„Fakten oder Artefakte? Zur wissenschaftlichen und politischen Produktion von Evidenzen“

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Input: zum Januarkolloquium:

“What are numbers for? Bildung, Wirtschaft, Evidenz”

Uni Zürich, Institut für Erziehungswissenschaft, 21.-22.1.2014

Agenda (‚Täterperspektive')

- Qualität und Quantität, warum der Streit/Wettbewerb?
  - xxx-Disziplinarität: Pädagogik, Erziehungswissenschaften, Kontexte…
  - ‚zwei, drei Kulturen': Geistes-, Natur-, Sozialwissenschaften?

- Ziffern und Buchstaben, Reflexion, ‚Doppelmühle'
  - ?‚(Irr)Glaube'1: „Ziffern bezeichnen 'Fakten' (Buchstaben nicht)"
  - ?'(Irr)Glaube'2: „Ziffern führen automatisch zur ‚künstlichen' Verkürzung (‚Reduktionismus') von ‚wirklicher Realität'"
  - ?'(Irr)Glaube'3: „Ohne Ziffern keine (‚wirklichen') Evidenzen, Ziffern sind notwendiges Medium für Nachweis von (kausalen) Evidenzen"

- Beispiele der Verwendung von Ziffern
  - Deskriptive Informationen, Strukturen, Vergleiche
  - Bildungsberichterstattung, quantitativer Teil
  - Benchmarks
  - Evaluierung
  - Kausale Analysen

Qualität und Quantität, warum der Streit/Wettbewerb?

Qualität und Quantität, warum der Streit/Wettbewerb?

- Wo kommen die Ziffern her? Wissenschafts-‘extern‘ oktroyiert oder wissenschafts-‘interne‘ Dynamik?

- Extern: Neoliberalismus, new Governance, Ökonomisierung…

- …interne Wissenschaftsdynamik: Grenzen der Disziplinarität(en), These der ‚zwei Kulturen‘ (C.P.Snow) bzw. ‚drei Kulturen‘ (W.Lepenies)
  - Bildung in ‚erster Kultur‘ verankert (Literatur-Philosophie-Geisteswissenschaft)…
  - …v.a. 1920er bis 1950er/1960er Aufstieg der Naturwissenschaften/Technik…
  - …seit 1970ern: Aufstieg der Sozialwissenschaften (v.a. Ökonomie…)

- Internationale Organisationen haben beides entwickelt und gefördert, gewisses ‚Feindbild‘
  - OECD seit Gründungsphase Science/Technology und Research & Development
  - EU (v.a. Kommission): sozialwissenschaftliches Paradigma

Ziffern und Buchstaben, Reflexion: ‚Doppelmühle‘

Ziffern und Buchstaben, Reflexion: ‚Doppelmühle‘

- Botschaften:
- Ziffern sind nichts ohne Buchstaben (Bedeutung)…
  - gibt keine Fakten ohne Bedeutung (unreflektiert-reflektiert)
- …Buchstaben werden durch Ziffern wesentlich angereichert…
  - Ziffern (zählen, messen) geben zusätzliche Dimension in Beschreibung und Verständnis von ‚Objekten‘ (wie immer man die ‚Realität‘ konzipiert…)
  - von ja/nein zu mehr/weniger…
  - …im Prinzip ist alles quantitfizierbar (geschieht auch im Alltagsverständnis)…
- …aber Quantifizierung ist nicht trivial und nicht neutral
  - N.TRIVIAL: lange, komplexe und umstrittene Prozesse im Wechselspiel von Buchstaben- Ziffern-Buchstaben-etc. (Beispiele VGR, Verteilung/Ungleichheit, Beschäftigung-Arbeitslosigkeit, Bildungsressourcen, -ergebnisse…)
  - N.NEUTRAL: Informations-Wissensgewinn (+), Normierung-Normalisierung (-)
- Ziffern entfalten eigene Dynamik (ANT: AkteurInnen im Geschehen)
  - unhintergehbar, wenn begonnen, ‚Eigenleben‘
  - Spirale Ziffern-Buchstaben-Ziffern (Z-B-Z)…Transformation Information>Wissen

?‚(Irr)Glaube‘1: „Ziffern bezeichnen 'Fakten' (Buchstaben nicht)“

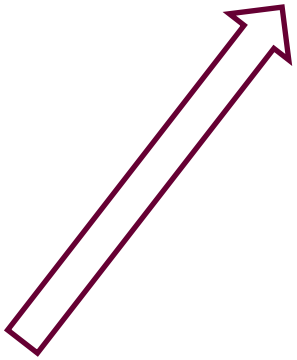
- TrägerInnen: v.a JournalistInnen, unterstützt von EmpiristikerInnen/ ‚PositivistInnen‘…
  - Spruch: „…and remember: Without data, you are just another person with an opinion” (S.Schleicher, OECD)…
  - …zynische Version: ‚Glaube keine Statistik, die du nicht selbst gefälscht hast…‘

- Wesentliches Problem: **unreflektierte Verwendung** von Ziffern als ‚Fakten‘ findet andauernd statt…
  - Ziffern können niemals ohne Buchstaben (Bedeutung) Fakten repräsentieren…
  - …keine Alternative zur Reflexion…(unreflektierte Verwendung kann nicht ungeschehen gemacht werden, z.B. einfache Zurückweisung funktioniert nicht)…
  - …Spirale Z-B-Z-B-Z…

- 2 Fragen:
  - ändert die Quantifizierung die Objekte? Ja, zusätzliche Beschreibungsdimension
  - Ist diese Änderung ‚wertgeladen‘? Ja (+ und -), Wissensgewinn und Normierung
  - Bezug zu Macht/Herrschaft? Tendenziell hegemonial, aber im Prinzip Ressource für beide Seiten, Bedeutungs-Glaubwürdigkeitskämpfe unhintergehbar

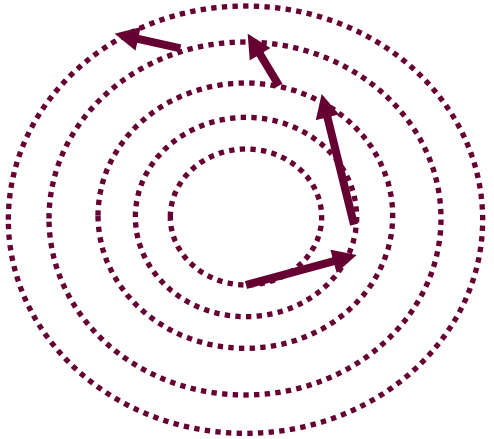
‚Modelle' von Wissensgewinn

kumulativ



kritisch

konfligierend



?‘(Irr)Glaube‘2: „Ziffern führen automatisch zur Verkürzung (‚Reduktionismus‘) von Realität“

- TrägerInnen: v.a. ‚fundamentalistische‘ AnhängerInnen qualitativer Paradigmen
  - Spruch: ‚Stehst du mit einem Fuß im siedenden Wasser und mit dem anderen auf einem Eisblock, ist die Befindlichkeit durchschnittlich gut‘
- 2 ‚**diskursive Asymmetrien**‘ vorausgesetzt:
  - Verwendung von Ziffern erfolgt (zuerst) grundsätzlich unreflektiert/unkritisch, und…
  - …Macht/Herrschaftsaspekt dominiert immer den Wissensgewinn
  - ‚Kritik‘ stellt Reflexion her, aber trotz ‚Kritik‘ ist das ‚Eigenleben‘ der Fakten und die normierende Reflexion stärker…
  - …kritischer Wissensgewinn‘ durch Quantifizierung unmöglich oder sehr unwahrscheinlich…
  - …daher Ablehnung von Ziffern, zurückweisende Kritik

- Fragen:
  - ‚diskursive Asymmetrien‘ hinterfragbar (Rolle von Quantifizierung von Herrschaft dabei?)
  - ja/nein vs. mehr/weniger: m/w legitimatorisch? j/n stärker reduktionsitisch?

?‘(Irr)Glaube‘3: „Ohne Ziffern keine Evidenzen, notwendiges Medium für Nachweis“

- TrägerInnen: v.a. ‚fundamentalistische‘ AnhängerInnen (disziplinärer) quantitativer und kausalanalytischer Paradigmen
  - Spruch: „…vergeblich beklagt sich die Vernunft, daß das Vorurteil die Welt regiert; denn wenn sie selbst die Welt regieren will, muß sie sich ebenfalls in ein Vorurteil verwandeln…“ (Hippolyte Taine nach E.Friedell)

- **Vorteile von Ziffern** im Glaubwürdigkeitskampf
  - relationale Verknüpfungen, Modelle, Abbildungen (komplexe Artefakte)…
  - …entwickeln ‚**Eigenleben**‘ (werden zu AkteurInnen)…
  - …Glaubwürgigkeitskämpfe innerwissenschaftlich und wissenschaftsextern…
  - …Ziffern haben ‚Multiplikatorwirkung‘ im Glaubwürdigkeitskampf (Prestige, Verwendbarkeit)

- Konsequenzen in Verwendung
  - ‚**zweites Eigenleben**‘ ermöglicht Verwendung unabhängig von Verständnis der Bedeutung (JournalistInnen, VisualisiererInnen, IntermediärInnen) [rück zu 1]
  - Rigorosität: Bias gegen Handeln, Legitimation dominiert Handeln, Pufferfunktion der Wissenschaft
  - ‚Logik des Konstruktivismus‘: >B-Z-B-Z-B-Z-B-Z-B…

Ziffern & Buchstaben (Z-B…) Beispiele

- VGR Volkswirtschaftliche Gesamtrechnung, BIP, Wachstum, Produktivtät, Lebensqualität

  Report by the Commission on the Measurement of Economic Performance and Social Progress. J.E.STIGLITZ, Chair, A. SEN, Chair Adviser, J.-P.FITOUSSI, Coordinator; www.stiglitz-sen-fitoussi.fr; Themen: GDP (incl. Konsumption und Verteilung) + QL + S

- Beschäftigung, Arbeitslosigkeit (Formen), Prekarität, ‚Working Poor'

  ESDE-Review (s.o.), ILO-Aktivitäten ‚Decent Work'; ‚Out of LF; Beispiel Jugendarbeitslosigkeit, ‚sozialer Fakt'

- Sozialstatistik: Verteilung (Einkommen, Vermögen), Ungleichheit, Armutsgefährdung (vgl. neuer ‚Krisenbericht' WEF)

  ESDE-Review: C DG for Employment, Social Affairs and Inclusion (2011). Employment and Social Developments in Europe 2011 (. Luxembourg: Publications Office of the European Union http://ec.europa.eu/social/BlobServlet?docId=7294&langId=en

  OECD (2008). Growing Unequal? Income distribution and poverty in OECD countries. Paris; OECD (2011) Divided We Stand. Why Inequality Keeps Rising. Paris.

- Erziehung/Bildung

  EAG, EU-Indikatoren, nationale Bildungsberichterstattung

  Ergebnisorientierung vs. volles Prozessmodell (Kontext, Input, Prozess, Output/Outcome); Standards & Governance (Oelkers/Reusser 2008)

  Kompetenzen: Niveau und Streuung, Kompetenzbereiche (Wirtschaft und Gesellschaft); EU-Schlüsselkompetenzen. Civic Indikatoren (CRELL), PIAAC-Erhebung…

Konkretisierungen zu 1: Produktion ‚sozialer Fakten‘

- Sozialstatistik: Verteilungsfragen
- Produktion von ‚sozialem Fakt‘: Jugendarbeitslosigkeit
- Ergebnisorientierung (‚Kompetenzfixierung‘): Verkürzung statt Erweiterung von Information/Wissen

Verteilungsfragen als ‚soziales Faktum‘

- …eine kondensierte Darstellung

WEF:
‚Global Risks 2014‘

Quelle: Die Presse, 18.1.2014, S.16

2 Darstellungen

- Quelle: Till van Treeck, Comments on „Fiscal Policy: Time for the Renaissance of Keynesianism“, paper by P. Arestis, Symposium „75 Jahre General Theory of Employment, Interest and Money”, Arbeiterkammer Wien, 29.09.2011

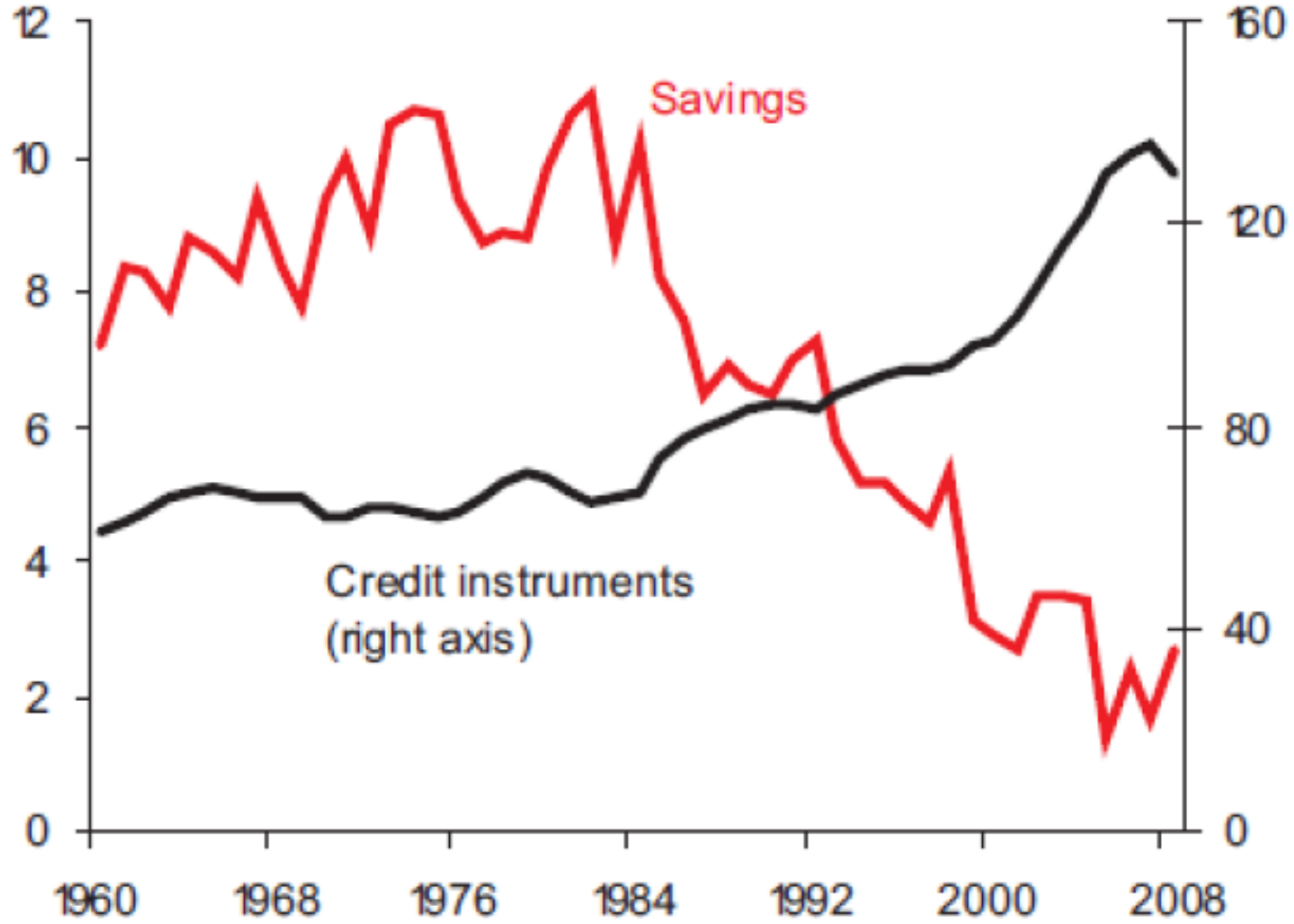
2 Darstellungen…

- …als Produktion von ‚sozialem Faktum‘

Quelle: Till van Treeck, Comments on „Fiscal Policy: Time for the Renaissance of Keynesianism“, paper by P. Arestis, Symposium „75 Jahre General Theory of Employment, Interest and Money”, Arbeiterkammer Wien, 29.09.2011

Share of the richest households in total private household incomes USA, in %

Savings and debt of private households relative to disposable income, USA, in %

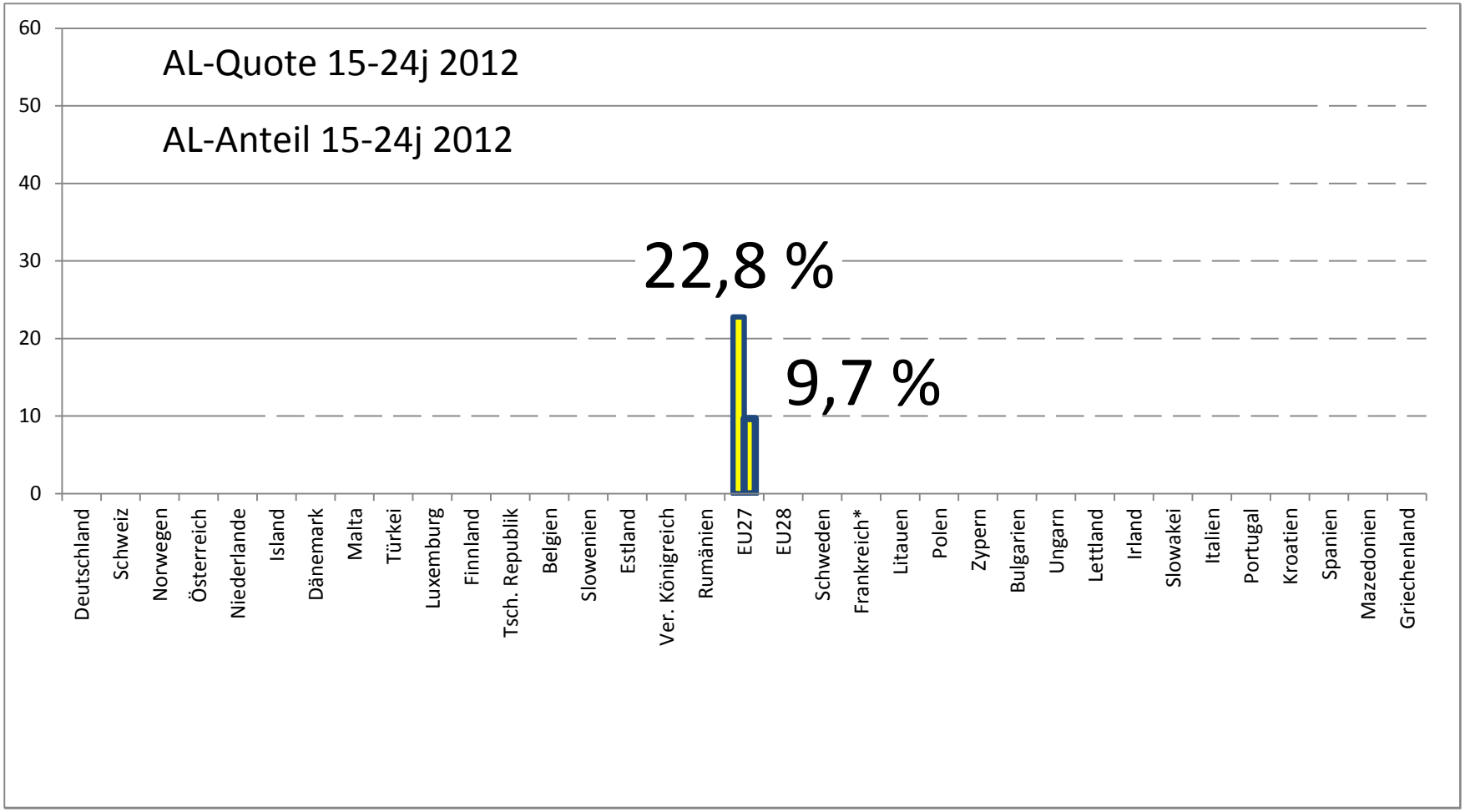


Jugendarbeitslosigkeit und Lehrlingsausbildung

- Daten und ‚soziale Fakten'
  - „(mehr als) 50% der Jugendlichen sind arbeitslos"
  - „Lehrlingsausbildung oder ‚Duales System' schützt vor Jugendarbeitslosigkeit"

