregate gross income minus the aggregate costs of obtaining higher education. We denote aggregate

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. #P#then y[l L 0
- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 9

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ydF(y) y v Y Jy2 dF(y) + hjy dF(y) - c(l - F(y)). (6.8) Here, for simplicity, we denote ylpl by y. Differentiating W with respect to the rate of subsidization yields y(p)-y'(p)f(y I uy 1 1 h cf(y)-y'(p) = 0. (6.9) As a first order condition we derive p = t. Proof. Differentiating W with respect to p yields eq. (6.9) O y'f(y) 3/(1 - h) - f y(i -h)-f (1 + r) +c 6.[4] Subsidization and Equity: Are Subsidies Pareto-Improving? A funding scheme is said to be equitable if all groups increase their net lifetime income due to subsidization. Otherwise, non-graduates are worse off and a redistribution from non-graduates to graduates has occurred. In the latter case, we can ascertain an equity-efficiency trade-off. Note also that subsidies may be potentially Pareto-improving if they are not equitable (i.e. lowering the net lifetime income of the non-graduates). If such subsidies raise net lifetime income of all agents, then equity-efficiency harmony exists. In this case, subsidization is said to be Pareto-superior. Equity, therefore, requires raising the income of each of the three groups.,! To verify whether subsidies achieve this, we treat each group in succession for the case p = t.i By doing so, we distinguish three kinds of income: gross income, net income (gross income minus taxes), and disposable income, i.e. net income plus the lump-sum transfer minus the cost of obtaining higher education (if obtained). The most important of these is disposable income. As we set the tax rate exogenously and constant, a rising gross income implies a rising net income and vice versa. Group 1. The gross income of group-1 agents (non-graduates) remains unchanged as does their net income. The only effect they experience is a change in N. As total revenue is spent on redistribution and subsidization, the introduction of a subsidy leads to a twofold effect on K. In the first period, a direct and an indirect effect occur. The direct effect on K results from the obvious fact that a proportion of the entire revenue is now spent for subsidization rather than for the lump-sum transfer alone. The indirect effect

68% Einzelplagiatswahrscheinlichkeit

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income by W, so that W = (l + j j j ydF(y) + -r -rj VdF(y) 1 + r) J a Ka' 1 + r - - ' (8) y y + y" 7 / y2 dF(y) + hJy dF(y) - <i - F(y)). y y Here, for simplicity reasons, we denote y[p] by y. Differentiating W with respect to the rate of subsidization yields y(p)-y'(p)f(y l-uy- -h + cf(y)-y'(p) = 0. (9) As a first order condition we derive p = t (see Appendix B). The fact that a rate of subsidization up to t raises aggregate income implies that subsidies may be Pareto-superior. It is potentially feasible to

higher education. We will show that there is a counterforce that limits the distributive virtues of subsidies to education. 4 Subsidization and equity: Are subsidies Pareto-superior? A funding scheme is said to be equitable if all groups increase their net lifetime income due to subsidization. Otherwise, non-graduates are worse off and a redistribution from non-graduates to graduates has occurred. In the latter case, we can ascertain an equity-efficiency trade-off. Note also that subsidies may be efficient if they are not equitable (i.e., lowering the net lifetime income of the non-graduates). If such subsidies raise net lifetime income of all agents, then equity-efficiency harmony exists. In this case, subsidization is said to be Pareto-superior. Equity, therefore, requires raising the income of each of the three groups.8 To verify whether 8Here we follow (Sinn, 1995, p 497), who clearly distinguished between equity and equitable. As he said, "equity is an aspect of efficiency". subsidies achieve this, we treat each group in succession for the case p = t.9 By doing so, we distinguish three kinds of income: gross income, net income (gross income minus taxes), and disposable income, i.e., net income plus the lump-sum transfer minus the cost of obtaining higher education (if obtained). The most important of these is disposable income. As we set the tax rate exogenously and constant, a rising gross income implies a rising net income and vice versa. Group 1. The gross income of group-1 agents (non-graduates) remains untouched as does their net income. The only effect they experience is a change in H. As total revenue is spent on redistribution and subsidization, the introduction of a subsidy leads to a twofold effect on H. In the first period, a direct and an indirect effect are at work. The direct effect on H derives from the obvious fact that a proportion of the entire revenue is now spent for

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 9
- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 10
- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 11

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results from the fact that group-2 agents earn less in the first period than otherwise (opportunity costs of obtaining higher education) and therefore pay less in taxes. Formally, total costs per capita of the subsidies are given by where the limits of integration are given by yl*""] and yf. The first term of the right-hand side of equation (6.10) features the change in the expenditure side of the budget. A part of the total revenue is now spent for subsidization rather than for redistribution alone. The decline in tax revenues in the first period, caused by the indirect costs of obtaining higher education, is represented by the second term. 3 Here we follow (Sinn, 1995, p 497), who clearly distinguished between equity and equitable. As he said, "equity is an aspect of efficiency". For the concept of equality see Haveman (1988). 6.4 Subsidization and Equity: Are Subsidies Pareto-Improving? 63 While the non-graduates face costs in the first period, they benefit from subsidization in the second period. The intuition is that they will also participate in the private rentability of human-capital investments through taxation and the use of the additional tax revenues for a higher lump-sum transfer. On the other hand, only a small portion of the taxed benefits from the private rentability of the investment could be assigned as benefits from the non-graduates' point of view. The private rentability of those who invest intrinsically would otherwise (i.e. without subsidization) also be taxed, so that only the tax revenue from the additional income of group- 2 agents could be assigned as a benefit from subsidization. Formally, the benefit function (per capita) is B(y(p)), where and the same limits of integral as in (6. 10) apply. Note that the effect on K is the same for all agents, as the lump-sum transfer is earmarked to be shared uniformly among all agents. Again, it is crucial to note that group-1 agents are better off only if H rises due to subsidization, because the second source of their disposable income, net income, remains unchanged in both cases, with and without subsidization. Group 2. In contrast to group-1 agents, subsidization affects both income sources of group-2 agents, net income as well as H. Nevertheless, we can easily show that group-2 agents are net gainers from the subsidy. These agents consist of those who change their investment decision after a subsidy has been established. Their reason is that they find it worthwhile investing in their education because of the subsidy. This means that the present value of their lifetime income is higher as a graduate than as a non-graduate. group 3. As noted above, group-3 agents' investment in education is motivated intrinsically. They would invest in education even if the government did not counteract tax

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subsidization rather than for the lump-sum transfer alone. The indirect effect derives from the fact that group-2 agents earn less in the first period than otherwise (opportunity costs of obtaining higher education) and therefore pay less in taxes. Formally, total costs per capita of the subsidies are given by C(p, y(p)) = p pc +1 (1 h) J y dF(y) (10) where the limits of integration are given by y[bm] and y0p]. The first term of the right-hand side of equation (10) features the change in the expenditure side of the budget. A part of the total revenue is now spent for subsidization rather than for redistribution alone. The decline in tax revenues in the first period, caused by the indirect costs of obtaining higher education, is represented by the second term. While the non-graduates face costs in the first period, they benefit from subsidization in the second period. The intuition is that they will also participate in the private rentability of human-capital investments through taxation and the use of the additional tax revenues for a

alone. The decline in tax revenues in the first period, caused by the indirect costs of obtaining higher education, is represented by the second term. While the non-graduates face costs in the first period, they benefit from subsidization in the second period. The intuition is that they will also participate in the private rentability of human-capital investments through taxation and the use of the additional tax revenues for a higher lump-sum transfer. On the other hand, only a small portion of the taxed benefits from the private rentability of the investment could be assigned as benefits from the non-graduates' point of view. The private rentability of those who invest intrinsically would otherwise (i.e. without subsidization) also be taxed, so that only the tax revenue from the additional income of group-2 agents could be assigned as a benefit from subsidization. Formally, the benefit function (per capita) is B (y(p)) where miP)) t-: - JvidF(y), (ii) and the same limits of integral as in (10) apply. Note that the effect on H is the same for all agents, as the lump-sum transfer is earmarked to be shared uniformly among all agents. Again, it is crucial to note that group-1 agents are better off only if H rises due to subsidization, because the second source of their disposable income, net income, remains unchanged in both cases, with and without subsidization. 9Note that here n1 = 1 - F(y[6m])