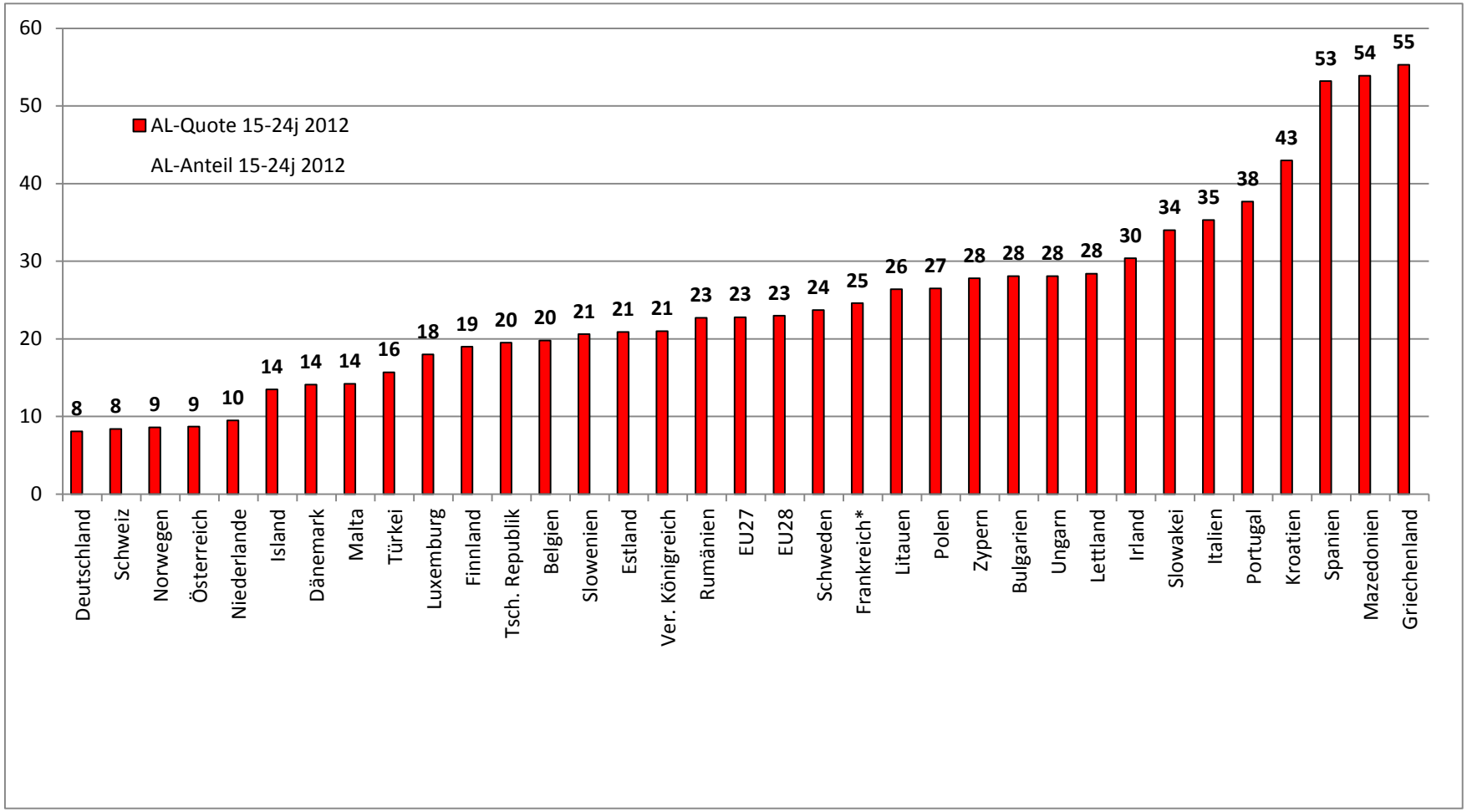
- Welche Indikatoren?
  - OECD bereits in ‚Transition-Review': Arbeitslosenrate kein guter Indikator für Jugendliche wegen institutioneller Unterschiede (Definition LF; Zählungsmodus, etc.)…
  - …trotzdem wird ‚notorisch' die AL-Rate verwendet und mit dem AL-Anteil verwechselt…

Jugendarbeitslosigkeit in EU 27
2 Indikatoren: AL-Rate/Quote, AL-Anteil



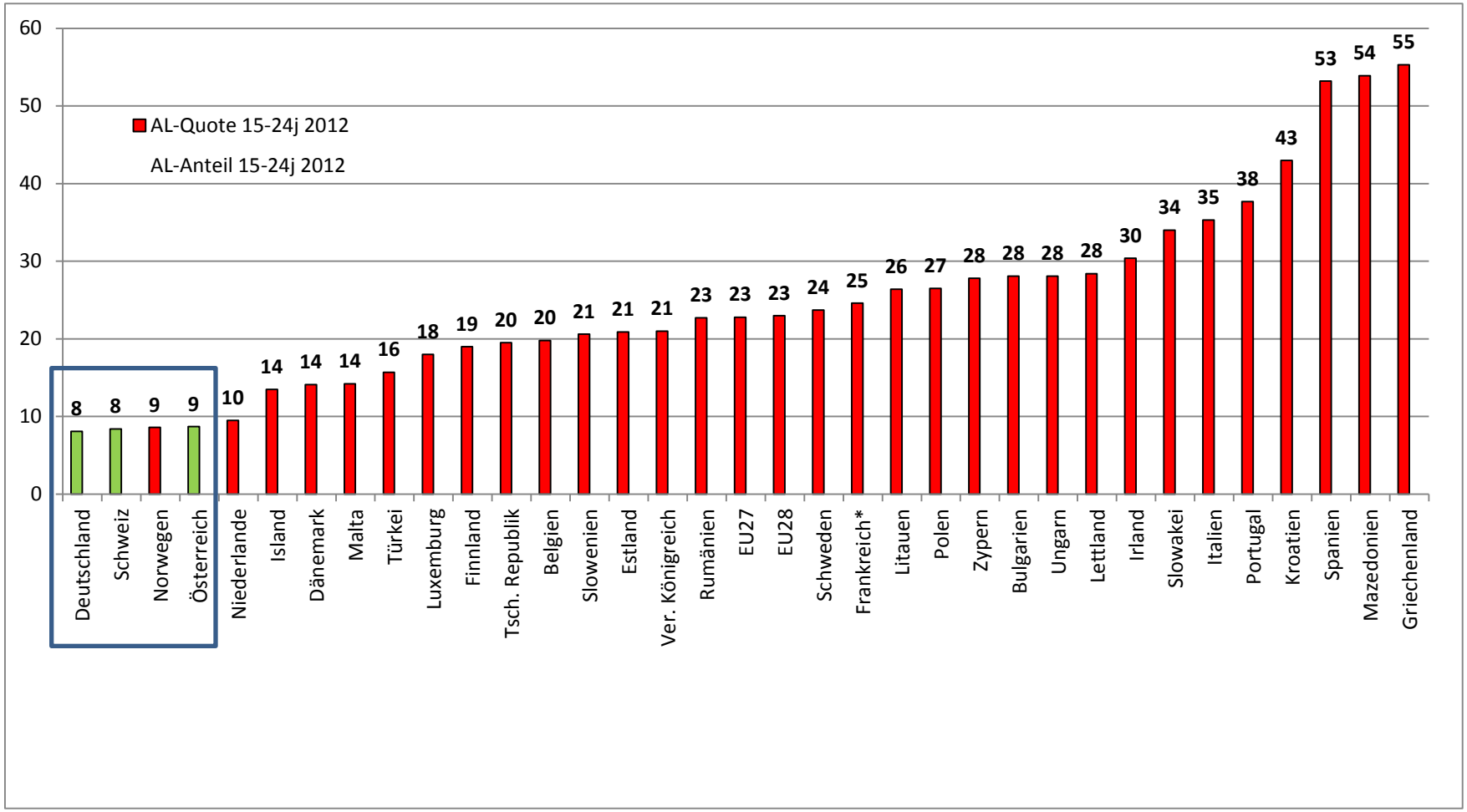
- Gleiche Zahl an arbeitslosen Jugendlichen
  - bezogen auf unterschiedliche Gesamtheiten: **Rate**=Arbeitskräftepotential, **Anteil**=Bevölkerung

Jugendarbeitslosigkeit
Arbeitslosenrate 15-24 Jährige, Länder



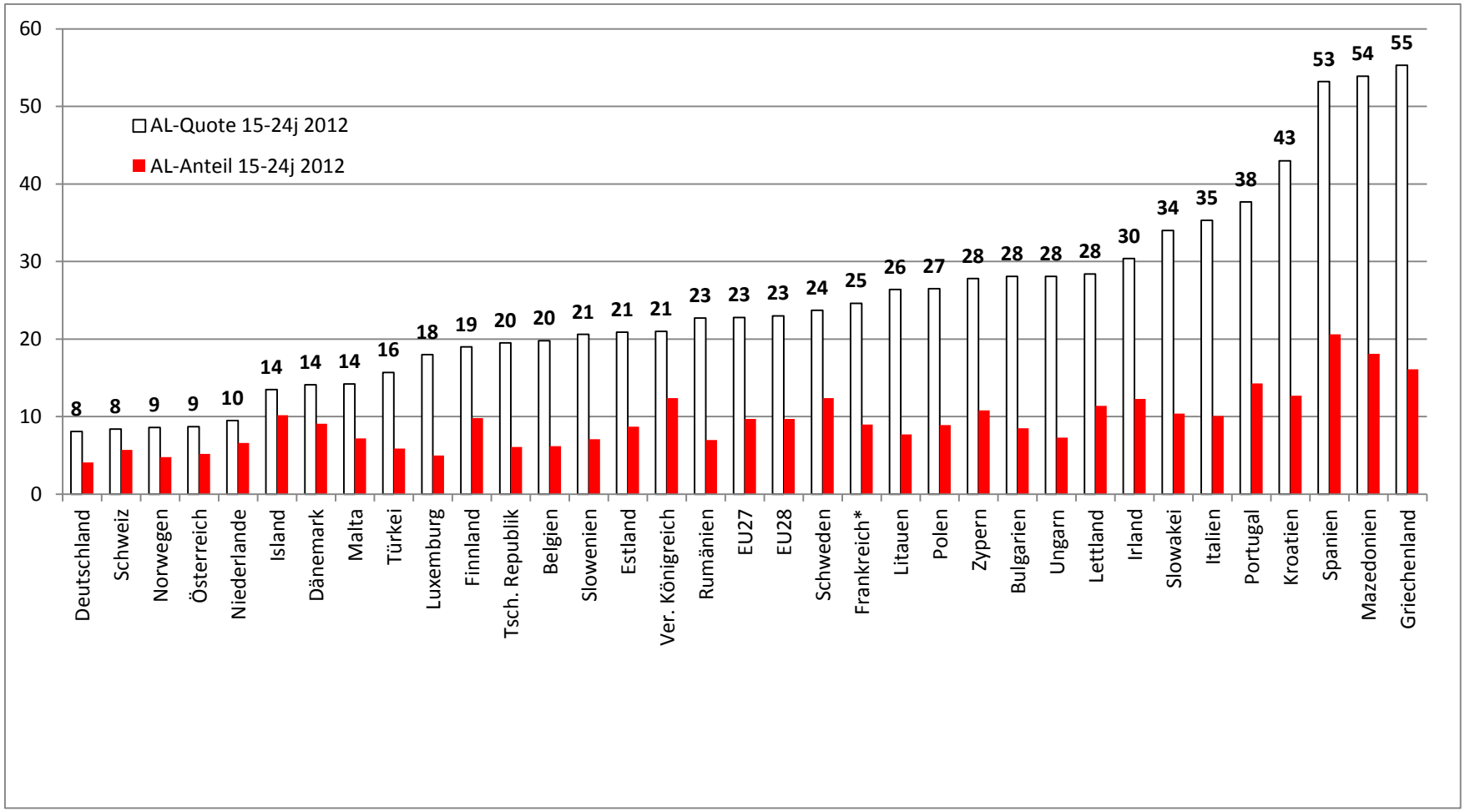
- **Rate** zwischen 8% und 55%

Jugendarbeitslosigkeit
Arbeitslosenrate 15-24 Jährige, Länder



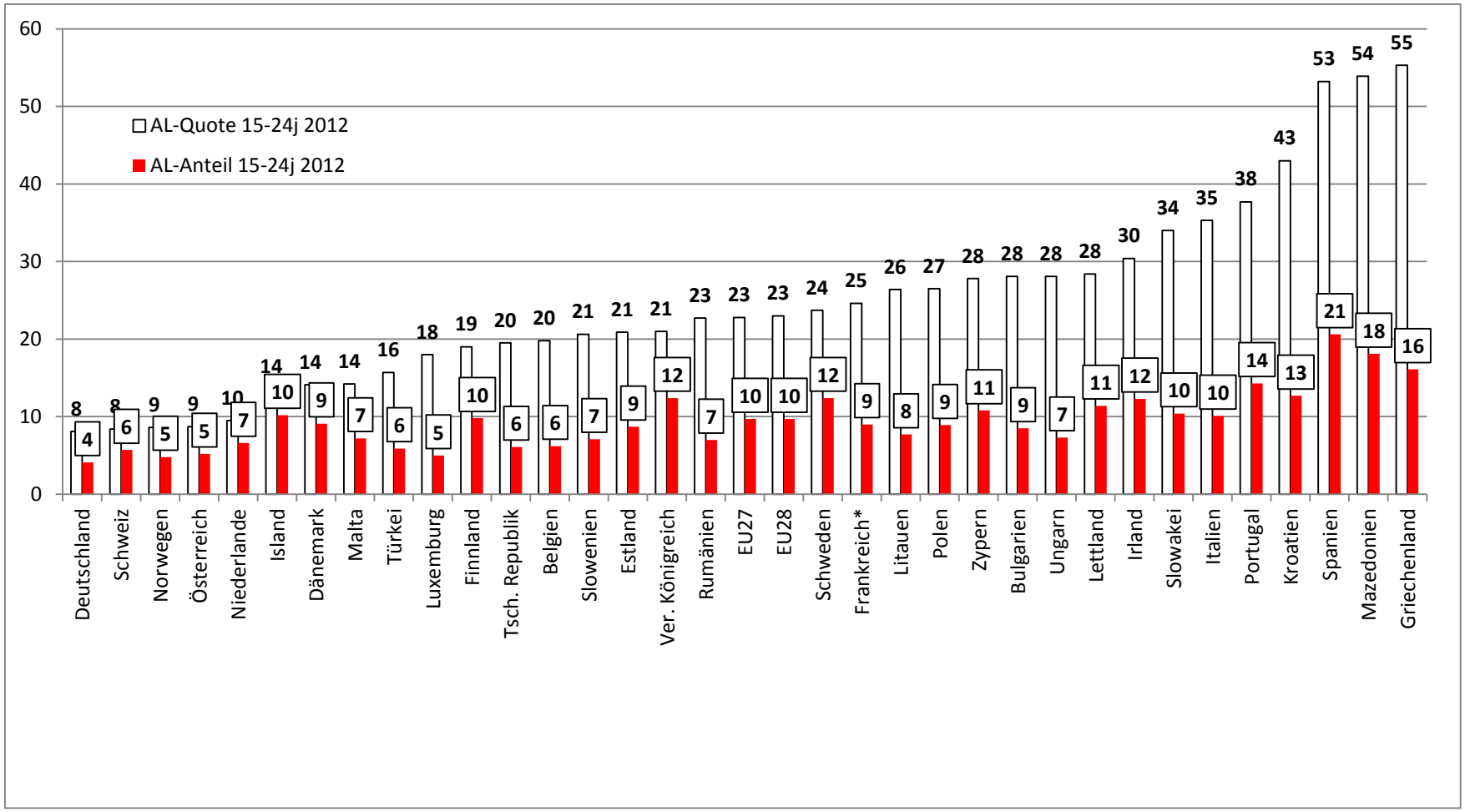
- **Rate**: Deutschland (1), Schweiz (2), Österreich (4), 8 - 9%

Jugendarbeitslosigkeit
Arbeitslosenrate & anteil 15-24 Jährige, Länder



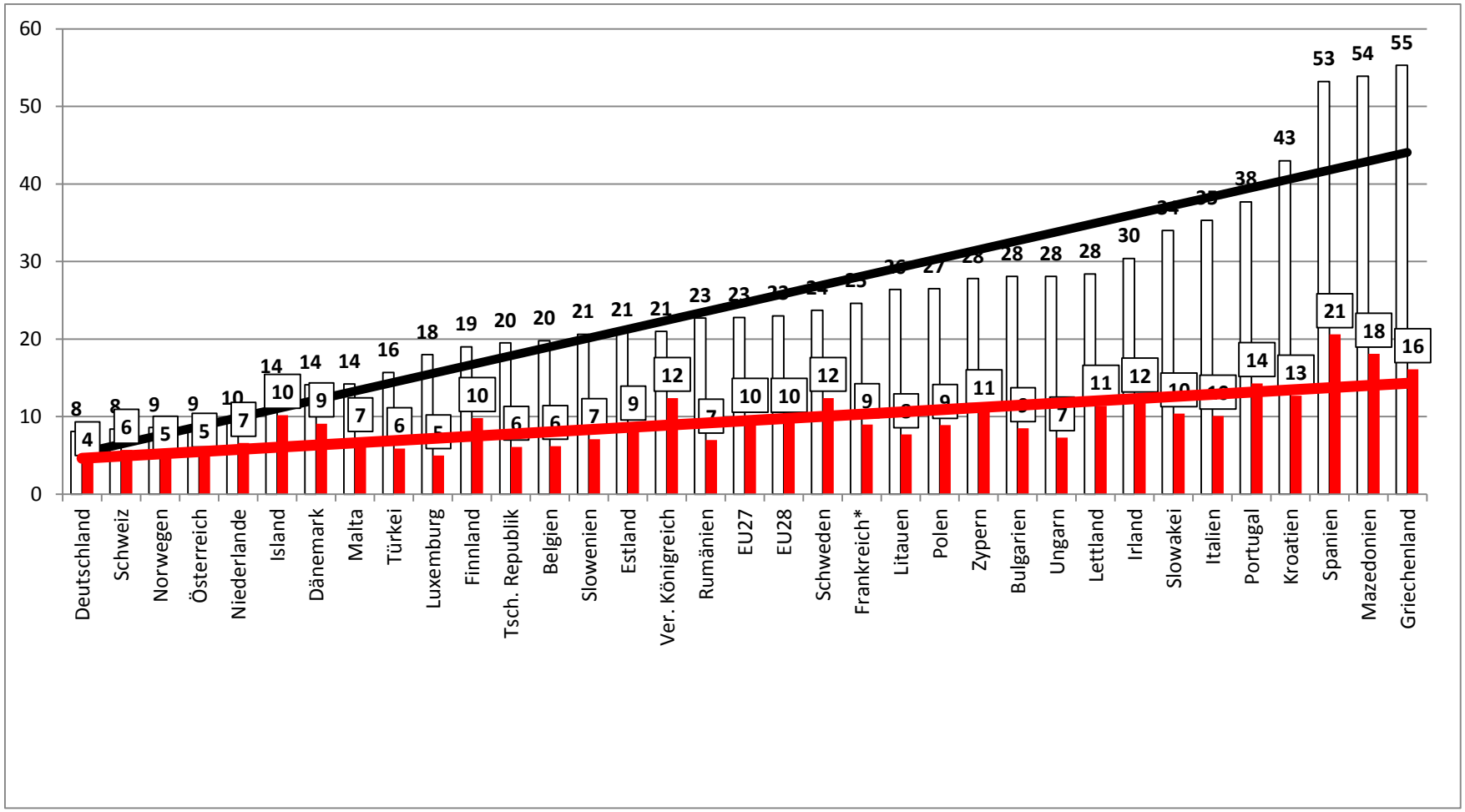
- **Anteil**: arbeitslose Jugendliche an der gleichaltrigen Bevölkerung 4% - 21%

Jugendarbeitslosigkeit
Arbeitslosenrate & anteil 15-24 Jährige, Länder



- AL-Anteil deutlich geringer als AL-Rate
  - institutionell bestimmt: wer zählt zum Arbeitskräftepotential?