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 11

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distortions. As a consequence, group-3 agents receive the same gross income (and the same net income) as without subsidization. Hence, they reap the subsidies as a pure windfall gain. They are therefore net gainers as long as pc + AH > 0 applies. In summary, a subsidy to higher education affects the educational choices of group-2 agents. Group-3 agents, on the other hand, reap pure windfall gains. Such windfall gains may have a lowering effect on N because they lower the fraction of total revenue that is devoted to financing the lump-sum transfer. We obtain, therefore, the following Proposition: Proposition 6.3. A subsidy that is granted to each agent who invests in higher education intrinsically reduces the lump-sum transfer by pc. In contrast to the effect of subsidizing group-3 agents, the subsidies to group-2 agents have a positive effect on N. Formally, we obtain the following Proposition: (6.11) Proposition 6.4. If all agents with an endowment below y\ and above the efficient level ylbml are subsidized by p c and no other agent is subsidized, then H rises. We can prove Proposition 6.4 as follows: Proof. For an individual whose endowment yi is equal to ylbm\ as a consequence of Proposition 6.1, the following equality applies: uy? = (l-h)yi(l-t) + (l-p)c, with p = t. (6.12) The left-hand side of equation (6.12) measures the additional net lifetime income (in present value terms) due to the investment in higher education, and the right-hand side measures the total costs of obtaining higher education, consisting of the direct and indirect costs of obtaining higher education. We can now multiply both sides by c -t) obtain an equation whose left-hand side yields the additional tax revenues and consequently raising N, and whose right-hand side indicates foregone tax revenues in the first period plus the expenditures for subsidizing this individual: t-j =t[(l-h)y,+c). (6.13) (1 +r) Equation (6.13) states that it has no effect on N if an individual with an endowment equal to y[

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. Group 2. In contrast to group-1 agents, subsidization affects both income sources of group-2 agents, net income as well as H. Nevertheless, we can easily show that group-2 agents are net gainers from the subsidy. These agents consist of those who change their investment decision after a subsidy has been established. Their reason is that they find it worthwhile investing in their education, because of the subsidy. This means that the present value of their lifetime income is higher as a graduate than as a non-graduate. Group 3. As noted above, group-3 agents' investment in education is motivated intrinsically. They would invest in education even if the government did not counteract tax distortions. As a consequence, group-3 agents receive the same gross income (and the same net income) as without subsidization. Hence, they reap the subsidies as a pure windfall gain. They are therefore net gainers as long as pc + AH > 0 applies. In summary, a subsidy to higher education affects the educational behavior of group-2 agents. Group-3 agents, on the other hand, reap pure windfall gains. Such windfall gains may have a lowering effect on H because they lower the fraction of total revenue that is devoted to financing the lump-sum transfer. We obtain, therefore, the following Proposition: Proposition 3 A subsidy that is granted to each agent who invests in higher education intrinsically reduces the lump-sum transfer by p c. In contrast to the effect of subsidizing group-3 agents, the subsidies to group-2 agents have a positive effect on H. Formally, we obtain the following Proposition: Proposition 4 If all agents with an endowment below yQp] and above the efficient level y[bm] are subsidized by p c, then H rises. We can prove Proposition 4 as follows: Proof. For an individual whose endowment y" is equal to y[bm], as a consequence of Proposition 1, the following equality applies: uy2t- = (l-h)y,Xl-t) + (l-p)c, with p = t. (12) The left-hand side of equation (12) measures the additional net lifetime income (in present value terms) due to the investment in higher education, and the right-hand side the total costs of obtaining higher education, consisting of the direct and indirect costs of obtaining higher education. We can now multiply both sides by j z to obtain an equation whose left-hand side yields the additional tax revenues and consequently raising H, and whose right-hand side indicates foregone tax

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 11
- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 12

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feml is subsidized by p c. All individuals with higher endowments, however, will find it worthwhile to invest in higher education so that (6.12) becomes an inequality with its left-hand side exceeding its righthand. The opposite case holds for all individuals with an endowment below It is now simple to consider all individuals with an endowment below yjf" by generalizing equations (6.12) and (6.13) to uy* (l-h)yi(l-t) + (l-p)c, Vy,:| H (6.14) and *-7TtH fW-h)yi+c], Vj/ l. (6.15) (1 + r) Only the case in the bottom line of equation (6.15) is concerned with an increasing H. ? In summary, we have seen that each subsidized group-2 agent contributes to an increasing lump-sum transfer and affects the disposable income of each group-1 agent positively. The opposite applies to each subsidized group-3 agent. Over the recent decades, the pros and cons of various kinds of higher-education funding have been discussed. In this section, we will discuss some of the proposals for a funding reform in the light of our framework and the main results we have obtained so far. In the preceding sections we emphasized the role of tax distortions. We ignored the role of externalities and we made no attempt to address the role of capital-market imperfections or unequal opportunity to access higher education. The persistent debate on alternative funding options, however, often tries to consider most of these problems and to look for alternative funding schemes that alleviate or solve all or most of these problems. Among others, the most popular ideas for a funding reform are: a graduate tax, vouchers, differential fees, and loans (see, e.g. Greenaway and Haynes (2003)). Most of these are mutually compatible in the sense that they work in a similar manner. Both vouchers and loans aim to correct market failures such as credit constraints. However, both schemes intend that graduates repay support received during their lifetime. A graduate tax is a mechanism to differentiate with respect to a concept, often weakly defined, of ability to pay; differential fees have a similar aim. However, only a small minority of economists claim that grants should be wholly state financed. The opposite attitude, however, seems to interest more economists, but two main drawbacks are also widely accepted. The first is concerned with equity considerations: tuition fees have become a target of much social hostility,

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revenues in the first period plus the expenditures for subsidizing this individual: * (H) =W-h)Vi + c]. (13) Equation (13) states that it has no effect on H if an individual with an endowment equal to y[bm] is subsidized by p c. All individuals with an higher endowment, however, will find it worthwhile to invest in higher education so that (12) becomes an inequality with its left-hand side exceeding its right-hand. The opposite case holds for all individuals with an endowment below y. It is now simple to consider all individuals with an endowment below yQ by generalizing equations (12) and (13) to uyf (l-h)yl(l-t) + (l-p)c, Vt/ yH (14) and t-r - tiil-Vyt + c], Vy yM. (15) (1 + r) Only the case in the bottom line of equation (15) is concerned with an increasing N. To sum up, we have seen that each subsidized group-2 agent contributes to an increasing lumpsum transfer and affects the disposable income of each group-1 agent positively. The opposite applies to each subsidized group-3 agent. It is therefore interesting to derive a critical value, denoted by n3, which states that if n3 exceeds n3, then subsidization is inequitable in the sense that it lowers

it lowers the lump-sum transfer compared to a situation without subsidization. This critical value is given by "3 < YM A _ "2 (VjzR fc + 1)= ,v (ia) 5 Alternative funding options Over recent decades, the pros and cons of various kinds of higher-education funding have been discussed. In this section, we will discuss some of the proposals for a funding reform in the light of our framework and the main results we have obtained so far. In the preceding sections we emphasized the role of tax distortions. We ignored the role of externalities and we made no attempt to address the role of capital-market imperfections or unequal opportunity to access higher education. The persistent debate on alternative funding options, however, often tries to consider most of these problems and to look for alternative funding schemes that alleviate or solve all or most of these problems. Among others, the most popular ideas for a funding reform are: a graduate tax, vouchers, differential fees, and loans (see, e. g., Greenaway and Haynes (2003)). Most of these are mutually compatible in the sense that they work in a similar manner. Both vouchers and loans aim to correct market failures such as credit constraints. However, both schemes intend that graduates repay support received during their lifetime. A graduate

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 12
- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 13