Jugendarbeitslosigkeit
Arbeitslosenrate & anteil 15-24 Jährige, Länder



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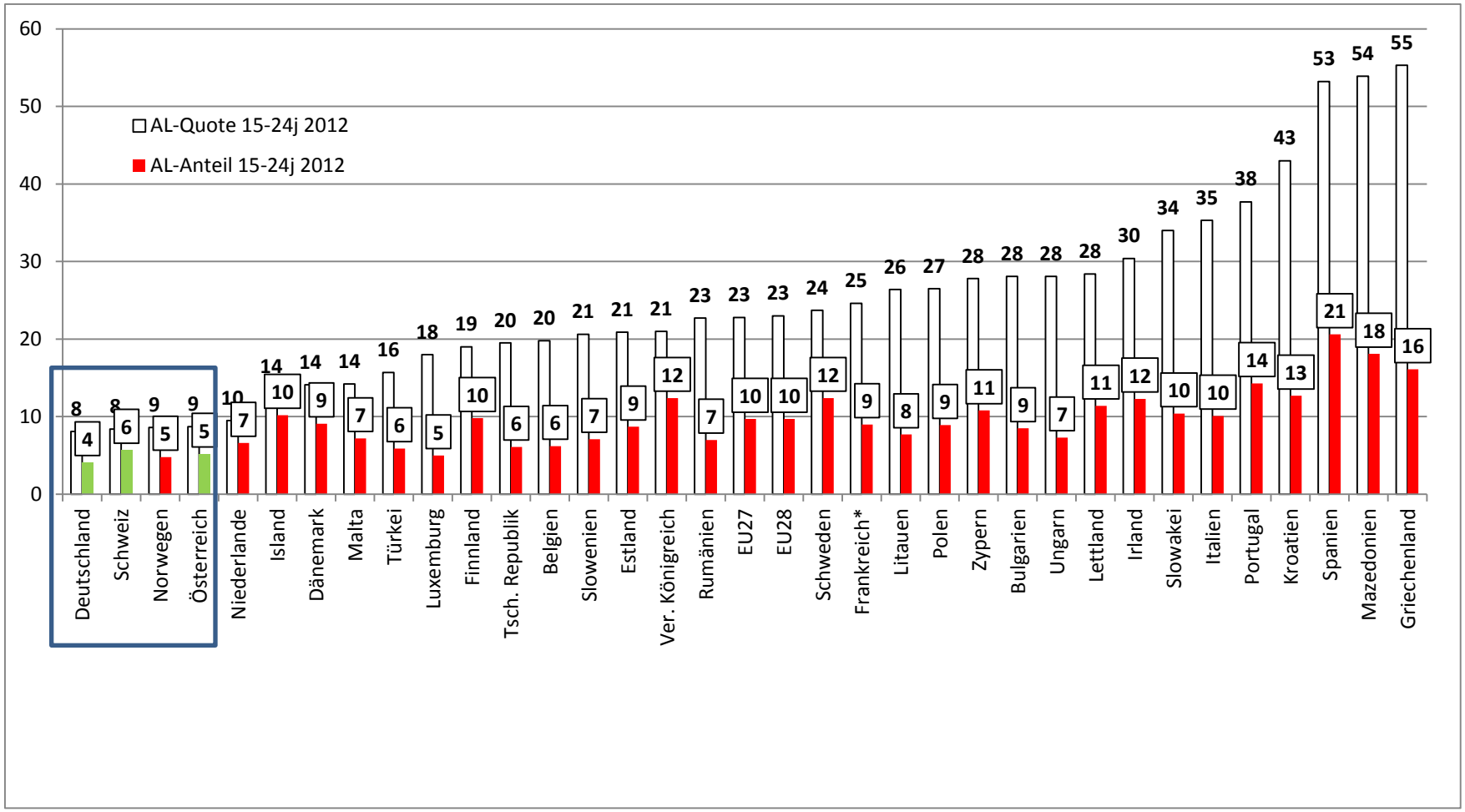
Jugendarbeitslosigkeit
Arbeitslosenrate & anteil 15-24 Jährige, Länder

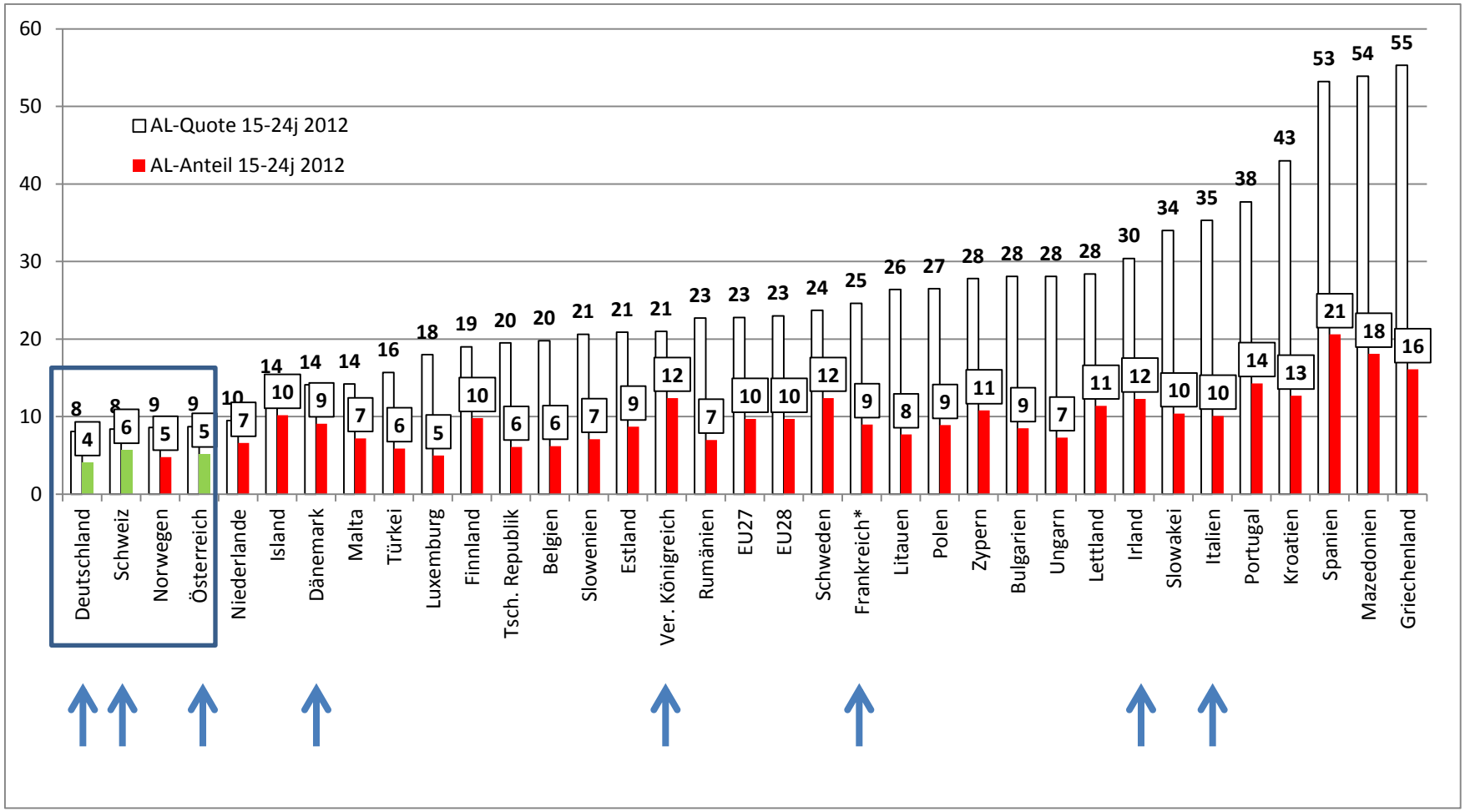


- **Anteil** Deutschland, Schweiz, Österreich
  4% - 6%

Lehrlingsausbildung 'Heilmittel' gegen Jugendarbeitslosigkeit? NEIN

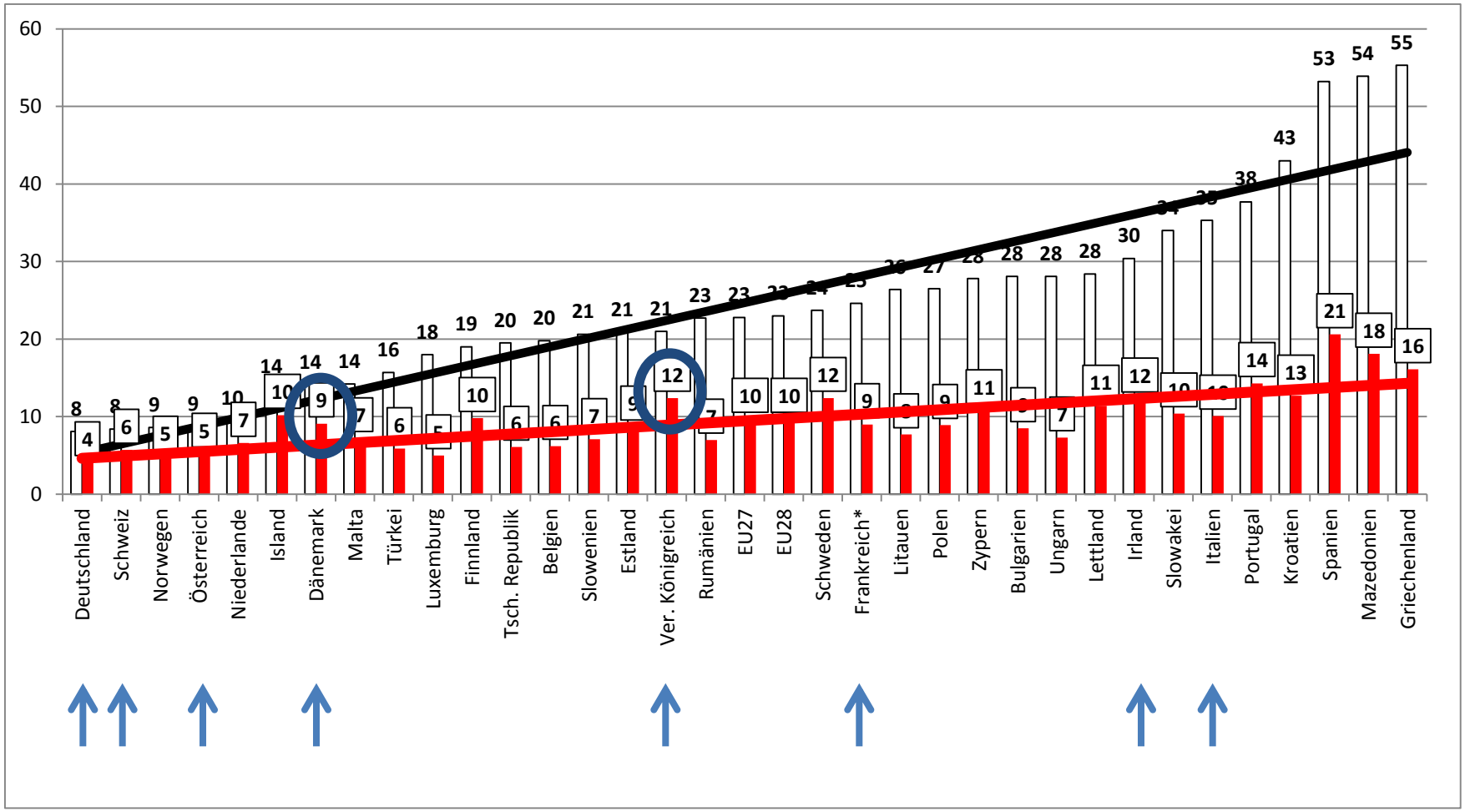
- Niedrige Jugendarbeitslosigkeit wird gerne auf Lehrlingsausbildung zurückgeführt…
- …daher große politische Anstrengungen, diese Form der Ausbildung zu ‚exportieren' (G20; INAP; Deutschland…)
- Aber: Zusammenhang weder eindeutig, noch kausal zu interpretieren…
- …von der Forschung her klar:
  - "While a positive relationship between apprenticeship and low youth unemployment can be observed over time, **it would be misguided to see apprenticeship primarily as a „cure" for high youth unemployment**. Apprenticeship is first and foremost about skill development to the benefit of companies, their employees and the wider economy. Apprenticeship can accommodate a wide range of abilities and aptitudes because it accurately reflects the equally wide range of skills required in a modern economy. However, **it is not a sufficient solution to improving the labour market transition of young people with poor school achievements or other disadvantages**." (Steedman 2012, S.2)

Jugendarbeitslosigkeit
Arbeitslosenrate & anteil 15-24 Jährige, Länder



- 8 Länder mit regulierter Lehrlingsausbildung
  - Steedman 2012: zwischen 10 und 44 Lehrlingen/1.000 Beschäftigte

Jugendarbeitslosigkeit
Arbeitslosenrate & anteil 15-24 Jährige, Länder



- 8 Länder mit regulierter Lehrlingsausbildung
  - Steedman 2012: zwischen 10 und 44 Lehrlingen/1.000 Beschäftigte

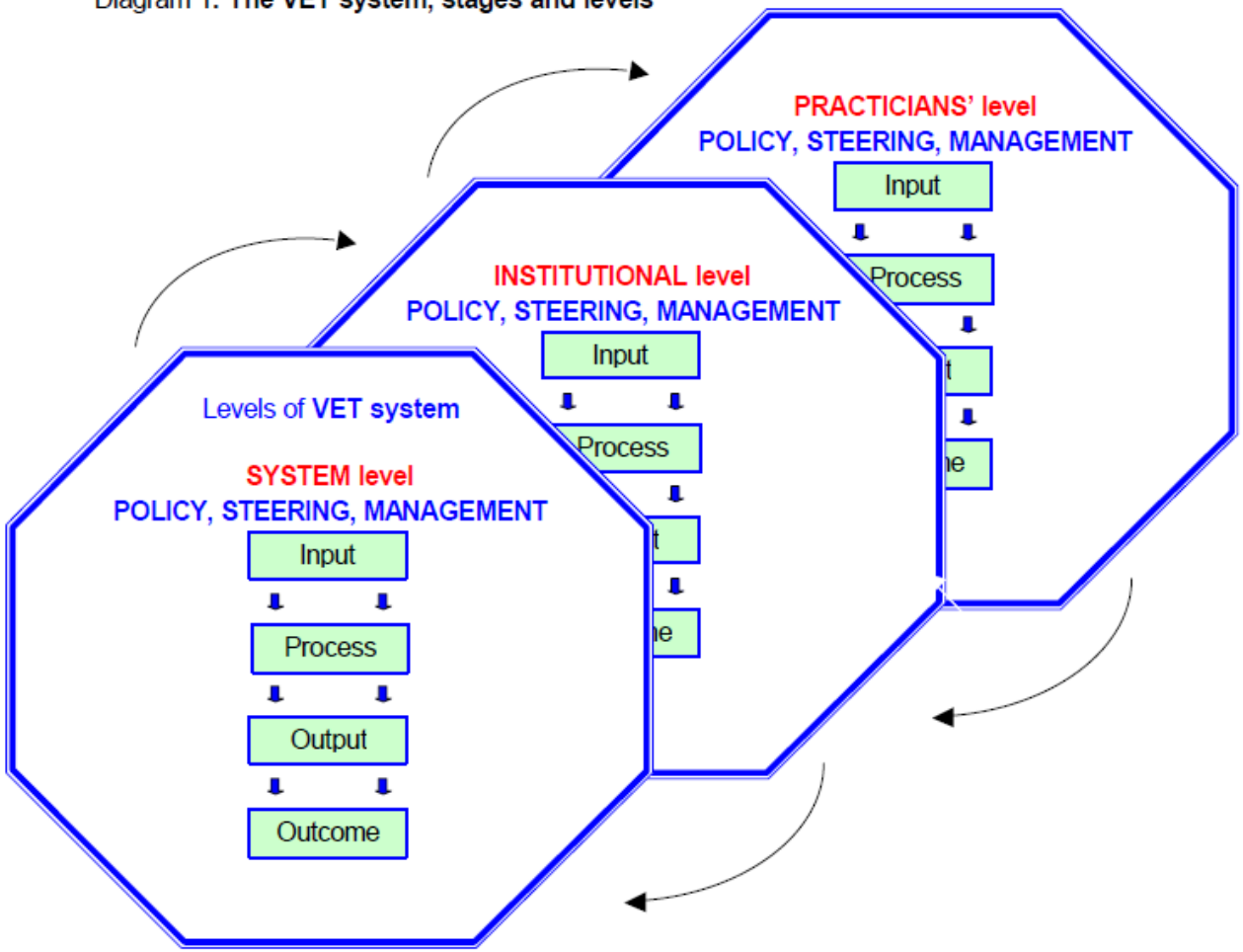
Erziehungs/Bildungswesen
Governance, Qualität, statistische Erfassung

- Erziehungs-Bildungsstatistik als ‚Normalisierung' und Wissensgewinn…
- …Entwicklung sehr langsam und gegen Widerstände…
- Heute: Ergebnisorientierung oder volles Modell?

Volles Modell, institutionelle Ebenen

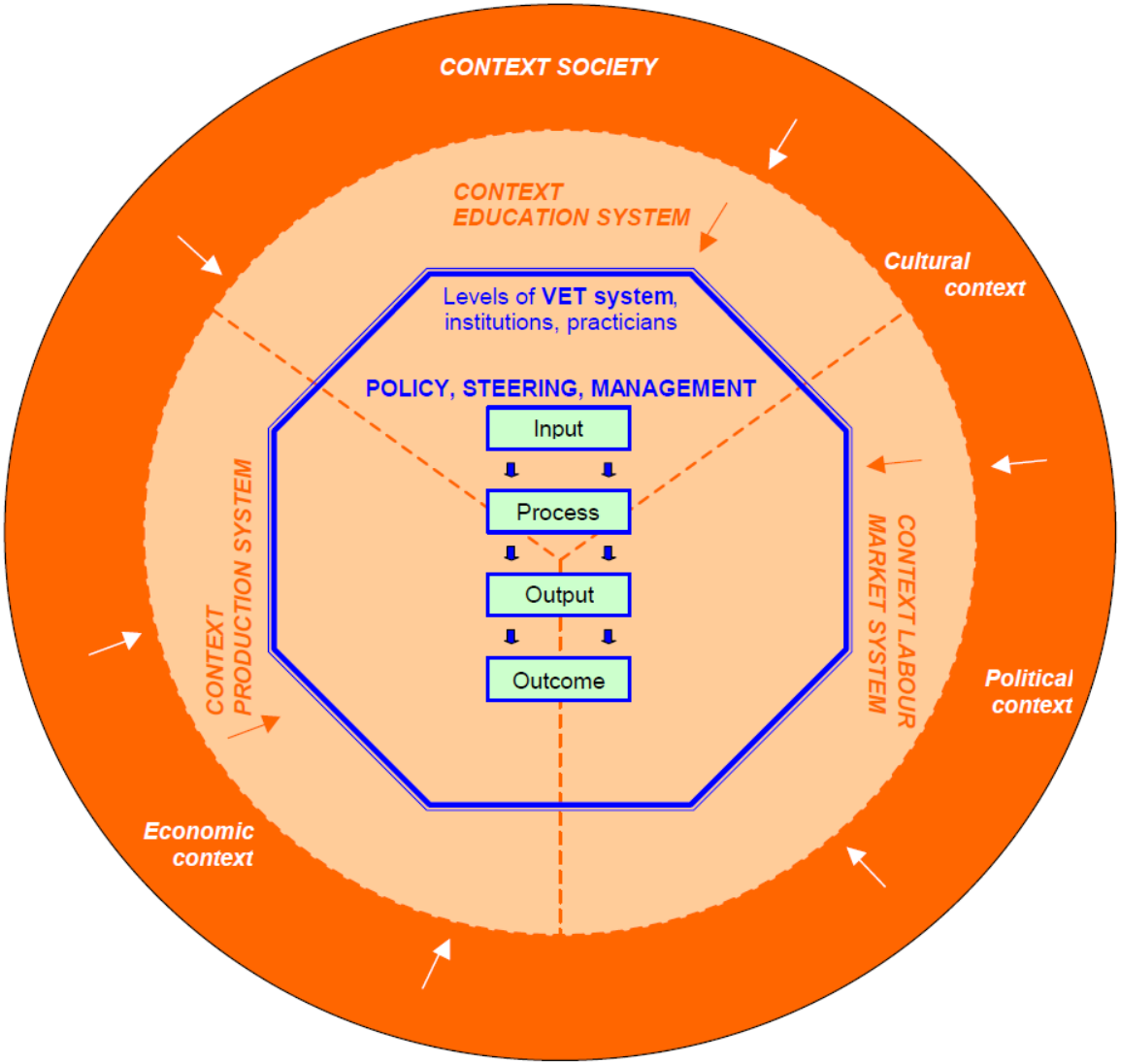
- Input-Prozess-Output-Outcome
- System, Institutionen, PraktikerInnen

Diagram 1: **The VET system, stages and levels**



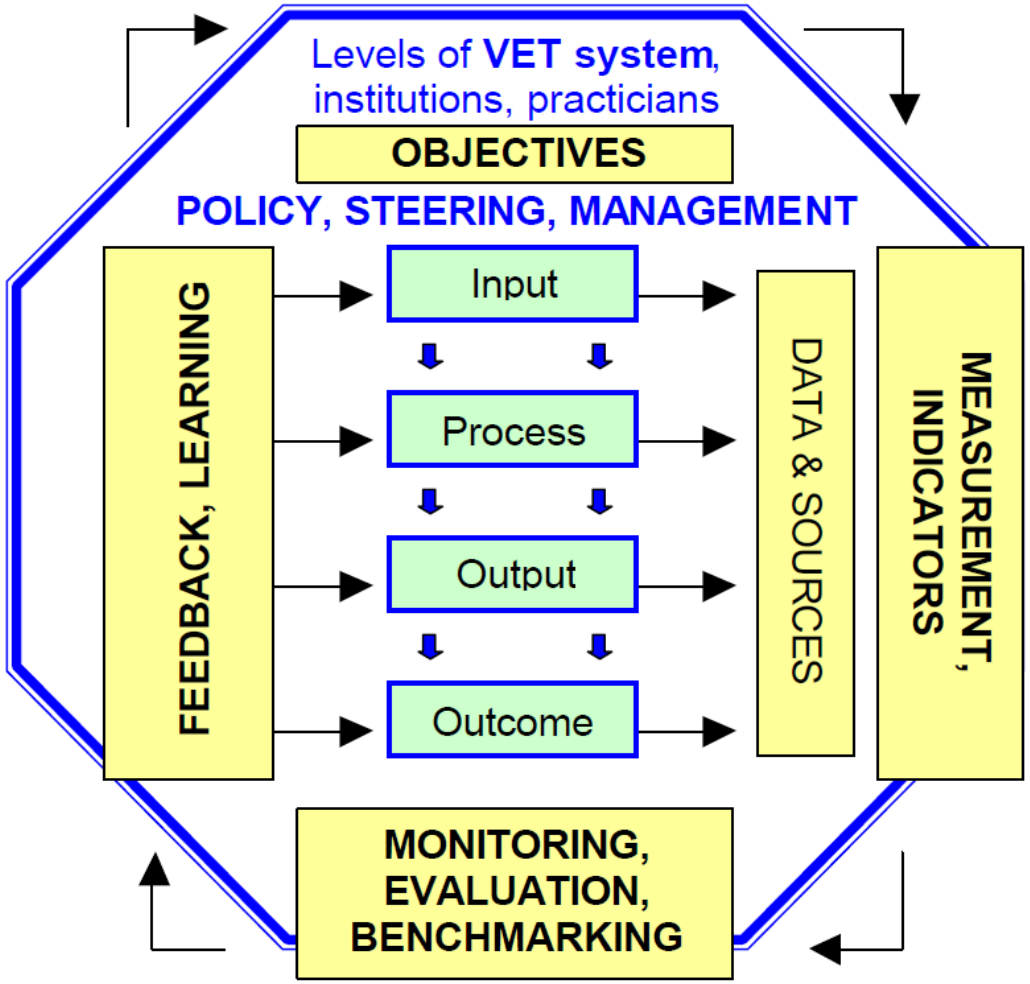
Kontextfaktoren

Diagram 2: The context of the VET system



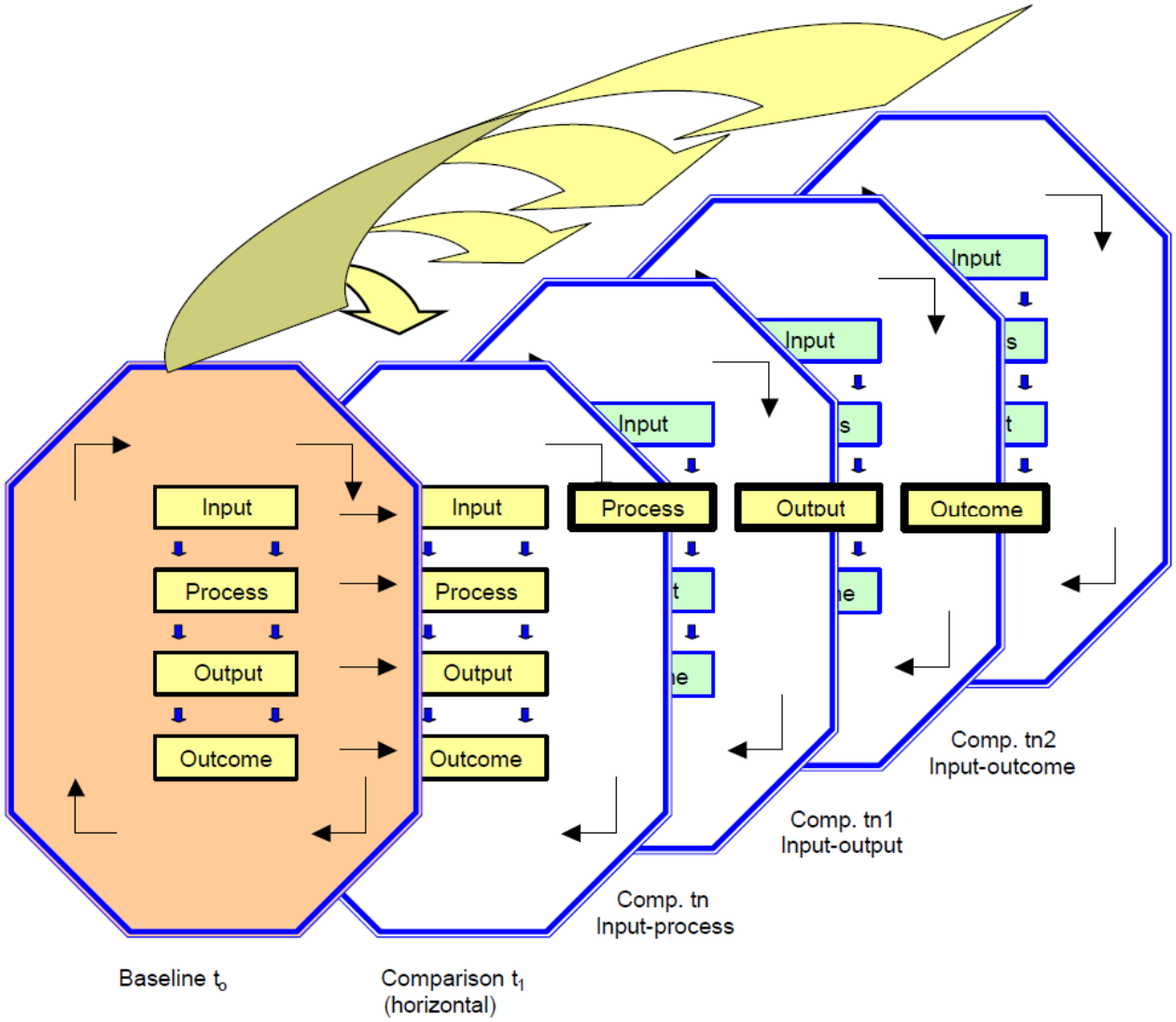
Indikatoren
Datenerfassung, Verarbeitung, Feedback

Diagram 3: The use of indicators in the policy cycle

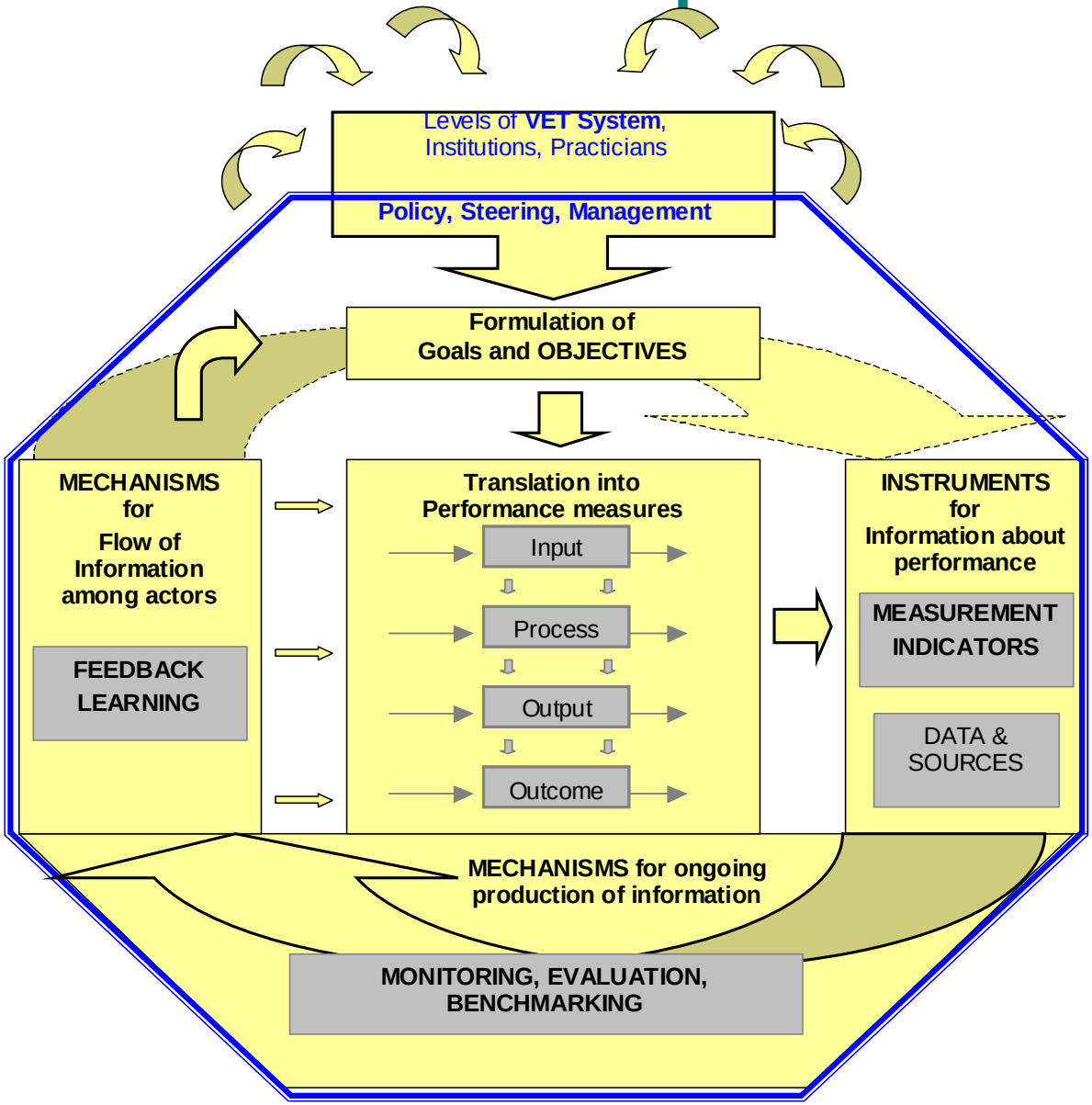


Zeit, Dimensionen

Diagram 4: The stages of VET implementation and performance and the time dimension



Volles Modell, meistens nur sehr rudimentär implementiert

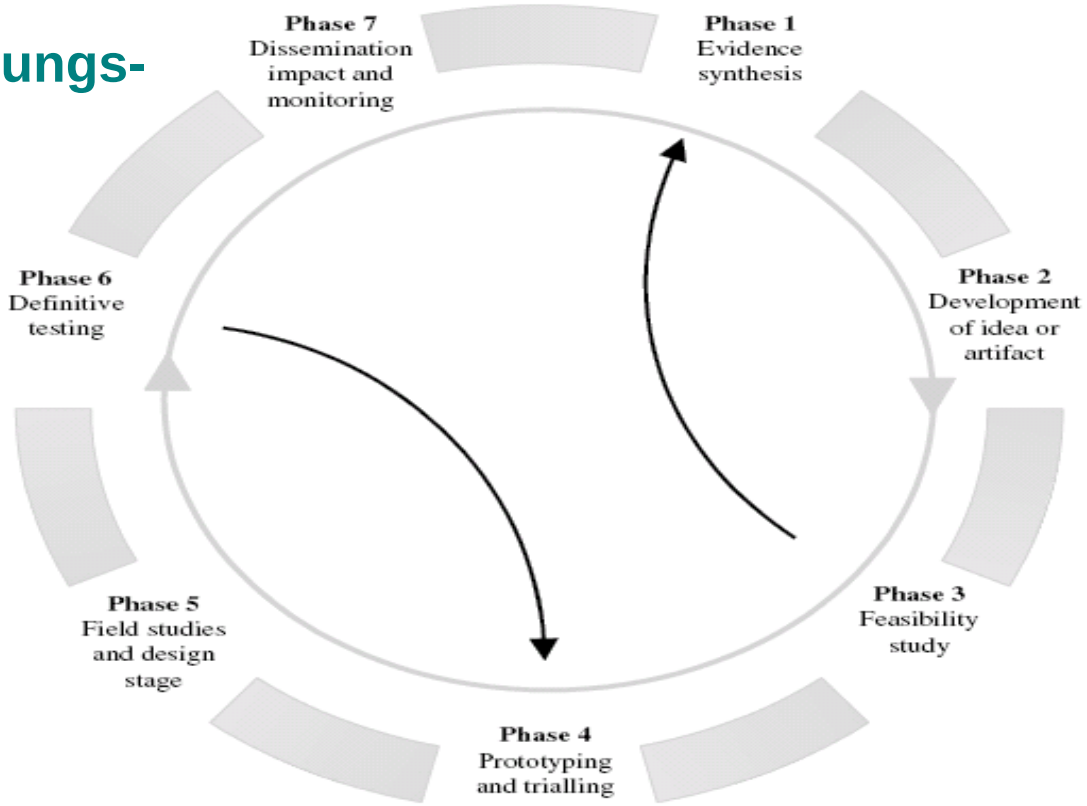


Konkretisierung zu 3
OECD-Modell des Forschungszyklus

Stufen des Forschungszyklus im vollen kausal-analytischen Modell (OECD)

Forschungs-zyklus

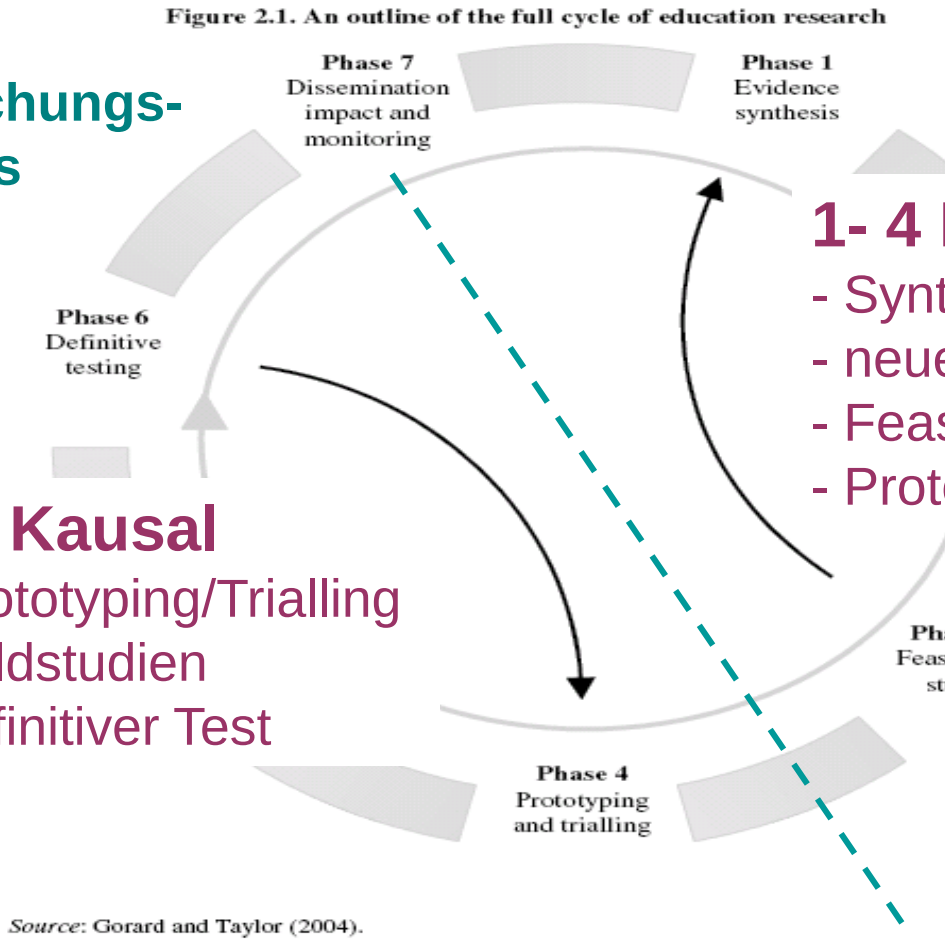
Figure 2.1. An outline of the full cycle of education research



Source: Gorard and Taylor (2004).