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mainly because they have to be paid at a time when young people have the least money. The second disadvantage is concerned with efficiency: considering the first drawback, parental contributions become more and more important and, despite the suggestion that this might also be socially undesirable, it separates payers (parents) and users (students). Consequently, so the argument goes, higher education is not an efficient decision because of a principal-agent problem. Furthermore, this divergence of payers and users may be the source of what John Stuart Mill labeled fiscal illusion.[1] Therefore, the debate within the economics of education is centered on a scheme somewhere between fully subsidized costs of obtaining higher education and tuition fees in its rough form. The main question in this field seems to be the relationship between the benefit granted during the investment period and the amount of repayment over the subsequent lifetime. The options here can be summarized as a pure (mortgage-type) loan scheme, a loan with income-related repayment (up to the borrowed amount), and a graduate tax. Under a loan scheme, a graduate repays what he or she has borrowed until the loan (plus interest) has been paid off, at which point repayments cease. With an income-related repayment, the borrowed amount can be regarded as a maximum value of repayment. Agents who are not very successful in the labor market repay less than received. Interestingly, most education economists seem to favor an income-related repayment. (Blaug, 1980, p. 45) has pointed out that "virtually every advocate of student loans in Britain [...] favors an income-related loans scheme [...] and not a personal loan repayable in a fixed number of years after taking up employment." A graduate tax, however, is a tax supplement that applies only to graduates. If the graduate tax is regarded as a repayment for benefits received during the education period, the repayable amount may have the opposite effect to an income-related repayment of a loan. High-income graduates are pushed to repay more than they received. Graduates, in this case, are taxed twice. Glennerster (2003) and Glennerster et al. (2003) refer to two equity grounds that both date back to Adam Smith: capacity to pay and disproportionate benefit. As we argued [...] graduates disproportionately benefit from higher education in ways no other group does from investment made in them by their fellows. State funded lifetime expenditure on the higher education of the richest fifth is worth five times as much as that on the lowest fifth. A graduate tax combines the principles of ability to pay, disproportionate benefit and efficient collection. Adam Smith's perfect tax! (Glennerster, 2003,

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tax is a mechanism to differentiate with respect to a concept, often weakly defined, of ability to pay; differential fees have a similar aim. However, only a small minority of economists claim that grants should be wholly state financed. The opposite attitude, however, seems to interest more economists but two main drawbacks are also widely accepted. The first is concerned with equity considerations: tuition fees have become a target of much social hostility, not least because they have to be paid at a time when young people have the least money. The second disadvantage is concerned with efficiency: considering the first drawback, parental contributions become more and more important and, despite the suggestion that this might also be socially undesirable, it separates payers (parents) and users (students). Consequently, so the argument goes, higher education is not an efficient decision because of a principal-agent problem. Furthermore, this divergence of payers and users may be the source of what John Stuart Mill labeled fiscal illusion.10 Therefore, the debate within the economics of education is centered on a scheme somewhere between fully subsidized costs of obtaining higher education and tuition fees in its rough form. The main question in this field seems to be the relationship between the benefit granted during the investment period and the amount of repayment over the subsequent lifetime. The options here can be summarized by a pure (mortgage-type) loan scheme, a loan with income-related repayment (up to the borrowed amount), and a graduate tax Under a loan scheme, a graduate repays what he or she has borrowed until the loan (plus interest) has been paid off, at which point repayments cease. With an income-related repayment, the borrowed amount can be regarded as a maximum value of repayment. Agents who are not very successful in the labor market repay less than received. Interestingly, most education economists seem to favor an income-related repayment. (Blaug, 1980, p. 45) has pointed out that "virtually every advocate of student loans in Britain [...] favors an income-related loans scheme [...] and not a personal loan repayable in a fixed number of years after taking up employment." A graduate tax, however, is a tax supplement that applies only to graduates. If the graduate tax is regarded as a repayment for benefits received during the education period, the repayable amount may have the opposite

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 13
- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 14

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p. 26) However, the concept of a graduate tax has been supported by several economists. Arrow (1993); Lincoln and Walker (1993) regard a graduate tax as a means to achieve a just contribution by students for the subsidies they received. Pennings (2000) pointed out that a graduate tax is an example for a zero expected cost investment stimulus. Garcia-Penalosa and Walde (2000) propose a lump-sum graduate tax in a model with capital-market imperfections and an uncertain outcome from the educational investment. The lumpsum graduate tax is higher than the received subsidy in order to finance the subsidies for those who also invest in higher education but do not pass a final exam. Finally, Poutvaara (2004) proposes a voluntary graduate tax and emphasizes that it can be seen as a triple dividend in new EU member states, " benefiting the emigrants, those left behind in the new member states and the old member states alike" (Poutvaara, 2004, p. 25). One of the most popular advocates for an income-related loan is Nicholas Barr. He argue that the main advantage of an income-related loan with regard to equity is that "no-one repays more than he/she has borrowed" (Barr, 1989, p. 64). By arguing in this way, Barr unveils exactly the opposite view on equity compared to the view of Glennerster, referred to above. The most obvious advantage of a graduate tax is that it would be relatively straightforward to introduce.[2] A graduate tax that is organized as a higher tax bracket in the income tax schedule can be raised without significant administrative costs. In particular, if the loan varies between agents (e.g. with respect to faculty, university, gender, and so on), it would be too complicated to recover the precise amount from each former student. The basic presumption is that administrative costs are minimized when a small scheme is piggy-backed onto a larger one like the income tax. The differences between the two concepts discussed here, however, are not as great as they may appear initially. The main differences between a voluntary graduate tax and a loan scheme with income-related repayment can be seen when we consider that the outcome of education is uncertain. Assume, for example, that agents do not know exactly their innate endowment, although they are able to form an unbiased estimate of it. As in Levhari and Weiss (1974) ; Eaton and Rosen (1980), we assume that endowment is given by

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effect to an income-related repayment of a loan. High-income graduates are pushed to repay more than they received. Graduates, in this case, are taxed twice. Glennerster (2003), and Glennerster et al. (2003) refer to two equity grounds that both date back to Adam Smith: capacity to pay and disproportionate benefit. As we argued [...] graduates disproportionately benefit from higher education in ways no other group does from investment made in them by their fellows. State funded lifetime expenditure on the higher education of the richest fifth is worth five times as much as that on the lowest fifth. A graduate tax combines the principles of ability to pay, disproportionate benefit and efficient collection. Adam Smith's perfect tax! (Glennerster, 2003, p. 26) However, the concept of a graduate tax has been supported by several economists. Arrow (1993); Lincoln and Walker (1993) regard a graduate tax as a means to achieve a just contribution by students for the subsidies they received. Pennings (2000) pointed out that a graduate tax is an example for a zero expected cost investment stimulus. Garcla-Penalosa and Walde (2000) propose a lump-sum graduate tax in a model with capital-market imperfections and an uncertain outcome 10"Perhaps [...] the money which [the taxpayer] is required to pay directly out of his pocket is the only taxation which he is quite sure that

of his pocket is the only taxation which he is quite sure that he pays at all". (Mill, 1848[1994], p. 237). from the educational investment. The lump-sum graduate tax is higher than the received subsidy in order to finance the subsidies for those who also invest in higher education but do not pass a final exam. Finally, Poutvaara (2004) propose a voluntary graduate tax and emphasize that it can be seen as a triple dividend in new EU member states, " benefiting the emigrants, those left behind in the new member states and the old member states alike" (Poutvaara, 2004, p. 25). One of the most popular advocates for an income-related loan is Nicholas Barr. He argued that the main advantage of an income-related loan with regard to equity is that "no-one repays more than he/she has borrowed" (Barr, 1989, p. 64). By arguing in this way, Barr unveils exactly the opposite view on equity compared to the view of Glennerster, referred to above. The most obvious advantage of a graduate tax is

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 14
- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 15

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xyt, where x is a random variable with a mean of unity and with support [fli > 0, a]- Note that agents are still risk-neutral. An agent with an expected endowment slightly above yf1 will also use the loan if its repayment is incomecontingent. The repayment equals the loan if x, unveiled in the second period, is unity, while the agent will repay less than received if x < 1 but will not repay more otherwise. Agents with an endowment equal to jffl + where < oi, would also find it worthwhile to use the loan scheme as they have nothing to lose. The scheme, then, is a means not only to offset tax distortions, but also to insure against uncertainty, which is not justified on efficiency grounds as agents are not risk-averse. Under a voluntary graduate tax, the agent with an endowment equal to j/g + c would not demand the subsidy. If a graduate tax is optional and the investment outcome is certain, the differences from a loan with income-related repayment vanish. Nevertheless, a voluntary graduate tax