Zwei Teilzyklen + ‚Mainsteaming'

Forschungs-zyklus



1- 4 Deskriptiv
- Synthesis vorhd.Evidenz
- neue Idee/Artefakt
- Feasibility
- Prototyping/Trialling

4-6 Kausal
- Prototyping/Trialling
- Feldstudien
- definitiver Test

Beispiele zur Verwendung von Ziffern

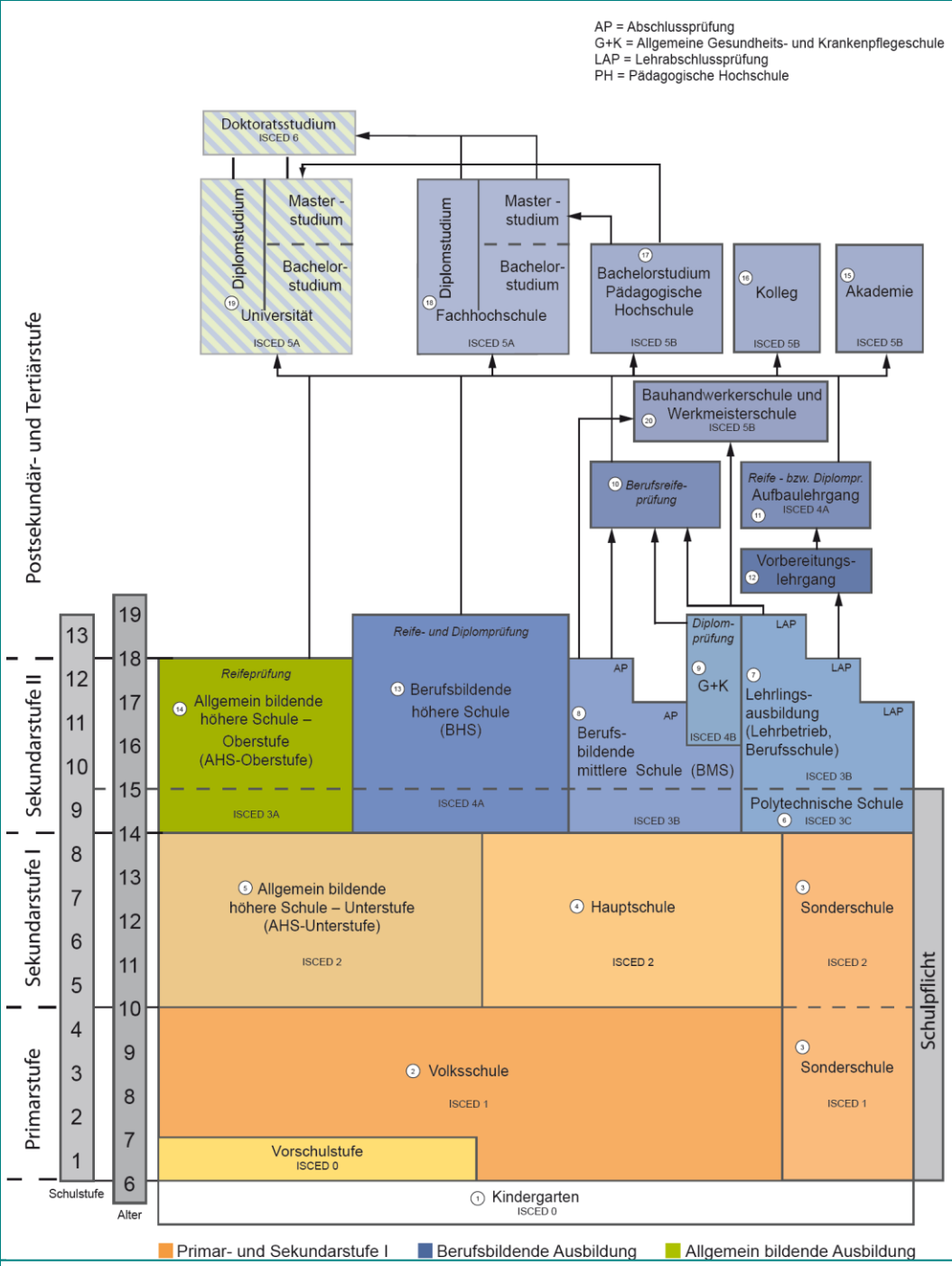
- Deskriptive Informationen, Strukturen, Vergleiche
- Bildungsberichterstattung, quantitativer Teil
- Benchmarks
- Evaluierung
- Kausale Analysen

Deskriptive Informationen, Strukturen, Vergleiche

- Beschreibung der Struktur

- Vergleichende Analysen von Bildung und Beschäftigung von Jugendlichen

Struktur des Bildungswesens ohne quantitative Information



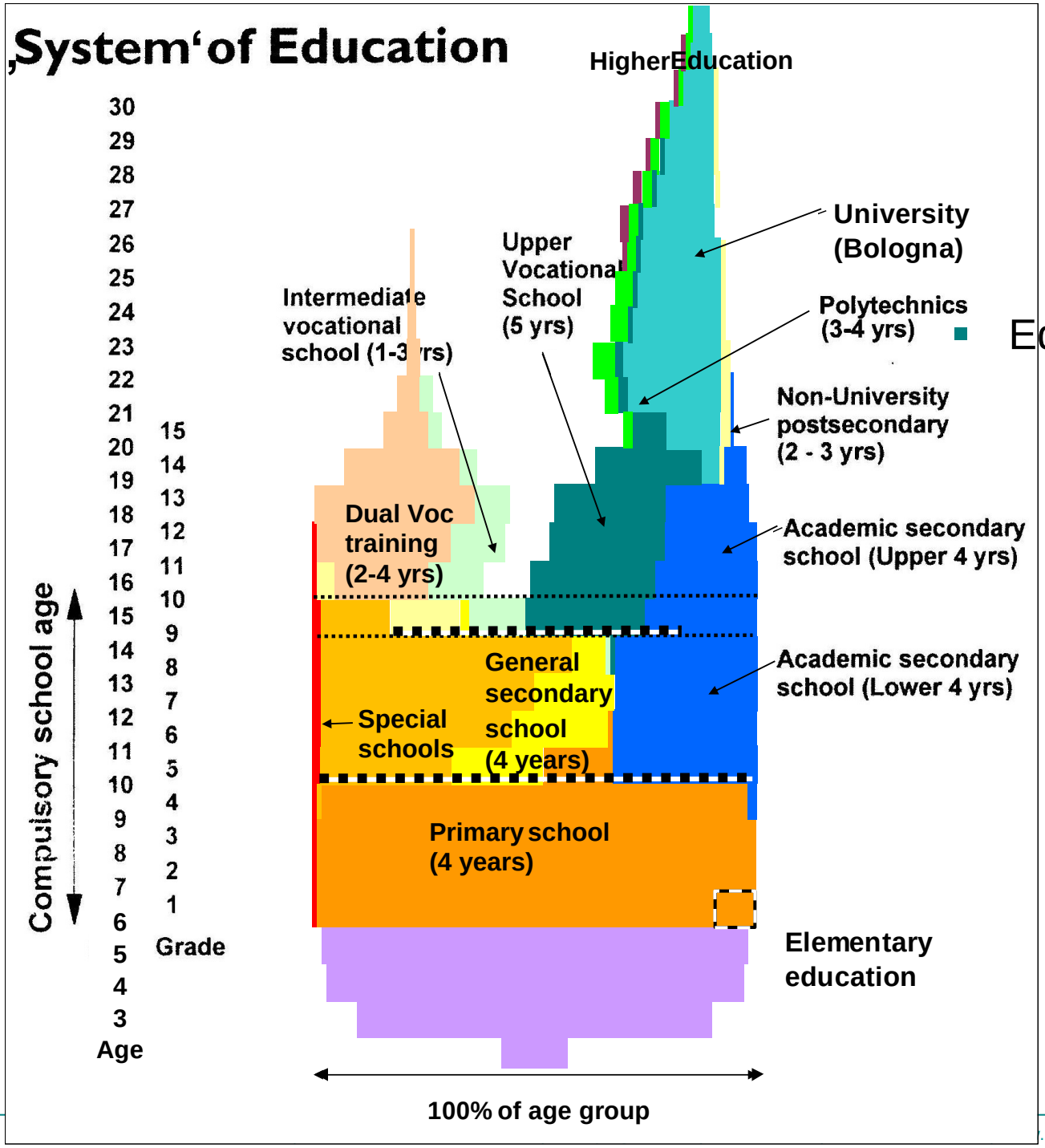
- Quelle: IBW

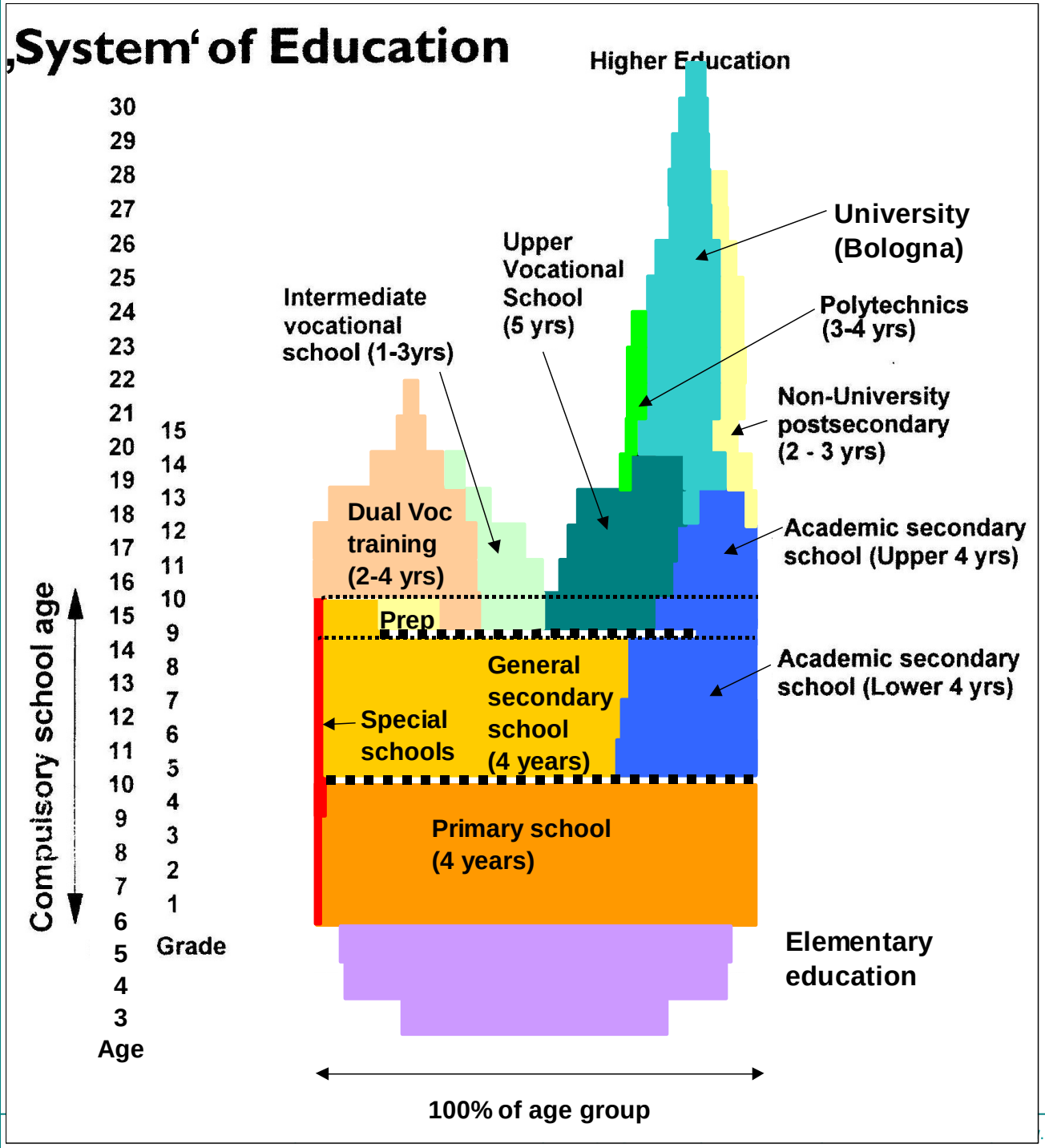
Struktur des Bildungswesens mit quantitativer Information

Current Structure

- 2010-12

Educational institutions due to participation per age cohorts

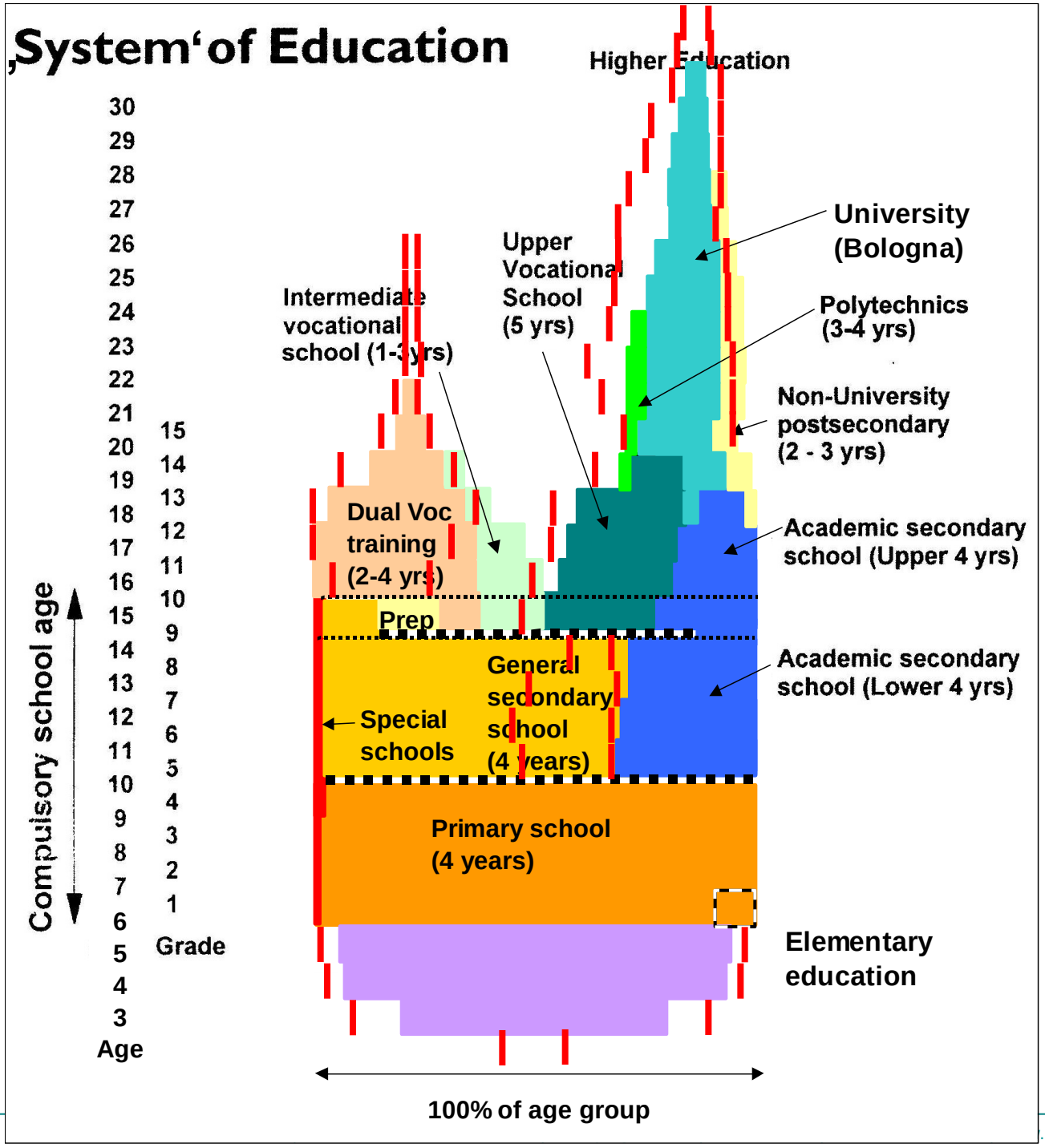




Previous Structure

- 1990-2000

- Changes:
  - expansion of HE, mainly university
  - postponed and prolonged careers in HE
  - postponement of apprenticeship
  - expansion of upper level programmes

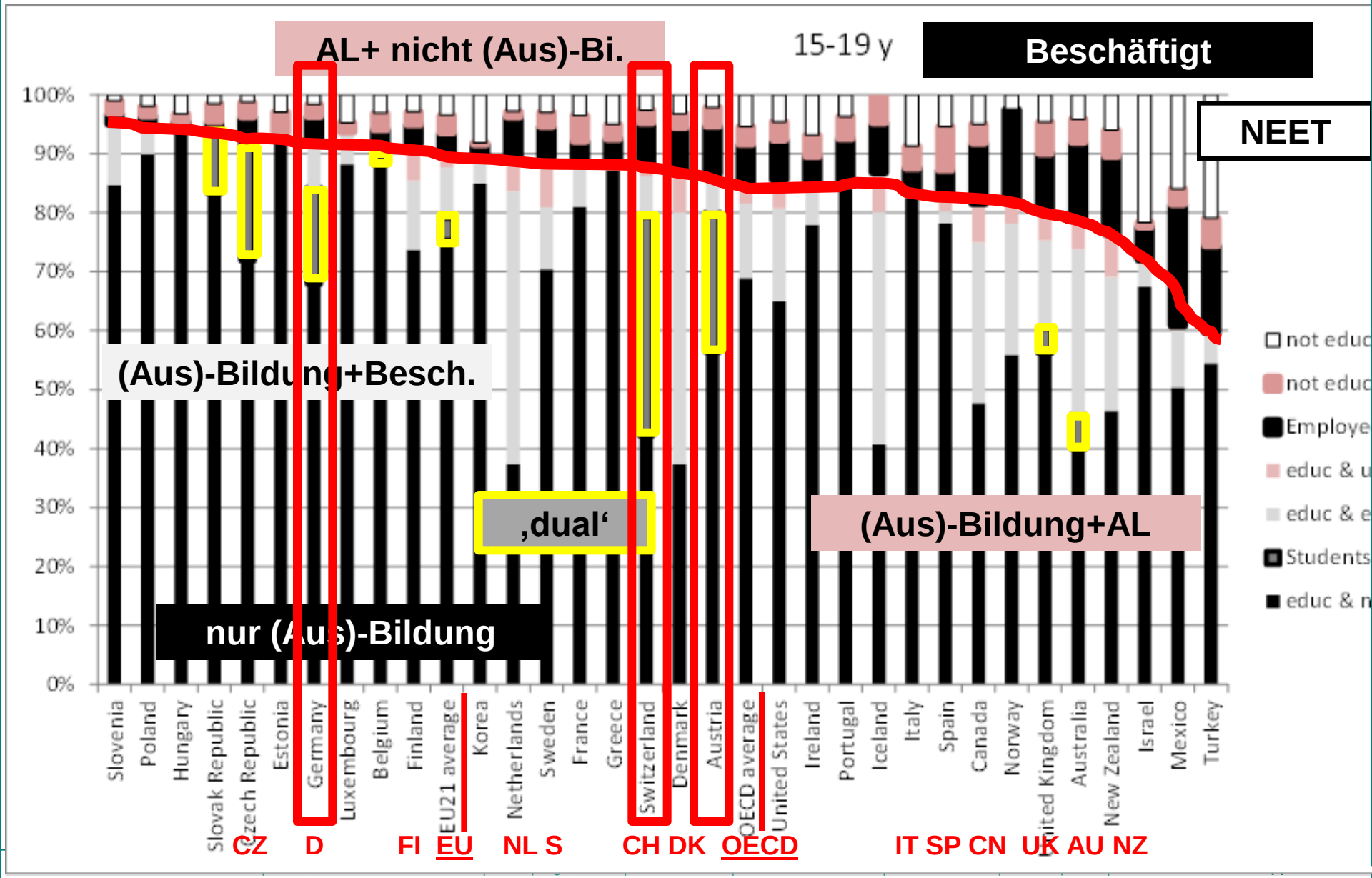


Changes

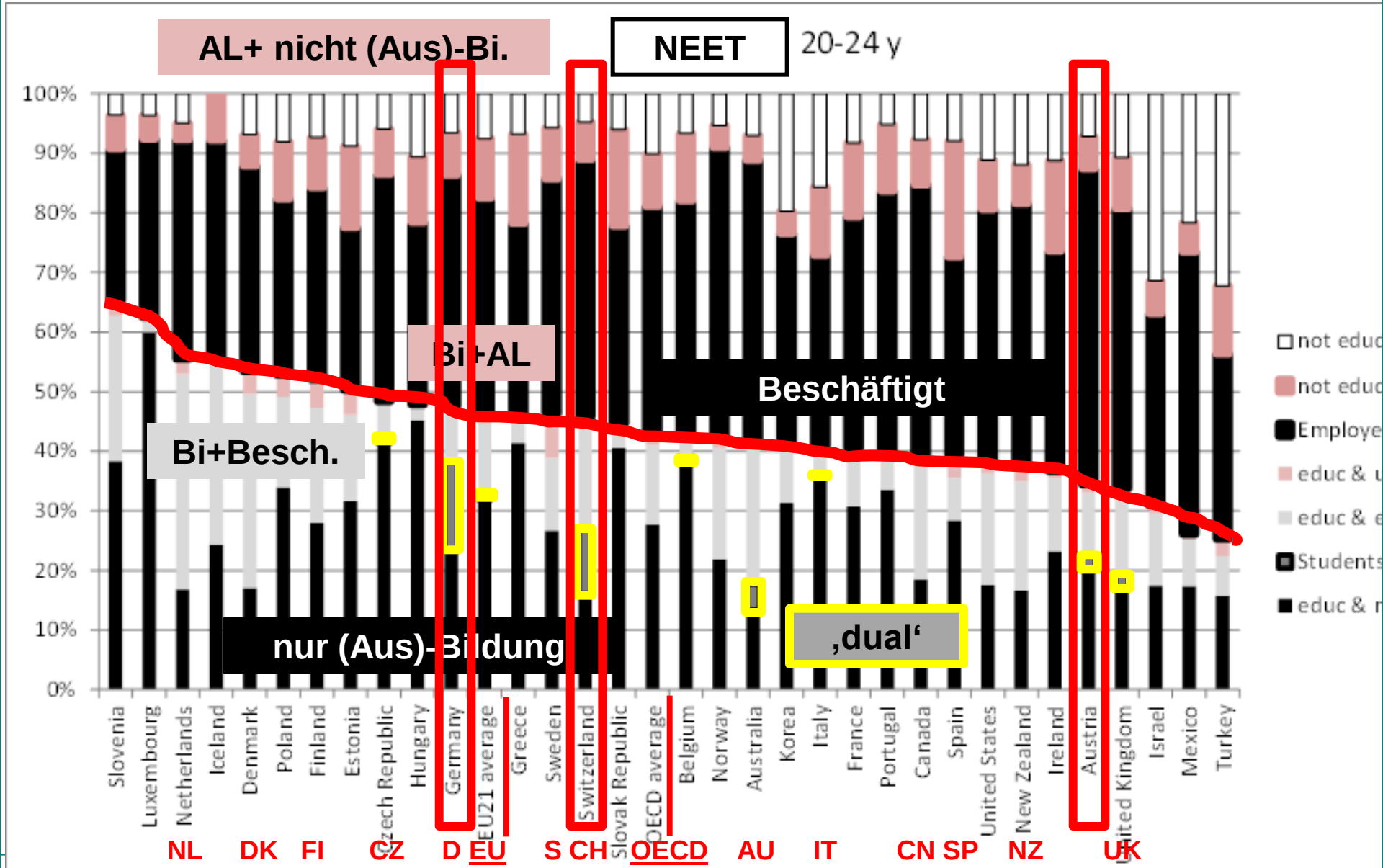
- 1990-2000
- Changes:
  - expansion of HE, mainly university
  - postponed and prolonged careers in HE
  - postponement of apprenticeship
  - expansion of upper level programmes
  - ‚Neue Mittelschule'
  - expansion of preprimary

Facetten des Überganges, OECD-Indikatoren

Facetten des Überganges, OECD-Indikatoren
15-19 Jährige, geordnet nach 'Brutto Bildung'

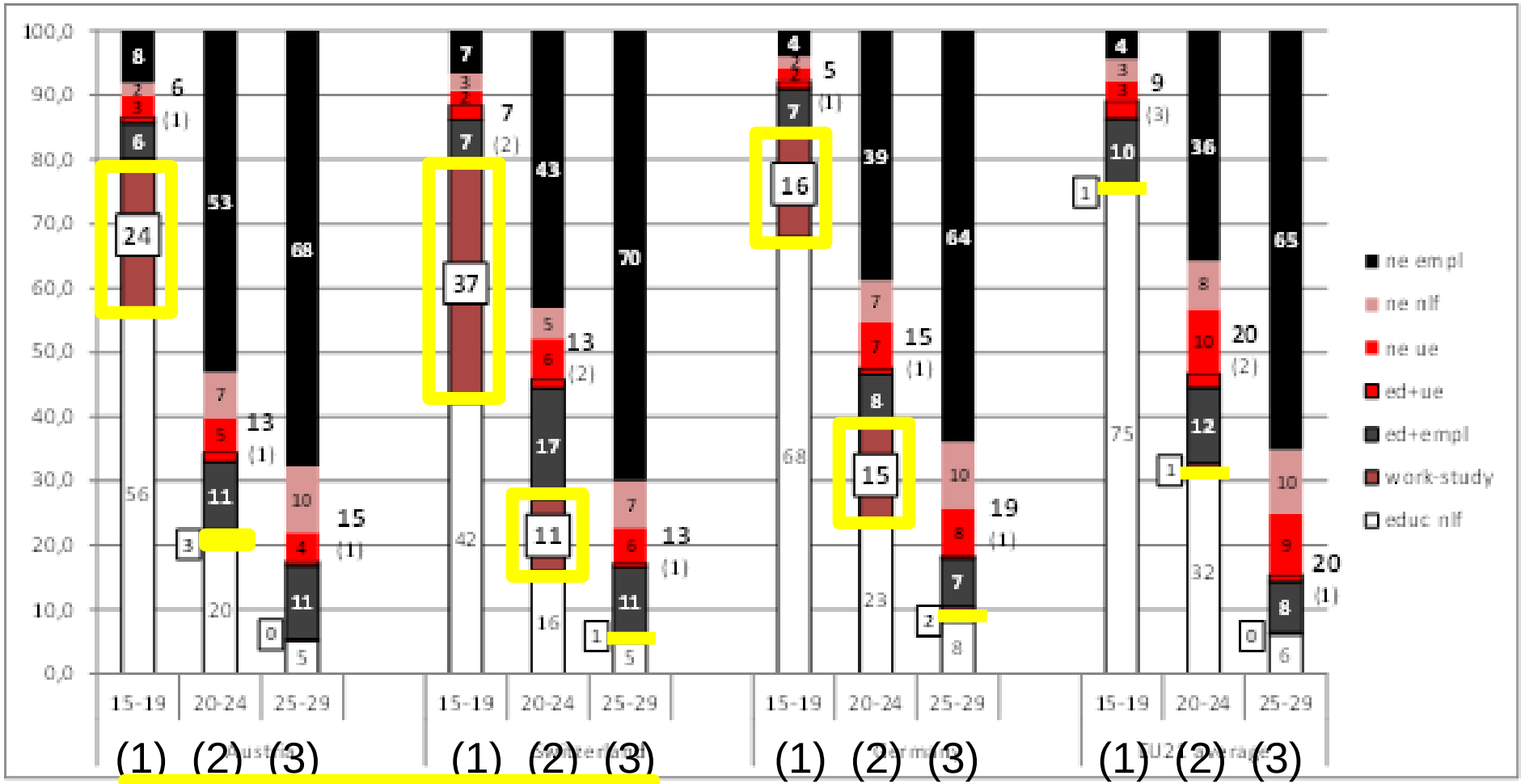


Facetten des Überganges, OECD-Indikatoren 20-24 Jährige, geordnet nach 'Brutto Bildung'



Facetten des Überganges, OECD-Indikatoren ÖST, CH, D, EU21 nach Altersgr.

Österreich Schweiz Deutschland EU 21



- Anteil Lehrlingsausbildung, jeweils (1) 15-19j, (2) 20-24j, (3) 25-29j

Bildungsberichterstattung, quantitativer Teil

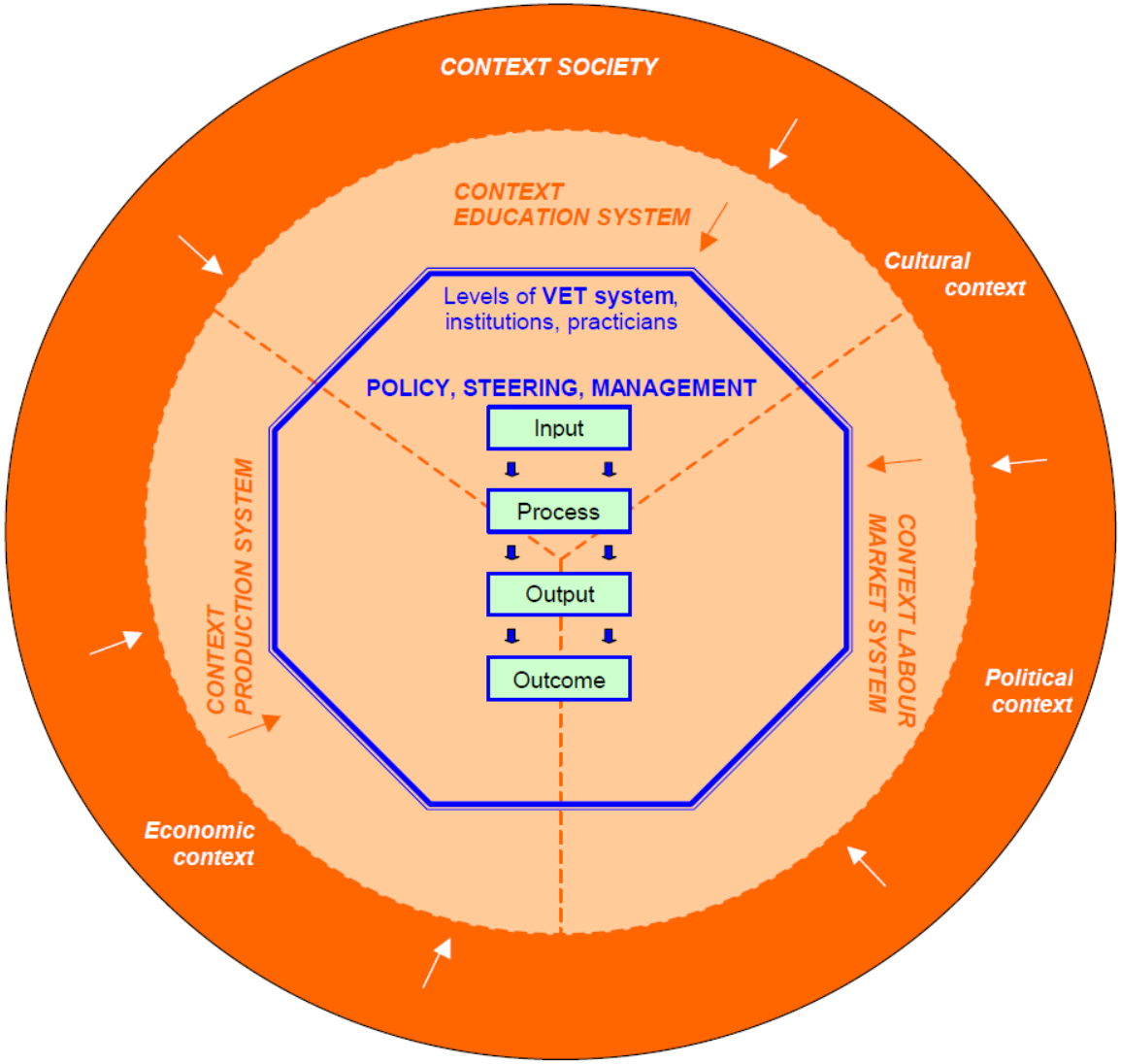
Bildungsberichterstattung, quantitativer Teil

Bruneforth, M. & Lassnigg, L. (Eds.). (2012). *National Education Report Austria 2012, Volume 1: The school system seen in data and indicators.* Graz: Leykam.

- http://www.equi.at/dateien/NBB2012_Band_1_gesamt.pdf

Im Prinzip dem vollen Modell gefolgt…

Diagram 2: The context of the VET system



Im Prinzip dem vollen Modell gefolgt…

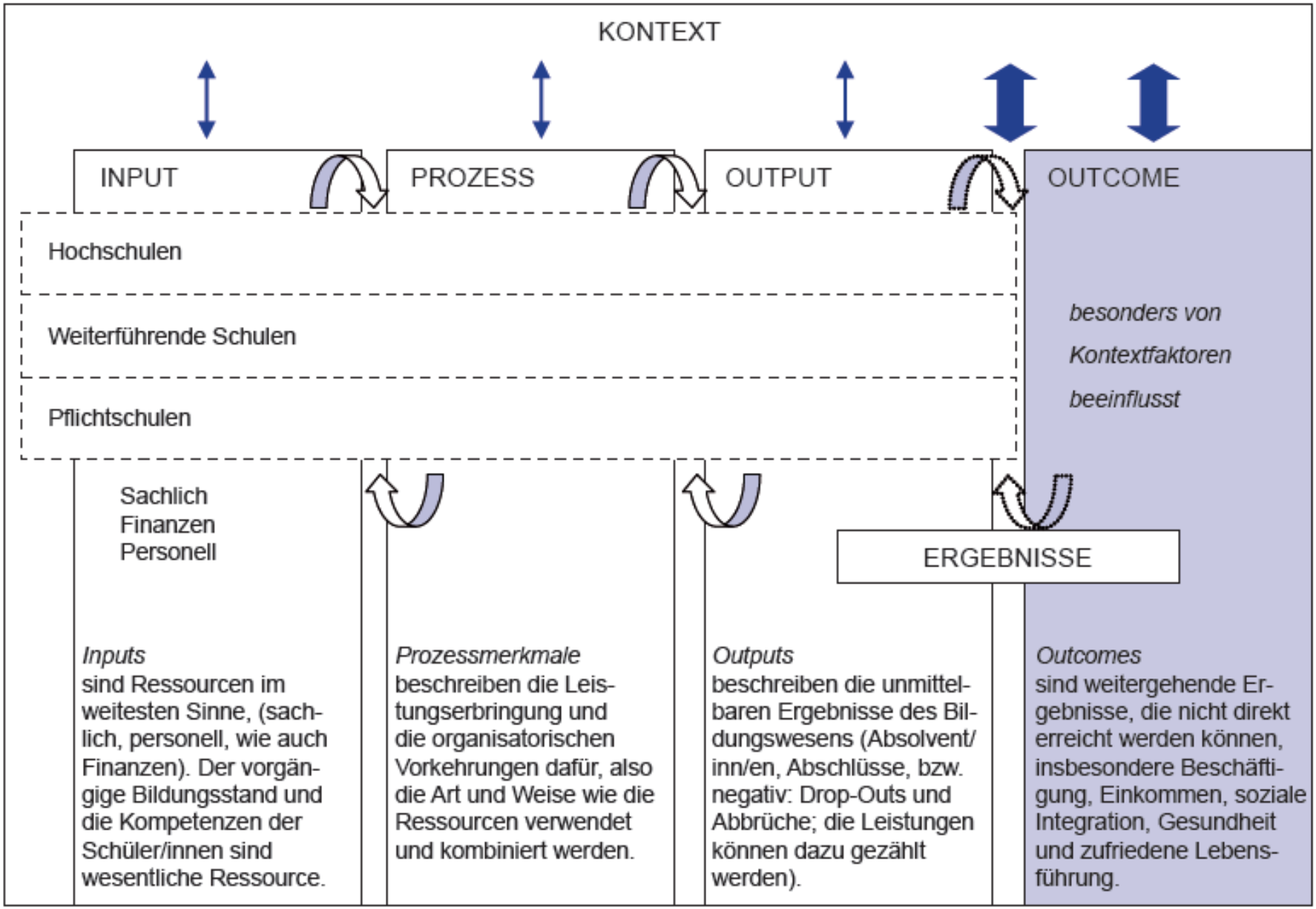


Abb. 1: Das Konzept der Aufbereitung und Analyse der bildungsstatistischen Kennzahlen

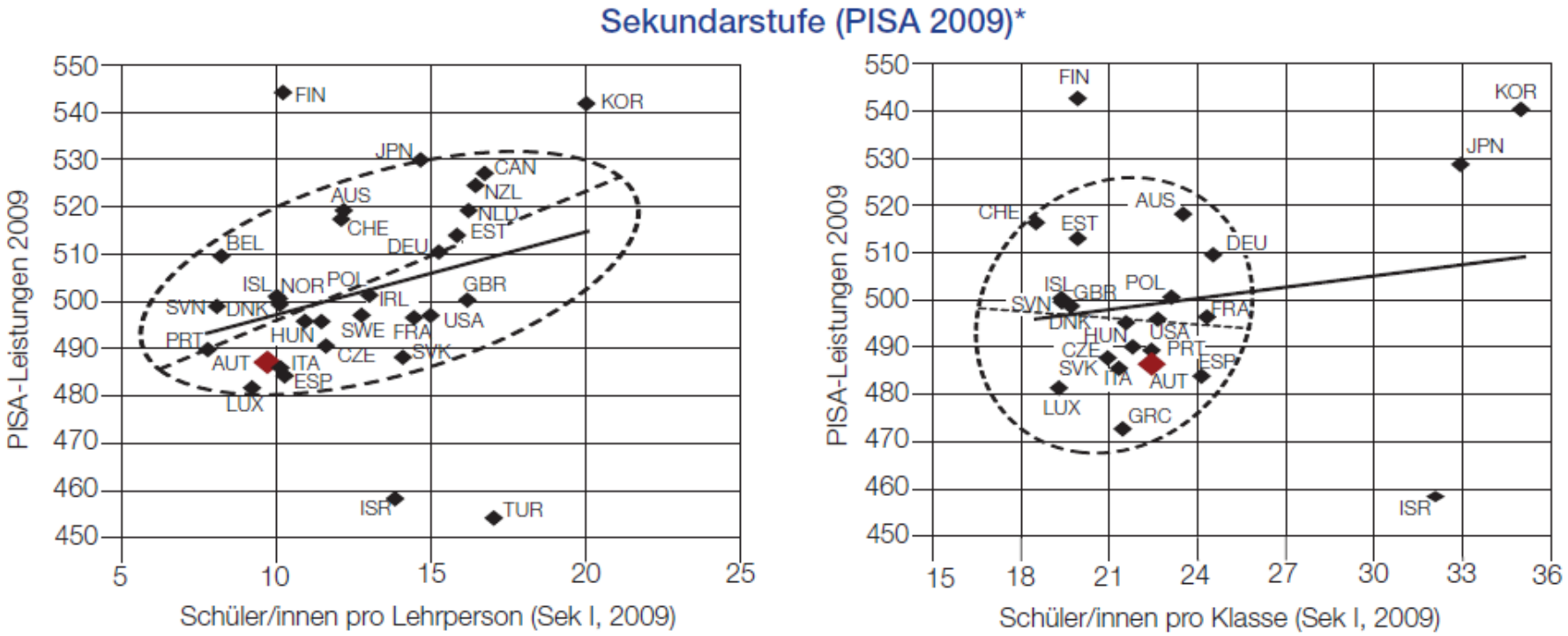
Im Prinzip dem vollen Modell gefolgt…

- Wesentliche Aspekte 2009:
  - Basiszahlen und Indikatoren
  - in konsistenten Blöcken von Informationen über den Zyklus von INPUT-PROZESS-OUTPUT-OUTCOME,
  - und für die verschiedenen Einheiten: SchülerInnen, Lehrpersonen, Finanzen, Ergebnisse
  - in vergleichbarer Klassifikation
  - Möglichkeit für Berechnung von Relationen, die nicht direkt enthalten sind
  - Kumulativer Aufbau von Zeitreihen
  - Klärung nationale Daten - internationale Daten

…aber nur teilweise möglich

- unterschiedliche DatenproduzentInnen mit unterschiedlichen Interessen
- operative Probleme, unterschiedliche Produktionslogiken bei verschiedenen Datenmassen
- Koordinationsprobleme
- …
- Insgesamt:
  Beträchtlicher Informations- und Wissenszuwachs, aber geringe operative Bedeutung

Ein Beispiel: Ressourcen und Leistungen



Anmerkung: PISA-Leistungen sind als Durchschnitt der Landesmittelwerte in Lesen, Mathematik und Naturwissenschaften berechnet. *OECD ohne Mexiko und Chile.

Quelle: PIRLS 2011, EUROSTAT, OECD (2011). Darstellung: IHS.