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that it would be relatively straightforward to introduce.11 A graduate tax that is organized as a higher tax bracket in the income tax schedule can be raised without significant administrative costs. In particular, if the loan varies between agents (e.g., with respect to faculty, university, gender, and so on), it would be too complicated to recover the precise amount from each former student. The basic presumption is that administrative costs are minimized when a small scheme is piggy-backed onto a larger one like the income tax. The differences between the two concepts discussed here, however, are not as great as they may appear initially.[12] If a graduate tax is optional and the investment outcome is certain, the differences from a loan with income-related repayment vanish. Furthermore, this scheme is much more likely to achieve both goals, equity and efficiency, than the current practice in many European countries, as will be shown in the next subsection. 5.1 A voluntary graduate tax In the preceding section it was emphasized that unwanted distributional consequences of public subsidization result primarily from the impracticability of discriminating between the subsidies granted to different students. The reason, as mentioned above, is the lack of

are able to form an unbiased estimate of it. [12] As in Levhari and Weiss (1974); Eaton and Rosen (1980), we assume that endowment is given by xyi, [12] where x is a random variable with a mean of unity and with support [a1 > 0, a2j. Note that agents are still [12] risk-neutral. An agent with an expected endowment slightly above y|,p] will also use the loan if its repayment [12] is income-contingent. The repayment equals the loan if x, unveiled in the second period, is unity, while the [12] agent will repay less than received if x < 1 but will not repay more otherwise. Agents with an endowment [12] equal to y0 + ?, where ? < a1, would also find it worthwhile to use the loan scheme as they have nothing to [12] lose. The scheme, then, is a means not only to offset tax distortions, but also to assure against uncertainty, [12] which is not justified on efficiency grounds as agents are not risk-averse. Under a voluntary graduate tax, [12] the agent with an endowment equal to y0 + ? would not demand the subsidy. [12] 15 [6] 6 Conclusion [6] The debate on higher education reform is widespread. Advocates of reform often refer to the [6] argument that subsidies to higher

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 15
- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. #P#then y[l L 0

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is much more likely to achieve both goals, equity and efficiency, than the current practice in many European countries, as will be shown in the next section. 7.1 A Voluntary Graduate Tax In the preceding section we emphasized that unwanted distributional consequences of public subsidization result primarily from the impracticability of discriminating between the subsidies granted to different students. The reason, as mentioned above, is the lack of information on individuals' endowments. This missing information is the main source of problematic equity effects. In this subsection, we will demonstrate that a voluntary graduate tax could be used as a revelation mechanism. This funding scheme allows us both to support higher education up to an efficient level and to avoid the problematic distributional consequences better than unconditional grants, although it might be that both goals can only be approximately achieved simultaneously. The model works as follows. Each agent is eligible for a subsidy to cover (partly) the direct costs of obtaining higher education, denoted by 7 e [0,1] C M. Each agent can choose whether to obtain a subsidy in the first period and consequently to accept the graduate tax on his or her income as a graduate, or to opt out. In the latter case, second-period income is taxed by the constant tax rate f [0,1) Ci Those who use the subsidy are additionally liable to a graduate tax on their income in the second period, denoted by (3 with 0 < P < (1 t), so that their second-period income is taxed by t + [3.

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education are regressive in their distributional consequences, and [6] these advocates often ignore efficiency arguments. Their opponents, however, often seem to ignore [6] efficiency losses to

appear initially.[12] If a graduate tax is optional and the investment outcome is certain, the differences from a loan with income-related repayment vanish. Furthermore, this scheme is much more likely to achieve both goals, equity and efficiency, than the current practice in many European countries, as will be shown in the next subsection. 5.1 A voluntary graduate tax In the preceding section it was emphasized that unwanted distributional consequences of public subsidization result primarily from the impracticability of discriminating between the subsidies granted to different students. The reason, as mentioned above, is the lack of information on individuals' endowments. This missing information is the main source of problematic equity effects. nIn this framework, we consider only a proportional tax system. Under this simple tax regime, the graduate tax is also simple to levy. However, under more complicated tax structures, in particular if taxation is progressive and, e.g., married couples can taxed jointly, a graduate tax may create further problems. Consider, for example, if only one partner has invested in higher education. What should then be regarded as the tax base for the graduate tax? The author is indebted to Barbaro Wolfe for highlighting this point. In this subsection, we will demonstrate that a voluntary graduate tax could be used as a revelation mechanism. This funding scheme allows us both to support higher education up to an efficient level and to avoid the problematic distributional consequences better than unconditional grants, although it might be that both goals can only be approximately achieved simultaneously. The model works as follows. Each agent is eligible for a

Each agent is eligible for a subsidy to cover (partly) the direct costs of obtaining higher education, denoted by 7 with 0 < 7 < 1. Those who use the subsidy are liable to a graduate tax on their income in the second period, denoted by p with 0 < ft < (1 t). Each agent can choose whether to obtain a subsidy in the first period and consequently to accept the graduate tax on his or her income

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 15
- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 16

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As in the previous analysis, there are three groups. For the first group (group 1) it is still not worthwhile to invest in higher education. Group-2 agents will take out a subsidy and therefore complete a degree, while group-3 agents will invest in higher education without drawing on the funding system. The reason for the last group's decision is that the burden from the graduate tax exceeds the benefit from the loan. There exist, as a consequence, two educational-choice margins, an upper one and a lower one. The upper one denotes that agent who is indifferent about the alternatives, i.e. to draw on the funding scheme or not. However, for this agent it is worthwhile to invest in higher education in any case. Those agents with endowments below the lower educational-choice margin will, nevertheless, abstain from investing in higher education. 69 7.1.1 Optimal Policy If we assume that the government's goal is efficiency, the government will set the rate of subsidization so that the lower educational-choice margin coincides with For that, we need to consider a graduate's present value of net lifetime income after having drawn upon the scheme. It is given by VfW ee hy,.(l -t)- c(l - 7) + (1 - t - i^3)y, + K. (7.1) The lower bound is then obtained by equating (7.1) and (6.4). It is given by -[i] = (1-*) +_P_ -0) (7.2) l-t,-(3 2u(l-i-/3) Proof. See Appendix G.3 (i~t-py The efficient educational-choice margin and j/W coincide if the subsidy is set to 7i =t + /3 [l + jj fl] (7.3) where 6 . (i-h) c(l+r) r. Proof. See Appendix G.4. It is obvious that the expression under the square root in (7.2) cannot become negative'* for any value of 7 less or equal to 1. Therefore, for every 0 < 71 < 1 a solution that ensures efficiency exists. Furthermore, from the condition that 71 < 1 follows that the graduate tax cannot exceed /3i, where 'h " 1 + gTy W

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his or her income as a graduate, or to opt out. In the latter case, second-period income is taxed by the constant tax rate t with 0 < t < 1. As in the previous analysis, there are three groups. For the first group (group 1) it is still not worthwhile to invest in higher education. Group-2 agents will take out a subsidy and therefore take up a degree, while group-3 agents will invest in higher education without drawing on the funding system. The reason for the last group's decision is that the burden from the graduate tax exceeds the benefit from the loan. There exist, as a consequence, two educational-choice margins, an upper one and a lower one. The upper one denotes that agent who is indifferent about the alternatives, i.e., to draw on the funding scheme or not. However, for this agent it is worthwhile to invest in higher education in any case. Those agents with endowments below the lower educational-choice margin will, nevertheless, abstain from investing in higher education. 5.1.1 Optimal policy If we assume the government's goal is efficiency, the government will set the rate of subsidization so that the lower educational-choice margin coincides with y[bm]. For that, we need to consider a graduate's present value of net lifetime income after having drawn upon the scheme. It is given by Vtm hVi(l -t) - C(l - 7) + (1 -1 - ft)y% (1(1++7f + The lower bound is then obtained by equating (17) and (4).13 It is given by jni (i-*) _§__ y l-t- ft 2u(l-t- ft) r (i-t) 3 r (1-7) V[l-t-ft 2u(l-t-ft)\ (l-t- 3)' (18) The efficient educational-choice margin and y[1] coincide if the subsidy is set to 71 = t + p [1 + y[

It is given by Vtm hVi(l -t) - C(l - 7) + (1 -1 - ft)y% (1(1++7f + The lower bound is then obtained by equating (17) and (4).13 It is given by jni (i-*) _§__ y l-t- ft 2u(l-t- ft) r (i-t) 3 r (1-7) V[l-t-ft 2u(l-t-ft)\ (l-t- 3)' (18) The efficient educational-choice margin and y[1] coincide if the subsidy is set to 71 = t + p [1 + y[bm] 0] (19) where 6 = + It is obvious that the square root in (18) cannot become negative14 for 13It was: Vf= yi (1 - t) + + N. 14If the square root becomes negative, the economic intuition is the following: the higher 7 the greater the size of agents with the lowest ability who invest in higher education. In this case (that we have ruled out), a fourth group of agents

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 16

If 7 is set equal to 71 to ensure efficiency, it is interesting to analyze the extent to which group-3 agents draw on the funding scheme. No one will do so if it is not advantageous for the least-talented agent in group 2 to draw on the subsidy in the first period. It is quite simple to derive a combination of 7 and (3, which ensures this goal: we equate a graduate's present value of lifetime income after having used the funding scheme, and the present value of those graduates who renounced the scheme. Thus, we equate Vt which has already been derived in equation (7.1) and V*W = hVi(l -t)-c+(l- t)Vi <i > + K. (7.[5]) As the educational-choice margin we obtain4 -,m~ 1 . / 1 . i *Ms-S + Vs? + "-5- (7' 6) Windfall gains are completely avoided if y!2' = fffl. A subsidy that satisfies this condition is given by 72-/3 1 - t + IVoPl (7.7) This upper bound divides those who invest in higher education into groups with and without use of the subsidy. For all y,; > y'2', it is worthwhile to opt out. Similarly to (7.4), the condition 0 < 72 < 1 requires that the graduate-tax rate reaches its maximum value at k = ---fir- (7-8) (TL7)+ 2/oP] 7.1.2 Can Both Goals be Achieved Simultaneously? In the preceding subsection we derived two values for 7, one that ensures efficiency (71) and another that avoids windfall gains (72). The government has to choose one of the two values, so it is not clear whether both goals can be achieved simultaneously. As both 71 and 72 depend on 3, we can check for the possibility that a value of (3 exists that leads to 71 =72- It is obvious that such a (3-value exists, because 72 increases more strongly in (3 than 71 (j p- > 7 3")'5 Dut; 71 intercepts the /?-axis at t whereas 72 starts at the origin. On the other hand, to avoid windfall gains from the highereducation investment of agents with the lowest ability, we do not allow any 7 to become greater than 1. As a consequence, it might be that a graduate tax that ensures coinciding values of 71 and 72 exceeds (3\ or fc. Let us denote such a graduate-tax rate (3 that ensures coinciding values of 71 and 72 by 3*: 13* =__ (7 CJ) t + 0(l-t) (yW-yl" Indeed, we can derive the following proposition: 4 The same result can be obtained by equating 7c and Vi (I + uyt). 71 Proposition 7.1. It is not possible to

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accrues starting from the left-hand side of

or equal to 1. Therefore, for every 0 < 71 < la solution that ensures efficiency exists. Furthermore, from the condition that 71 < 1 follows that the graduate tax cannot exceed where 1 -t 1 + 6 (20) If 7 is set equal to 71 to ensure efficiency, it is interesting to analyze the extent to which group-3 agents draw on the funding scheme. No one will do so if it is not advantageous for the least talented agent in group 2 to draw on the subsidy in the first period. It is quite simple to derive a combination of 7 and //, which ensures this goal: we equate a graduate's present value of lifetime income after having used the funding scheme, and the present value of those graduates EMI who renounced the scheme. Thus, we equate V which has already been derived in equation (4) and VE[2] = hy (1 t) - c +(1 - t)yi Q- + uyj) (1 + r) As the educational-choice margin we obtain15 yl2] = -- + y 2u 1 (21) (22) Windfall gains are completely avoided if y[2] given by 72 = P 2/q . A subsidy that satisfies this condition is (23) This upper bound divides those who invest in higher education into groups with and without use of the subsidy. For all y > y[2], it is worthwhile to opt out. Similarly, the condition 0 < 72 < 1 requires that the graduate-tax rate reaches its maximum value at P2 = 1 (l-t) + 6 (24) 1 5.1.2 Can both goals be achieved? In the preceding sections we derived two values for 7, one that ensures eiciency and another that avoids windfall gains. The government has to choose one of the two values, so it is not clear whether both goals can be achieved simultaneously. As both 71 and 72 depend on //, we can check for the possibility that a value of // exists that leads to 71 = 72. It is obvious that such a //-value exists, because 72 increases more strongly in // than 71,16 but 71 intercepts the /-axis at t whereas 72 starts at the origin. On the other hand, to avoid windfall gains from the higher-education investment of agents with the lowest ability, we do not allow any 7 to become greater than 1. As a consequence, it might be that a graduate tax that ensures coinciding values of 7 lies below /31 and /32. 15The same result can be obtained by equating 7 c and jy j 1 + uy j. 16This can be proved very easily: y > yl6 ! and > t. V
Figure 2: Equity effects

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 17

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achieve both goals simultaneously. Proof. To prove this, we show that 8* > fa > 1. This means that at pi the point of intersection between 71 and 72, both 7-values are greater than l.[6] Considering (7.8) and (7.9), we obtain: ft* J2 t(l-t) t + 0(l t) [%W y[hm] Division by (1 t) yields ft* Jz The

1 As V' ' slopes quadratically, there is a second solution. It is given by ip

2 Optimal-tax theory states that the optimal tax is a lump-sum tax (see e.g. Eaton

1 +r) + c_

4 Note that in this case m = 1 - F(y[bm]).

1 "Perhaps [...] the money which [the taxpayer] is required to pay directly out of

2 In this framework, we consider only a proportional tax system. Under this simple

3 If the expression under the square root becomes negative, the economic intuition is the following: the higher 7 the greater the size of agents with the lowest ability

5 This can be proved very easily: y] > y bm and j j > t.

6 Note that "/[(ft), ~t'2(/3) > 0 and -y['(ft) = 72 (ft) = 0. Thus, the point of intersection

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the two educational-choice margins, which is given by Jip2 + \/ip2 + u. This is the intuition for the following proposition: Proposition 5 It is not possible to achieve both goals simultaneously. Proof. See Appendix A Given Proposition 5, the question that arises is: which combination of 7 and P minimizes the windfall gains? To answer this question we analyze the slope

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 18

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in y hr' is greater than the square root in y . From this and from (a) follows that y[bm] > _t)ybl. ? ? Note that /3i < , so that 0* also exceeds 0\. The idea behind this way to prove Proposition 7.1 is illustrated in Figure 7.1. Given Proposition 7.1, the question that arises is: which combination of 7 and 0 minimizes the windfall gains while maintaining efficiency? To answer this question we analyze the slope of y'2'(7i). It can be derived as follows: we insert 71 into y and generate the first derivation with respect to 0. By doing so we obtain 8yW tu dP 202 .H--L-Y -1- .31 (7.11) As u>,t,u, and 0 are positive, the slope is negative. The consequence of these properties is that the closer the graduate tax is to 0*, the smaller the number of agents who reap windfall gains. Thus, the higher 71, the close; r j/Pl is to yjf1. The resulting curve is illustrated in Figure 7.2. The higher 0, the closer this curve is to y . The gray horizontal lines represent the two educational-choice margins under consideration, the decreasing one represents ?y'2'(7i). By considering the slope of y'2'(7i) and Proposition 7.1, we can derive the following Proposition: Proposition 7.3. If fh < P*, then the best policy is for the subsidy to cover the entire cost of obtaining higher education. Figure 7.2 illustrates the intuition for the Proposition 7.3. Fig. 7.2. Equity effects of an efficiency-orientated policy Part III The Role of Progressive Taxation The following sections shed light on the distortive effect of various kinds of progressive taxation and infer the subsidy rate required to offset such distortions. The main purpose of

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given by Jip2 + \/ip2 + u. This is the intuition for the following proposition: Proposition 5 It is not possible to achieve both goals simultaneously. Proof. See Appendix A Given Proposition 5, the question that arises is: which combination of 7 and P minimizes the windfall gains? To answer this question we analyze the slope of y[2\(71). It can be derived as follows: we insert y1 into y[2\ and generate the first derivation with respect to p. By doing so we As w, t, and P are positive, the slope is negative. The consequence of these properties is that the closer the graduate tax is to P*, the smaller the number of agents who reap windfall gains. Thus, the higher 71, the closer y[2] is to y([p]. The resulting curve is illustrated in Figure 2. The higher P, the closer this curve is to y((. The gray horizontal lines represent the two educational-choice margins under consideration. The vertical line close to the right, marked with p*, indicates that value of P where the y[2]-line would coincide with the y[p]o-line. By considering the slope of y[2](71) and Proposition 5, we can derive the following Proposition: Proposition [6] If p2 < P* , then the best policy is for the subsidy to cover the entire cost of obtaining higher education. A Proof of Proposition 5 It will be shown that (3* leads to 71 = 72 > 1. To do so, we analyze the case where costs are fully covered by the state (7 = 1).

values of 7 lies below /31 and /32. 15The same result can be obtained by equating 7 c and jy j 1 + uy j. 16This can be proved very easily: y > yl6 ! and > t. V Figure 2: Equity effects of an efficiency-orientated policy The condition for a simultaneous achievement of both goals is that y[bm\ pays a graduate tax that amounts to (1 t) c if 7 = 1 and also in that case would pay c.