- steigende Zahl an SchülerInnen/Lehrperson, steigende Leistungen
- SchülerInnen/Klasse kein Bezug zu Leistungen

Benchmarks

- EU-2010, 2020
- Mazedonien
- Österreich LLL:2020

Europäisches Zielprogramm, (ET2010) Gesamtstruktur

- Mapping des Bildungswesens
- Definition von Zieldimensionen…
- …und Ergebnisse
- Beobachtungssystem
- ausgewählte Benchmarks

- …de facto sehr ‚lose‘ Umsetzung, ‚Benchmarks‘ nicht erreicht

Europäisches Zielprogramm, (ET2010) Gesamtstruktur

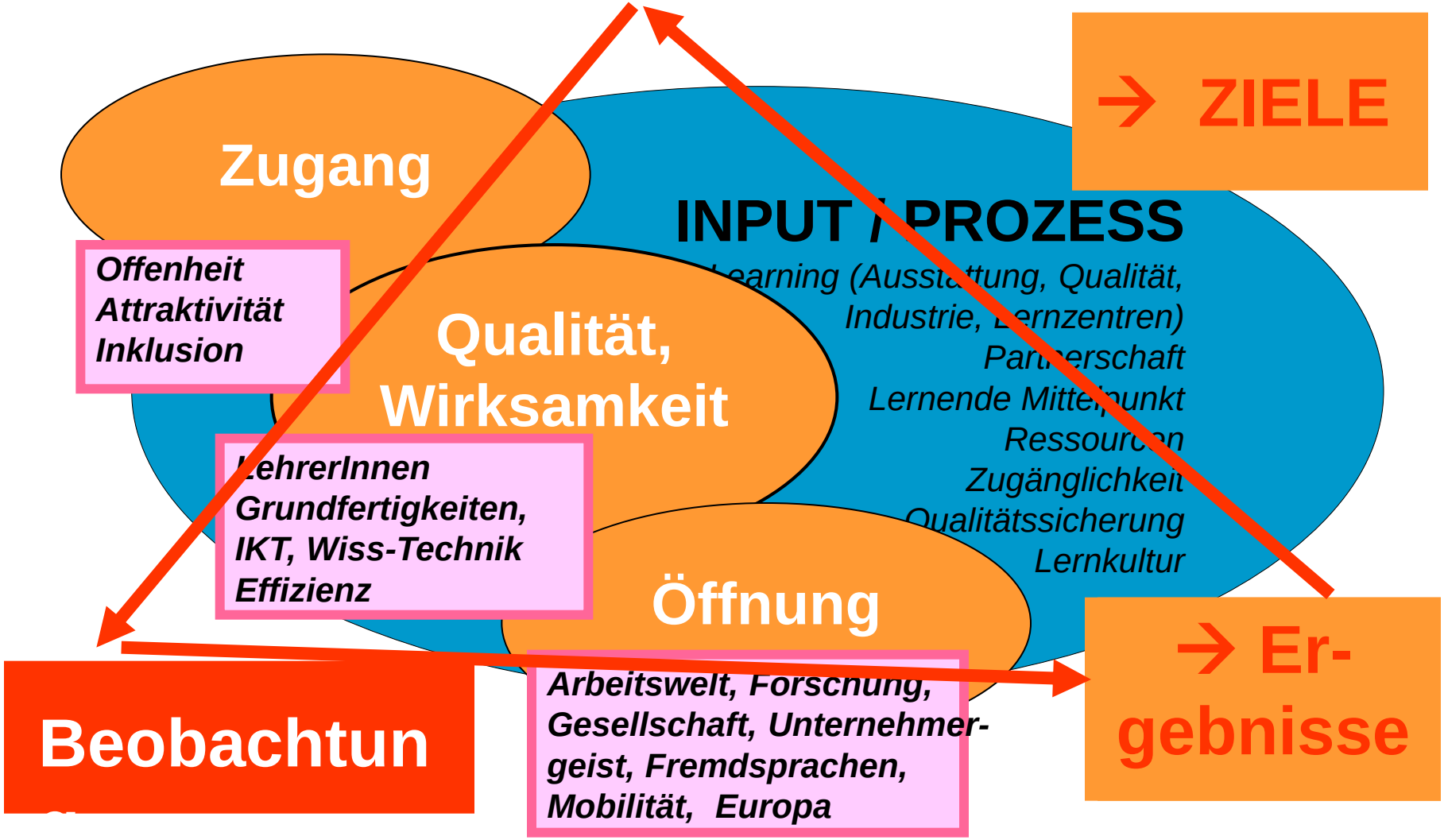
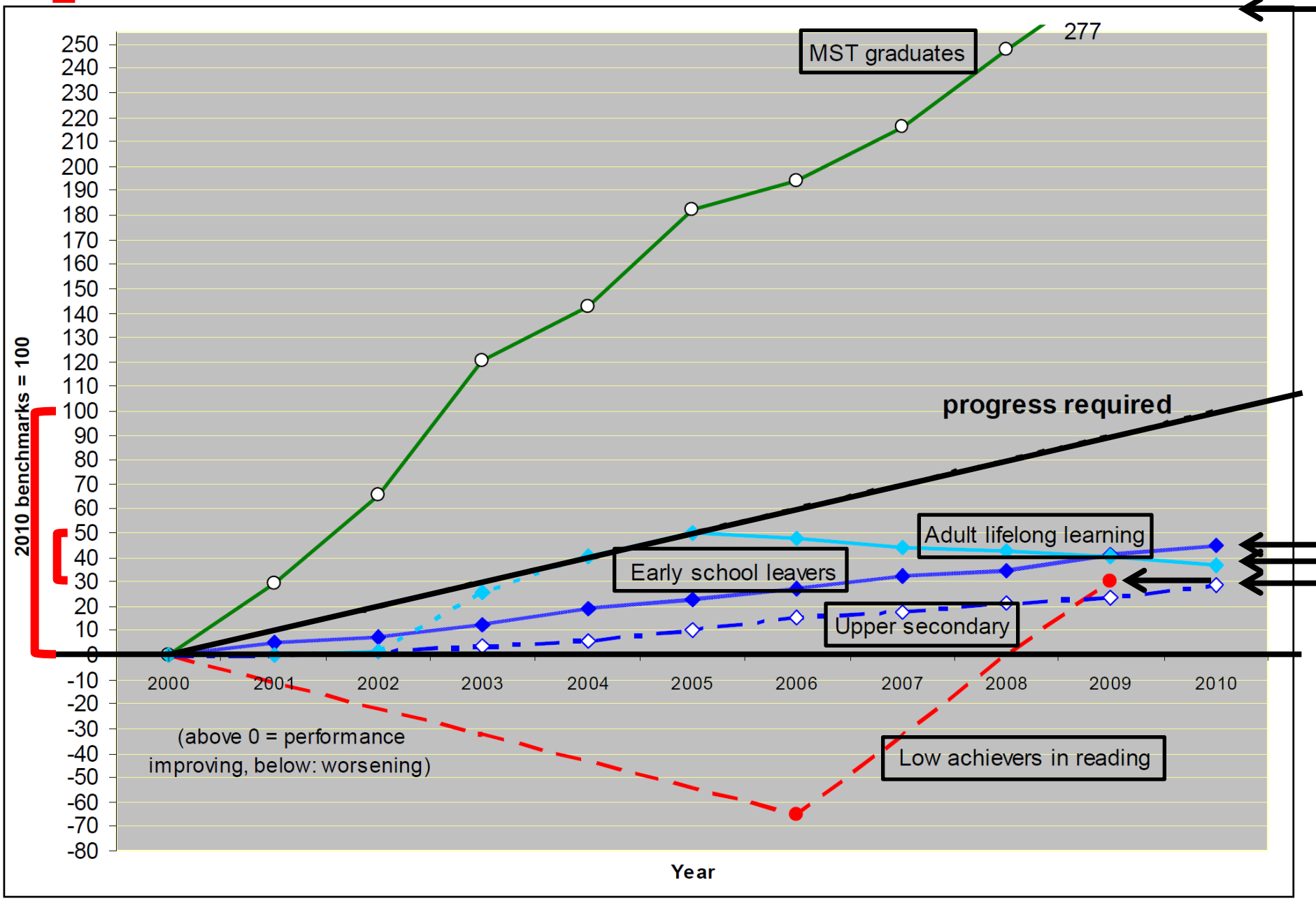


Figure Int.2.1: Progress towards meeting the five benchmarks for 2010 (2000-2010)



MSS table 1: Planned achievement by key indicators

For each indicator to be calculated absolute numbers for baseline, goal (broken down per years), and absolute change desired (JAF-Indicators)	Absolute Baseline (2010)		Absolute goal 2013			Absolute change 2010-2013
	% of (20-					
Absolute numbers						
Absolute numbers						
Absolute numbers						

‚Employability' EU BENCHMARK PROPOSED 2020 80%

% in employment of 20-34years old people

MK: not specified, EU-BM

SIMPLIFIED

EU-Definition refers to subgroup 3 years after leaving education, data not available for Macedonia, would be better

‚Early school leavers' EU BENCHMARK, 2020 max. 10%

% of population 18-24y with at most lower secondary education and not in education or training

MK: 14% in 2015

‚Tertiary education' EU BENCHMARK, 2020 min. 40%

% of teritary education among population 30-34y

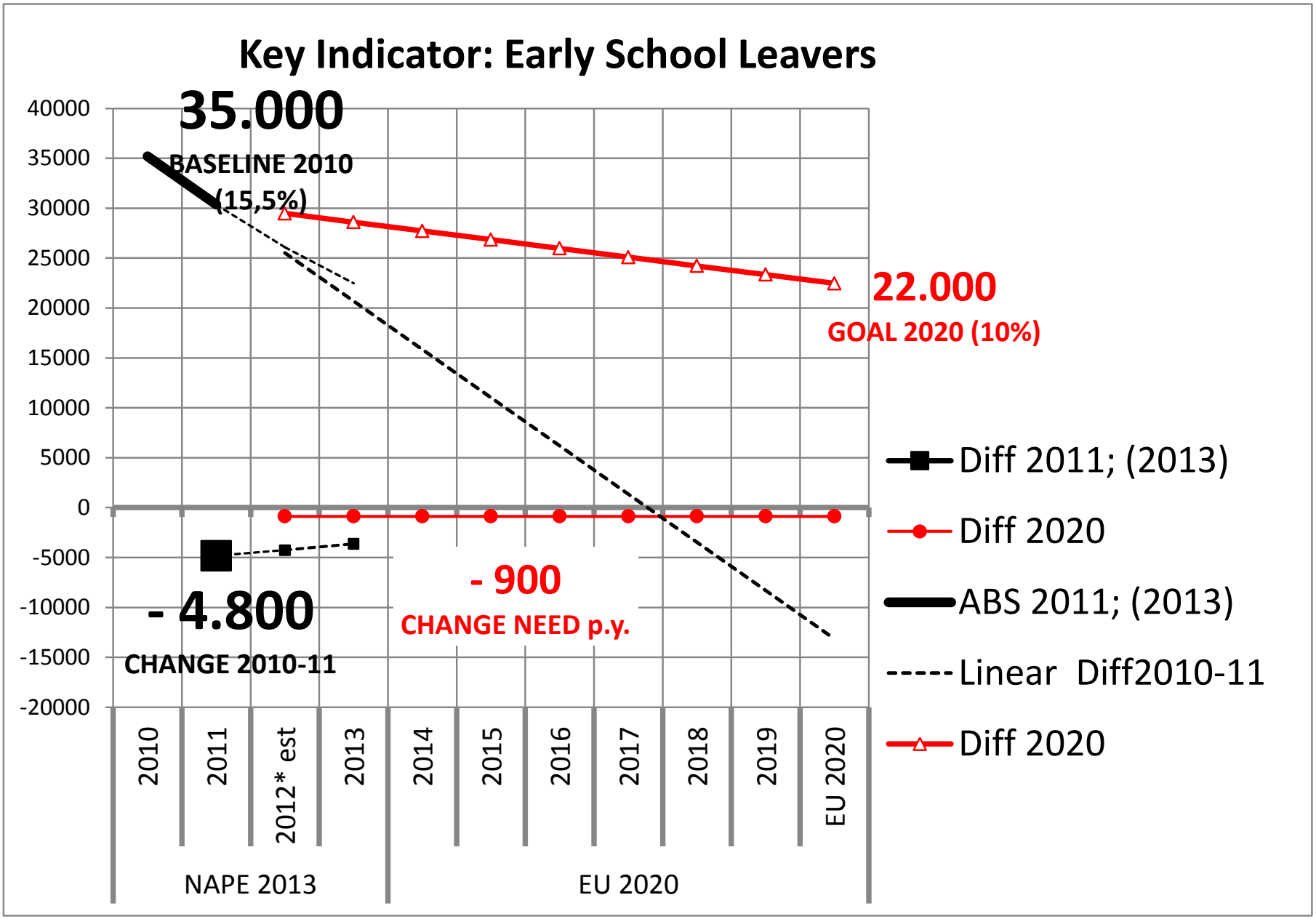
MK: 19% in 2015

‚Low qualified adults' MACEDONIAN goal (EU27 av. 26%)

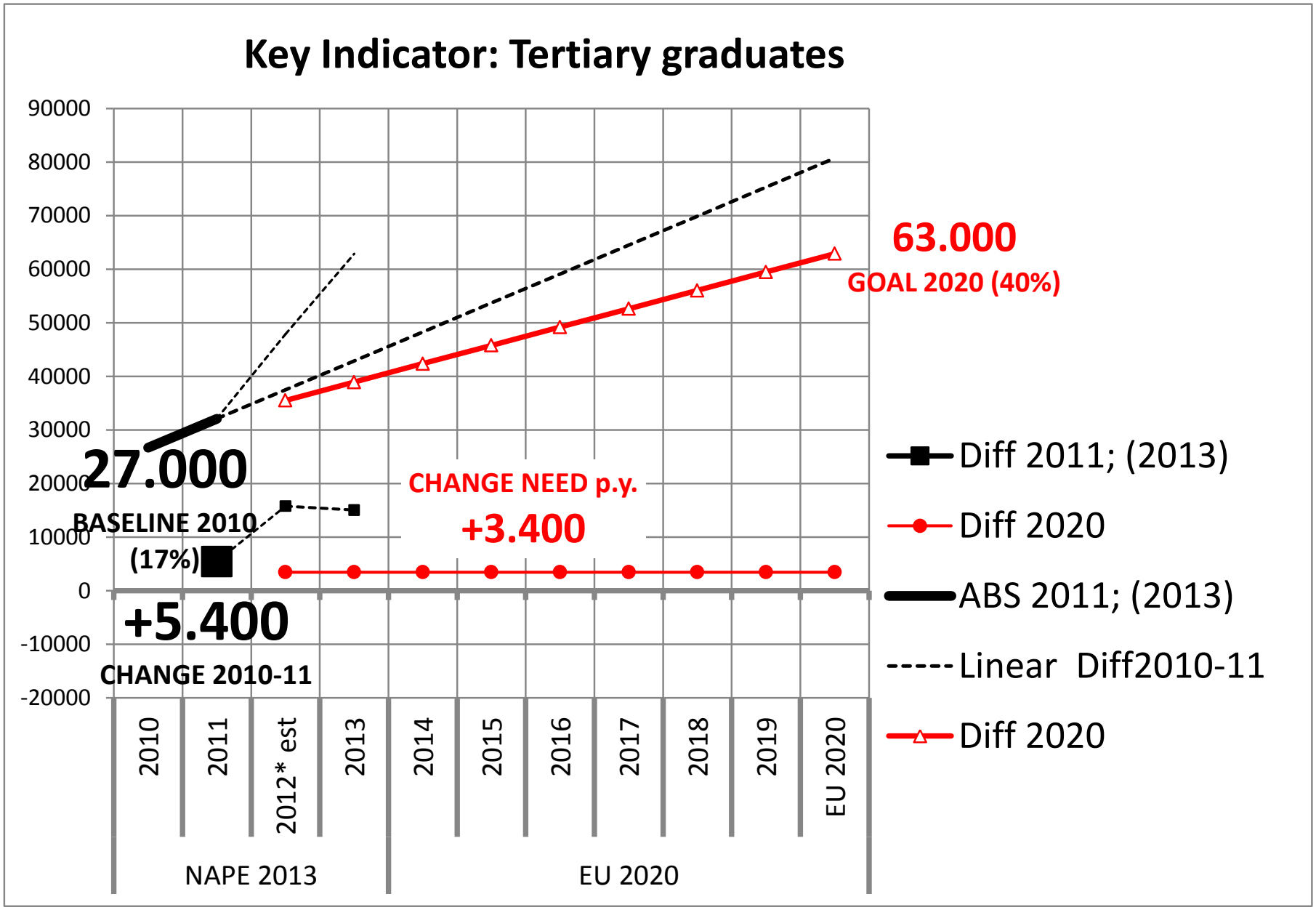
% of 25-64 years old people with maximum ISCED 0-2 (lower sec. ed)

MK: not specified (proposal)

Empirical illustration, change 2010-11



Empirical illustration, change 2010-11



LLL:2020

LLL:2020


Vier Grundprinzipien
B
Fünf Leitlinien A
Zehn Aktionslinien
Acht Schlüsselkompetenzen
C

LLL:2020

10 AKTIONSLINIEN

1. Stärkung der **vorschulischen** Bildung und Erziehung als längerfristige Grundvoraussetzung
2. Grundbildung und Chancengerechtigkeit im **Schul- und Erstausbildung**swesen
3. **Kostenloses Nachholen** von grundlegenden Abschlüssen, Grundkompetenzen im **Erwachsenenalter**
4. Ausbau von alternativen **Übergangssystemen** ins Berufsleben für **Jugendliche**
5. Maßnahmen zur **Neuorientierung** in Bildung und Beruf und Berücksichtigung von **Work-Life-Balance**
6. „Community-Education“ mittels kommunaler Einrichtungen und der organisierten Zivilgesellschaft
7. Förderung lernfreundlicher Arbeitsumgebungen
8. **Weiterbildung** zur Sicherung der Beschäftigungs- und Wettbewerbsfähigkeit
9. Bereicherung der **Lebensqualität** durch Bildung in der **nachberuflichen** Lebensphase
10. Verfahren zur Anerkennung non-formal und informell erworbener Kenntnisse und Kompetenzen

LLL:2020

10 AKTIONSLINIEN

3 QUALITATIVE ZIELE, 9 QUANTITATIVE ZIELE UND EIN BUDGETZIEL

1. 1.Verabschiedung eines **Bundesrahmengesetzes** für Kindergärten zur Sicherstellung qualitativer Mindeststandards bei der frühen Förderung bis 2014
2. 2.Halbierung des Anteils der **Lese-RisikoschülerInnen** von 28% laut PISA 2009 auf 14% (2020)
3. 3.Reduktion der frühzeitigen Schul- und **AusbildungsabgängerInnen** laut EU2020-Indikator von 8,7% (2009) auf 6% (2020)
4. 4.ESL: Steigerung des Anteils an Lehrlingen und LehrabsolventInnen, die die **Berufsreifeprüfung** ablegen, von rund 2% (2008) auf 10% (2020)
5. 5.NEET: Senkung des Anteils der 15-24jährigen, die sich **weder in Beschäftigung noch in Ausbildung** befinden, von 7,8% (2009) auf 6,4% (2020)
6. 6.Erhöhung der **Erwerbstätigenquote der 55-64jährigen** laut EU-Indikator von 41,1% (2009) auf mindestens 50% (2020)
7. 7.Steigerung der Teilnahmequoten an nicht-formaler **Weiterbildung in dünn besiedelten Gebieten** von 35,7% laut AES 2007 auf die Teilnahmequote von Gebieten mittlerer Siedlungsdichte mit mindestens 45%
8. 8.Erhöhung des Anteils der Beschäftigten, die **während der Arbeitszeit in den Genuss einer Weiterbildung** kommen und lediglich über einen Pflichtschulabschluss als höchste abgeschlossene Ausbildung verfügen, von 5,6% (2007) laut AES auf mindestens 15% (2020)
9. 9.Der Anteil der 30-34jährigen, die ein **Hochschulstudium abgeschlossen** haben oder über einen gleichwertigen Abschluss verfügen, soll bis 2020 auf 38% erhöht werden
10. 10.Erhöhung der **Weiterbildungsbeteiligung** gemessen anhand des LLL-Strukturindikators von 13,7% (2010) auf 20% (2020)

11.Etablierung von **Qualitätsstandards** für Bildungsangebote und Qualifikation der TrainerInnen im Bereich der nachberuflichen Bildungsphase bis 2015

12.Implementierung des **NQR** bis 2012 und Umsetzung einer Validierungsstrategie zur Anerkennung non-formalen und informellen Lernens bis 2015

13.Budgetziel: Erhöhung der Ausgaben für Bildung gemäß OECD-Indikator von 5,4% des BIP (2007) auf 6% des BIP (2020)

LLL:2020

- Strategie:
  - Entwicklungspfade für Zielerreichung
  - Zuordnung von Aktionslinien und Maßnahmen zu den Zielen
  - Gewicht der Maßnahmen für Zielerreichung (‚Kalibrierung')