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 18
- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 19
- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 18

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earnings are equal to: "E[d+iP] n n s . , . (1 +Sj)yj(l -t-e)+tK Vi 1 FJ = (1 -t)hyi - c(l - p) +tn-\----h N (8.1) and V,N[d+lp] =yi(i-t) + tK+ Vi(l~*)r+tK + N. (8.2) Equating (8.1) and (8.2) and isolating yi leads to the ECM of: o Denmarko Germany Sweden 0 en d Ireland o d Spain o o Australia d to d USAo d d "T 1.02 1.03 1.04 1.05 1.06 1.07 Musgrave Measure 1.08 1.09 Fig. 8.2. Progressivity and p-Values for some OECD countries. Source: OECD (1993) and Norregaard (1990). -ld+iP] = (l + r)(l-f)(fe-l)- ' 2u(\-t-e) + (l+r)(l-f)(ft-l) 2u(l - t - e) (1-t-e i.3) The rate of subsidization that is required in order to compensate for the distorting impact of direct and indirect income-tax progression on y can be found by equating (8.3) and (6.6). It is given by where, as before, 9 c(l+r) Pl = t + s [l + y > (8.4) Proof. Substitute 7 by p and ß by e in Appendix G.4. ? For the remainder of the discussion, it is useful to distinguish three special cases. 1. Indirect income-tax progression: k > 0, e = 0 3. Indirect and direct income-tax progression: k > 0, 0 < e < (1 t). 8.1 Indirect Income-Tax Progression A lot of different groups of individuals would have to be considered under indirect income-tax progression: two groups of individuals who invest in higher education, and two groups that are below the ECM. One subgroup of those investing in human capital pays no taxes in the first period because the yi of its members is below the threshold. Members of the second subgroup pay taxes in the first period as their basic income exceeds the threshold. Of those not investing in higher education, the first subgroup receives a basic income that is below the threshold. Hence, these individuals pay no taxes. The second group of individuals not investing in higher education pay taxes in both periods as their endowment exceeds the threshold (yi > k). Considering all these cases would certainly complicate the analysis. Therefore, it shall be assumed that the income of students during their qualification period does not exceed the threshold (k > h y) and that all non-graduates pay taxes in both periods. The net lifetime earnings of non-graduates differ from those of graduates with earnings below the threshold only with regard to the double relief of the threshold (which, of course, has to be discounted in the second period). Introducing an indirect income-tax progression changes the net lifetime earnings of graduates in two ways. First, no income taxes are paid in the first period. Second, the threshold increases income in the second period by jfy,- In the second period, the relief due to the basic allowance is the same for both graduates and non-graduates. Therefore, the effect in the first period is crucial. In this case, the easing of tK for non-

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present value of net lifetime income after having drawn upon the scheme. It is given by Vtm hVi(l -t) - C(l - 7) + (1 -1 - ft)y% (1(1++7f + The lower bound is then obtained by equating (17) and (4).13 It is given by

1 Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 16

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graduates is opposed by an easing of htyt for graduates. As we have assumed above that the income of students during their qualification period does not exceed the threshold, h y,; < k applies. By comparing the relief accruing to graduate and non-graduates in the first period (h t yi versus tn), it becomes clear that it is larger for the latter group. Therefore, it is expected that introducing a tax-free threshold will lead to a higher educational-choice margin than will proportional taxation. With the restricting assumption made above, the net lifetime earnings of whose investing in higher education are V? =hyt-c(l-p)+ (1 +) (1- -) + + N (8.5) and that of non-educated are still given by eq. (8.2). The educational choice margin becomes more complicated, it is given by 81 .[iP] = (l+r)(h-l + t)-e y 2u(l-t-e) (l + r)(h-\+t) uj(l-p) tk(l + r) (8.6) 2u(\-t-e) J (' -t-e) u(l-t-e)' Equating (8.6) and yields the optimal rate of subsidization: 1 + (8.7) Proposition 8.2. In the case of indirect income-tax progression, the distortioncorrecting rate of subsidization has to be higher than the tax rate. Proof. First, the assumption that k > h y implies k> h y[bml. Second, c is strictly positive. ? Note that this and the other optimal subsidy rates yield only the necessary condition. As we will see in Chapter 9, optimality can be derived only if the rate of subsidization does not exceed unity. 8.2 Direct Income-Tax Progression Application of increasing marginal tax rates to annual income discriminates against the taxpayer whose income fluctuates. If net lifetime earnings are identical,.the direct income-tax progression results in an advantage for those individuals who can spread their net lifetime earnings evenly over a longer period of time. Thus, taxpayers with fluctuating incomes and taxpayers with steady incomes carry different burdens. Sturn and Wohlfahrt (2000) have recently labeled this additional burden Foregone Smoothing Benefit. The present value of net lifetime earnings are given in eq. (8.1) and (8.2) where k is set to zero. The same applies to the educational-choice margin in eq. (8.3). With the same procedure used in the preceding sections, we obtain the following optimal rate of subsidization: p = t + e[l + y[hr" Fig. 8.3. ECM under a indirectly and directly progressive taxation 8. 3 Direct and Indirect Income-Tax Progression In the previous sections, we separated the effects for the most complicated case of a tax schedule with a tax-free threshold and

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jni (i-*) _§__ y l-t- ft 2u(l-t- ft) r (i-t) 3 r (1-7) V[l-t-ft 2u(l-t-ft)\ (l-t- 3)' (18) The efficient educational-choice margin and y[1] coincide if the subsidy is set to 71 = t + p [1 + y[bm] 0] (19) where 6 = + It is obvious that the

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impact of public higher education has become more and more important. Only to a lesser extent has there been focus on empirical investigations, the need for which has been ignored by both textbook authors and theorists. Our analysis suggests that the question of distributional consequences is much more variegated than a glance at many textbooks and models would suggest. It is beyond controversy that a cross-sectional analysis is the most appropriate universe to deal with the impact on rich and poor households. Such studies have been carried out for many countries and the results indicate that the Friedman-thesis should be handled with some care. In contrast to a widespread belief among economists, the use of the net-transfer calculation provides an incidence, which is clearly in favor of the lower-income deciles. As noted above, the pattern of the net-transfer

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opponents, however, often seem to ignore [6] efficiency losses to which huge subsidies may lead and that these efficiency losses are concerned [6] with negative distributional effects. [6] Our analysis suggests that the question of distributional consequences is much more variegated [6] than a glance at many textbooks and models would suggest. It is beyond controversy that a [6] cross-sectional analysis is the most appropriate universe to deal with the impact on rich and poor [6] households. Such studies have been carried out for many countries and the results indicate that the [6] Friedman-thesis should be handled with some care. In the long run, however, the question remains [6] whether students reap subsidies at the expense of non-graduates. [6] However, distributional considerations are only part of the

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. #P#then y[l L 0

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selection and allocation of students are more in favor of the upper-income brackets (in support of the thesis of many economists), the so-called level effect may overcompensate this structural effect. However, cross-sectional distributional considerations are only part of the discussion. Most attention should be given to efficiency arguments. With regard to the normative justification for educational subsidization, this thesis has emphasized an efficiency justification for subsidies to higher education besides the classical arguments. We have shown that subsidizing education is optimal in a second-best sense, because it offsets the distortionary effects of taxation on human-capital accumulation. Some authors argue that if an inefficiency can be counteracted by subsidies, the distributional effects on graduates and non-graduates may not be regressive because these groups can negotiate on the value-added. We have called this viewpoint into question by emphasizing the role of windfall gains, which are likely to vitiate this optimistic view. So far, this argument has been neglected in the related literature. However, the thesis also shows that windfall gains are avoidable to a large extent. A voluntary graduate tax is shown to be a means of achieving this, and furthermore, as a self-selection mechanism. At least in our framework, a voluntary graduate tax offsets the distortionary role of taxation and is likely to be a means to establish a Pareto-superior policy to the mutual advantage of both graduates and non-graduates. With regard to most countries, it is acceptable to assume that the median voter is not a graduate. From the viewpoint of political economy, one might ask how it is possible that the median voter accepts a

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should be handled with some care. In the long run, however, the question remains [6] whether students reap subsidies at the expense of non-graduates. [6] However, distributional considerations are only part of the discussion. Most attention should be [6] given to efficiency arguments. With regard to the normative justification for educational subsidization, this paper has emphasized an efficiency justification for subsidies to higher education besides [6] the classical arguments. We have shown that subsidizing education is optimal in a second-best [6] sense, because it offsets the distortionary effects of taxation on human-capital accumulation. [6] Some authors argue that if an inefficiency can be countervailed by subsidies, the distributional [6] effects on graduates and non-graduates may not be regressive because these groups can negotiate [6] on the value-added. We have called this viewpoint into question by emphasizing the role of windfall [6] gains, which are likely to vitiate this optimistic view. Although this argument is not very difficult, [6] it has so far been neglected in the related literature. [6] However, the paper also shows that windfall gains are avoidable to a large extent. A voluntary [6] graduate tax is shown as a means of achieving this, and furthermore, as a revelation mechanism. [6] At least in our framework, a voluntary graduate tax offsets the distortionary role of taxation and is [6] likely to be a means to establish a Pareto-superior policy to the mutual advantage of both graduates [6] and non-graduates. [6] 19

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. #P#then y[l L 0

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hand, is a statistical software, made available under the General Public License (GPL). This means that the source code is freely available. It is often said that R is free software. The term "free" refers to ones freedom to run, copy, distribute, study, change and improve the software. R is part of the GNU Project. It was launched more than 20 years ago to develop a complete and freely available operating system. In particular, the R-package bootstrap contains (almost) all functions and data sets from Efron

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The Site for Libre Software Developers [httplibreacteuropefr]: "Libre Software is the European term for free software, a term coined by Richard Stallman to denote the users freedom to run, copy, distribute, study, change and improve the software. We have chosen to use the word "Libre" over "Free" because it avoids the "free beer" confusion. As Richard Stallman puts it: "Free Software" is a

- **4** Robles, Gregorio/u.a.: Who is doing it, 2001, S.

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The closer p to p*, the higher W, which denotes the utilitarian welfare. Due to the windfall gains, however, the lump-sum transfer declines. The higher p, the higher the graduation rate. G G.l The Educational-Choice Margin Under Proportional Taxation The present values of the net lifetime income of educated agents, VE, and of non-educated ones, VN, were given by . (6.3) and (6.4): Vi = (! " t)hyi - c(l -p) +-j-j- -+ H, Equation both yields: (l~t)yl(h-l)+y2 - c(l-p)=0 (f-t)(fe-l)(l + r) (1 - + r) y ~* y /-i i\ u(l-t) u(l-t) Let ib = (1~ ,'")(i+r) and u> = (1 + r), then y$ = ib *+u;. - . (G.l) As uj,p, and are all nonnegative, and p [0,1], G [0,1), yjf' is negative because the square root exceeds ip. Hence, y[p' is unique in the relevant range. G.[2] Educational-Choice Margin: Benchmark Case We labelled the non-interventionist, redistribution-free equilibrium, where the government does not implement any income policy, so that the educationalchoice margin is fully determined by market forces. This benchmark case is determined by p = t = 0. The educational-choice margin in this benchmark case can be derived by setting p = t = 0 in eq. (G.l). It yields: yl6ml = i> + yV + lj. (G.2) The optimal rate of subsidization, p* can be derived by setting (G.l) = (G.2): y2+"-(iy=T)= IT'2 +10 |rrf| = 4>2+u i - v (i - p) , o (1-p) = (!-) <=> p = t. G.3 The Lower Educational-Choice Margin

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● **17%** Einzelplagiatswahrscheinlichkeit

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enrol in a degree or, alternatively, to start working without a university degree. The share of those choosing higher education depends on the exogenously given distribution of y. The present values of the net lifetime income of educated agents, VE, and of non-educated ones, VN, are given by V? = (l-t)hvi-c(l-p)+(1-t)Vf + UVi)+K (3) 1 + r and by V,N = (l-t)yl+(- + H. (4) It is straightforward to find an ability level corresponding to that of an agent who is

of the 6As slopes quadratically, there is a second solution. It is given by ip yV2 + (i-tj s w> Pi and t are all nonnegative, and 0 < p < 1,0 < t < 1, this second solution is negative because the square root exceeds Hence, (5) is unique in the relevant range. cost of obtaining higher education is borne by the state. This can be seen by comparing (5) and (7). In the case of taxation without subsidization, three

and, therefore, does not distort the choice of educational investment. For the ongoing discussion, it is useful to define a benchmark equilibrium. For this, we take the non-interventionist, redistribution-free equilibrium, where the government does not implement any income policy, so that the educational-choice margin is fully determined by market forces. This benchmark case is determined by p = t = 0. The educational-choice margin is then given by y[bm] = i> + V 2 + oj. (6) The second case considers a distortionary taxation (0 < t < 1) and investments in higher education are not subsidized (p = 0). As noted above, we assume

• **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 7

Textstelle (Prüfdokument) S. 2012

rate of subsidization, p* can be derived by setting (G.l) = (G.2): y2+"-(iy=T)= IT'2 +10 |rrf| = 4>2+u i - v (i - p) , o (1-p) = (!-) <=> p = t. G.3 The Lower Educational-Choice Margin The lower educational-choice margin (7.2) in a system with proportional taxation and a voluntary graduate-tax scheme is obtained by equating a graduate's present value of net lifetime income after having drawn upon the scheme and the present value of net lifetime income without graduation. Thus, we equate (7.1) and (6.4). Consider first that the present value of second-period income of a graduate who is liable to a graduate tax, (1 t 8)yi +r)'> snnPnnes to 1 - t 2 u(l - t - 3)

3% Einzelplagiatswahrscheinlichkeit

Textstelle (Originalquellen)

efficiency, the government will set the rate of subsidization so that the lower educational-choice margin coincides with y[bm]. For that, we need to consider a graduate's present value of net lifetime income after having drawn upon the scheme. It is given by Vtm hVi(l -t) - C(l - 7) + (1 -1 - ft)y% (1(1++7f + The lower bound is then obtained by equating (17) and (4).13 It is given by jni (i-*) _§__ y l-t- ft 2u(l-t- ft) r (i-t) 3 r (1-7) V[l-t-ft 2u(l-t-ft)\ (l-t- 3) ' (18)

1 Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 16

Textstelle (Prüfdokument) S. 2

1 See e.g. (Atkinson and Stiglitz, 1985, p. 263) who argue that "[i]n empirical work, the unit of analysis is typically taken as the nuclear family or household, and

Textstelle (Originalquellen)

throughout their lives. Second, Pareto-superior subsidies can also be identified as "regressive" using this approach,3 1See Barbaro (2003) for a recent survey of the empirical literature 2See, e.g., (Atkinson and Stiglitz, 1985, p. 263) who argue that "[i]n empirical work, the unit of analysis is typically taken as the nuclear family or household, and the distribution based on all such units in existence at a particular

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 2

2% Einzelplagiatswahrscheinlichkeit

Textstelle (Prüfdokument) S. 3

4 The basic intuition for that has been put forth very clearly by (Baran and Sweezy, 1966, p. 150): "If what government takes would otherwise not have been produced at all, it cannot be said to have been squeezed out of anybody. Government

4% Einzelplagiatswahrscheinlichkeit

Textstelle (Originalquellen)

Then, if such complementarities apply, optimism on the distributional effect may be discounted. Bovenberg and Jacobs (2001) regard distribution and subsidies to education as Siamese twins. 4The basic intuition for that has been put forth very clearly by (Baran and Sweezy, 1966, p. 150): "If what government takes would otherwise not have been produced at all, it cannot be said to have been squeezed out of anybody. Government spending and taxing, which used to be primarily a mechanism for transferring

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 3

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Textstelle (Prüfdokument) S. 5

are, e.g. Heckman (1976), and Eaton and Rosen (1980). In both works, laborincome taxation was found to have a neutral effect if the educational outcome [6] is certain, but in both papers only the opportunity costs of obtaining higher

6 Previous examinations of the effect of taxation on human-capital accumulation

4% Einzelplagiatswahrscheinlichkeit

Textstelle (Originalquellen)

the budget, recent5 5Previous examinations of the effect of taxation on human-capital accumulation are, e.g., Heckman (1976), and Eaton and Rosen (1980). In both works, labor-income taxation was found to have a neutral effect, but contributions focus more on revenue. The impact of taxes on human-capital accumulation has become the central element in the recent literature. Trostel (1993, 1996) has

from the model of Creedy and Francois (1990) in two particulars. First, [2] we neglect the existence of externalities. A justification for fiscal activities is given by a distortion [2] in both papers only the opportunity costs of obtaining higher education are considered. [2] 5 [3] 3 Subsidization and efficiency [3] Starting from the benchmark case (p = t = 0), there would be no potential for Pareto improvement [3] through the establishment of public education,

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 4
- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. #P#then y[l L 0

Textstelle (Prüfdokument) S. 58

1 As V' ' slopes quadratically, there is a second solution. It is given by ip Jip2 + u> As ui,p, and t are all nonnegative, and 0 < p < 1, 0 < t < 1, [1] this second solution is negative because the square root exceeds Hence, (6.5)

1 As V' ' slopes quadratically, there is a second solution. It is given by ip

6% Einzelplagiatswahrscheinlichkeit

Textstelle (Originalquellen)

the educational-choice margin and, consequently, the lower the graduation rate. On the other hand, the educational-choice margin is lowered if part of the 6As slopes quadratically, there is a second solution. It is given by ip yV2 + (i-tj s w> Pi and t are all nonnegative, and 0 < p < 1,0 < t < 1, this second solution is negative because the square root exceeds Hence, (5) is unique in the relevant range. cost of obtaining higher education is borne by the state. This can be seen by comparing (5) and (7). In the

1 Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 7

Textstelle (Prüfdokument) S. 59

2 Optimal-tax theory states that the optimal tax is a lump-sum tax (see e.g. Eaton and Rosen, 1980, p. 706). We can prove that a lump-sum tax, denoted by r, does [2] not influence the educational-choice margin: The present value of a graduate's [2] lifetime income is given by hyt c + Vi *'~* r and that of a non-graduate by [2] y% 1 + ~~ r- By equating both, the resulting educational-choice margin is

2 Optimal-tax theory states that the optimal tax is a lump-sum tax (see e.g. Eaton

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6% Einzelplagiatswahrscheinlichkeit

Textstelle (Originalquellen)

educational-choice margin falls and p rises. In the opposite [3] case, p falls if | < 1. [3] Proof. If | = 1, it follows that the term jjzfj" = 1 arL(i, hence, y = tp + \A/> 2 + oj = y brn . m [3] 7Optimal-tax theory states that the optimal tax is a lump-sum tax (see, e.g., (Eaton and Rosen, 1980, [3] p. 706)). We can prove that a lump-sum tax, denoted by t, does not influence the educational-choice margin: [3] The present value of a graduate's lifetime income

influence the educational-choice margin: [3] The present value of a graduate's lifetime income is given by hyi c+ Vt t and that of a non-graduate [3] by Hi (1 + IT?) T- By equating both, the resulting educational-choice margin is independent of t. [3] 8 [12] 12 The main differences between a voluntary graduate tax and a loan scheme with income-related repayment [12] can be seen when we consider that the outcome

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. #P#then y[l L 0

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Textstelle (Prüfdokument) S. 61

The fact that a rate of subsidization up to t raises aggregate income implies that subsidies may be Pareto-improving. It is potentially feasible to distribute [1] the efficiency gains so that all agents, including the non-graduates, are better off, although non-graduates have not benefited directly from subsidization. As [1] noted in Section 4.3, Johnson (1984) argues that non-graduates' incomes may also) be increased in such a manner, so that subsidization is equitable. In the [1] next section, therefore, we will go into in more detail about the equity effects of subsidies to higher education. We will show that there is a counterforce

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11% Einzelplagiatswahrscheinlichkeit

Textstelle (Originalquellen)

for simplicity reasons, we denote y[p] by y. Differentiating W with respect to the rate of subsidization yields y(p)-y'(p)f(y l-uy- -h + cf(y)-y'(p) = 0. (9) As a first order condition we derive p = t (see Appendix B). The fact that a rate of subsidization up to t raises aggregate income implies that subsidies may be Pareto-superior. It is potentially feasible to distribute the efficiency gains so that all agents, including the non-graduates, are better off, although non-graduates have not benefited directly from subsidization. As noted in the introduction, Johnson (1984), e.g., argues that non-graduates' incomes may be increased in such a manner. In the next section, therefore, we will go into in more detail about the equity effects of subsidies to higher education. We will show that there is a counterforce that limits the distributive virtues of subsidies to education. 4 Subsidization and

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 10

Textstelle (Prüfdokument) S. 62

(6.10) [1] 1 "Perhaps [...] the money which [the taxpayer] is required to pay directly out of

1 "Perhaps [...] the money which [the taxpayer] is required to pay directly out of

Textstelle (Originalquellen)

for a zero expected cost investment stimulus. Garcla-Penalosa and Walde (2000) propose a lump-sum graduate tax in a model with capital-market imperfections and an uncertain outcome 10"Perhaps [...] the money which [the taxpayer] is required to pay directly out of his pocket is the only taxation which he is quite sure that he pays at all". (Mill, 1848[1994], p. 237). from the educational investment. The lump-sum graduate

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 14

0% Einzelplagiatswahrscheinlichkeit

Textstelle (Prüfdokument) S. 66

his pocket is the only taxation which he is quite sure that he pays at all". (Mill, 1848(1994], p. 237).

Textstelle (Originalquellen)

0% Einzelplagiatswahrscheinlichkeit

Textstelle (Prüfdokument) S. 67

2 In this framework, we consider only a proportional tax system. Under this simple tax regime, the graduate tax is also simple to levy. However, under more complicated tax structures, in particular if taxation is progressive and, e.g. married [2] couples can be taxed jointly, a graduate tax may create further problems. Consider, for example, if only one partner has invested in higher education. What

2 In this framework, we consider only a proportional tax system. Under this simple

8% Einzelplagiatswahrscheinlichkeit

Textstelle (Originalquellen)

The reason, as mentioned above, is the lack of information on individuals' endowments. This missing information is the main source of problematic equity effects. nIn this framework, we consider only a proportional tax system. Under this simple tax regime, the graduate tax is also simple to levy. However, under more complicated tax structures, in particular if taxation is progressive and, e.g., married couples can taxed jointly, a graduate tax may create further problems. Consider, for example, if only one partner has invested in higher education. What should then be regarded as the tax base for the graduate tax? The author is indebted to Barbara Wolfe for highlighting this point. In this

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 15

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3 If the expression under the square root becomes negative, the economic intuition is the following: the higher 7 the greater the size of agents with the lowest ability who invest in higher education. In this case (that we have ruled out), a fourth [3] group of agents accrues starting from the left-hand side of the density function of y. If 7 is so huge that the square root becomes negative, then no agent will reject

6% Einzelplagiatswahrscheinlichkeit

Textstelle (Originalquellen)

if the subsidy is set to 71 = t + p [1 + y[bm] 0] (19) where 6 = + It is obvious that the square root in (18) cannot become negative14 for 13It was: Vf= yi (1 - t) + + N. 14If the square root becomes negative, the economic intuition is the following: the higher 7 the greater the size of agents with the lowest ability who invest in higher education. In this case (that we have ruled out), a fourth group of agents accrues starting from the left-hand side of

- **1** Barbaro, Salvatore: Tax Distortion, Countervailing Subs..., 2004, S. 16

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