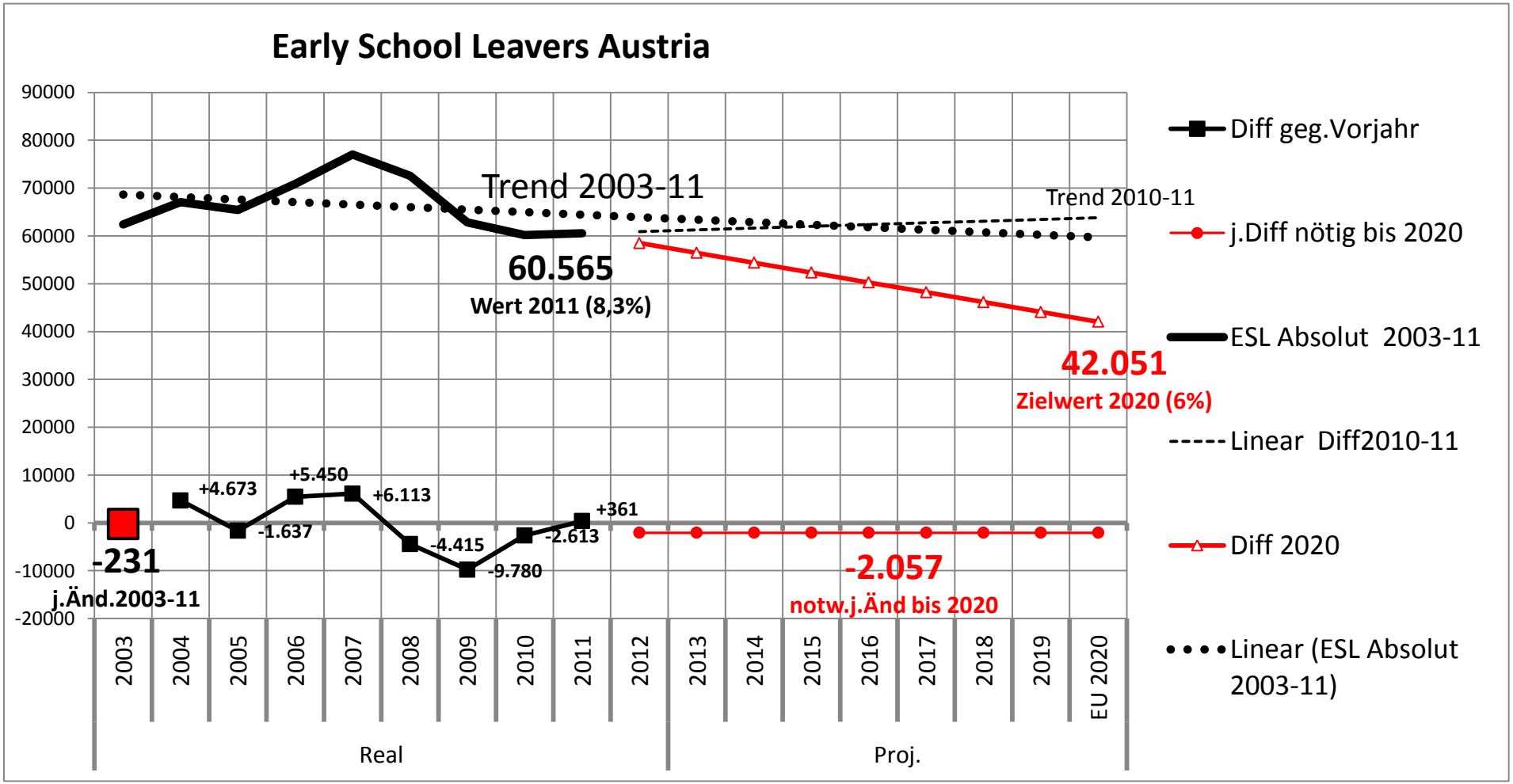
    erwartetes Gewicht von Maßnahmen zur Beeinflussung des Indikators: um wieviel % kann Maßnahme x den Indikatorwert 1 (z.B. Early School Leavers) reduzieren oder erhöhen (z.B. Beteiligung an EB
  - Erwartungsbildung über Ergebnisse?

    ‚pädagogische Maßnahme' für AkteurInnen

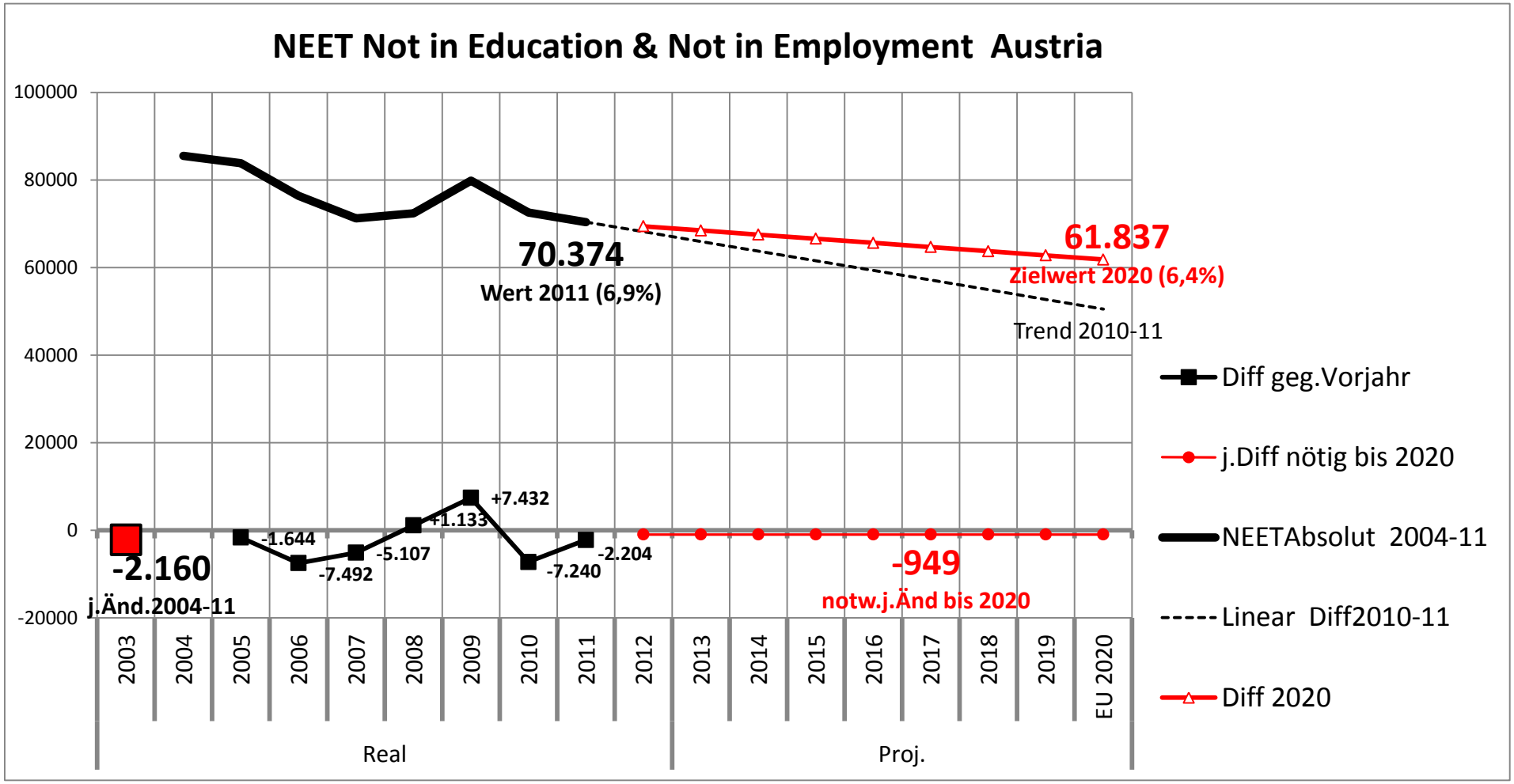
    welches Wissen ist für diese Erwartungsbildung vorhanden? (Lernprozesse; Selektionsgefahr?)

Beispiele Pfade der Zielerreichung absolute Darstellung

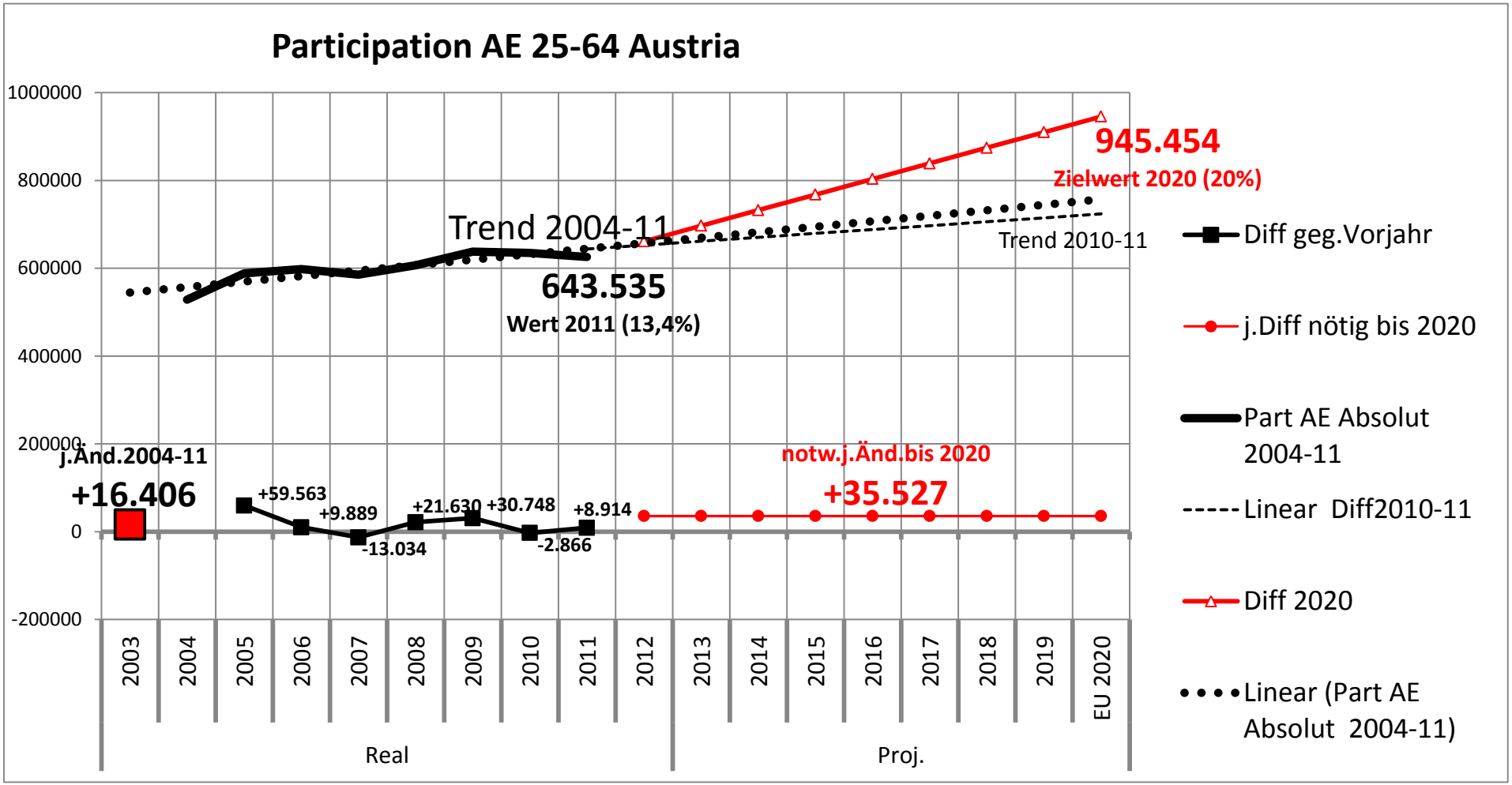
Beispiel (Ind.3) Early School Leavers



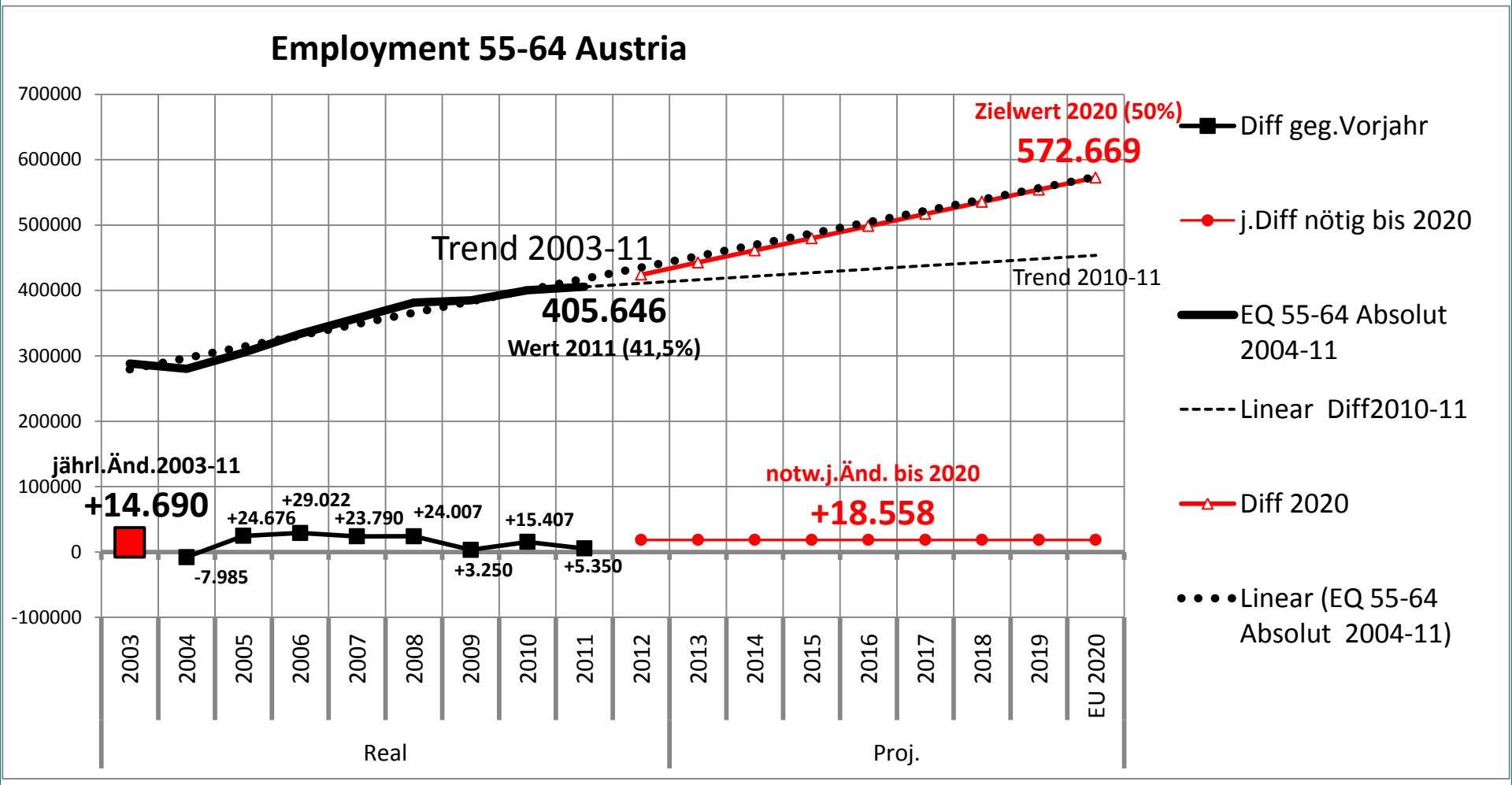
Beispiel (Ind.5) Not in education/employment (NEET)



Beispiel (10) EB-Beteiligung 25-64jährige



Beispiel (6) Beschäftigung 55-64jährige



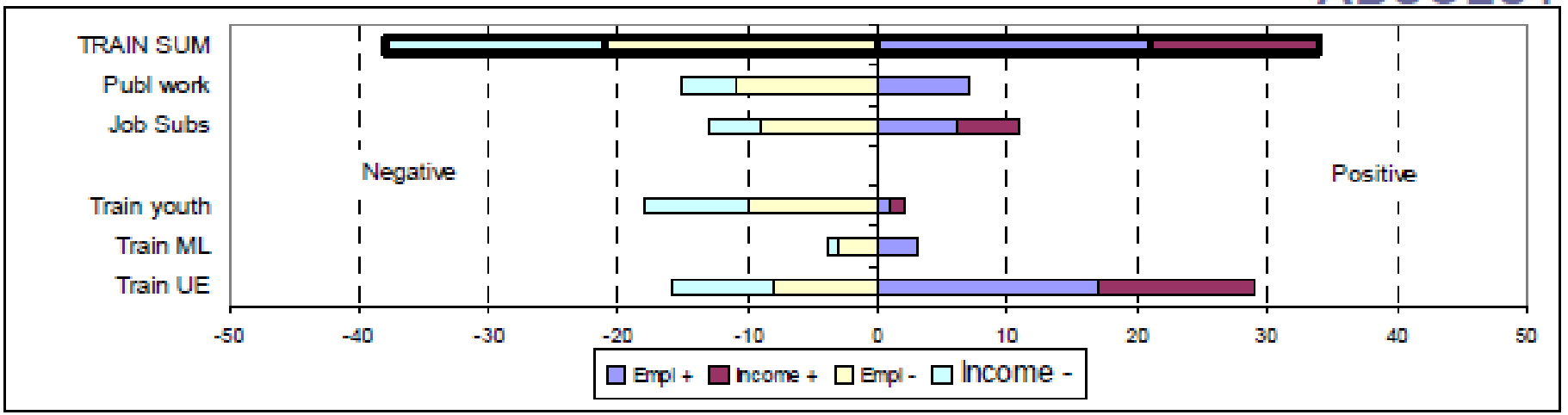
Evaluierung

- Aktive AMP, jahrzehntelange Entwicklung, mit sehr hohem konzeptionellem und instrumententellen Aufwand an zunehmend sophistizierten Methoden
  - ‚gold standard'…
  - ‚ExpertInnendiskurs'; Anwendbarkeit, Nachvollziehbarkeit,
- …aber bei Ausbildung keine/wenig konklusive Ergebnisse…
  - Vergleichsproblem wg. Nicht-Suche während Ausbildung, kurze Frist
- Metaanalysen
  - Z.B. Active Labor Market Policy Evaluations: A Meta-Analysis. D.Card, J. Kluve, A. Weber. Discussion Paper No. 4002, February 2009, IZA, Bonn, Germany

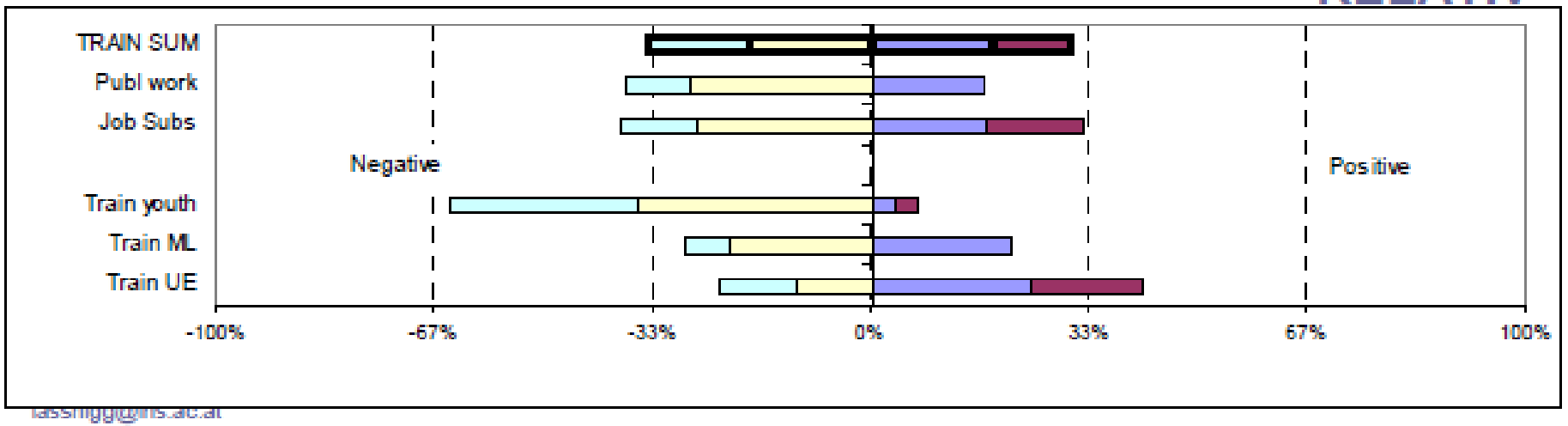
    "199 program estimates drawn from 97 studies conducted between 1995 and 2007"
- Dar & Gil 1998:
  - evaluations do not permit definite conclusions about an economic justification of training programmes for adult people; despite „non-scientific" evaluations present a rosy picture, „scientific" evaluations are quite discouraging…

Erste große Metaanalyse (Betcherman et al.)

ABSOLUT



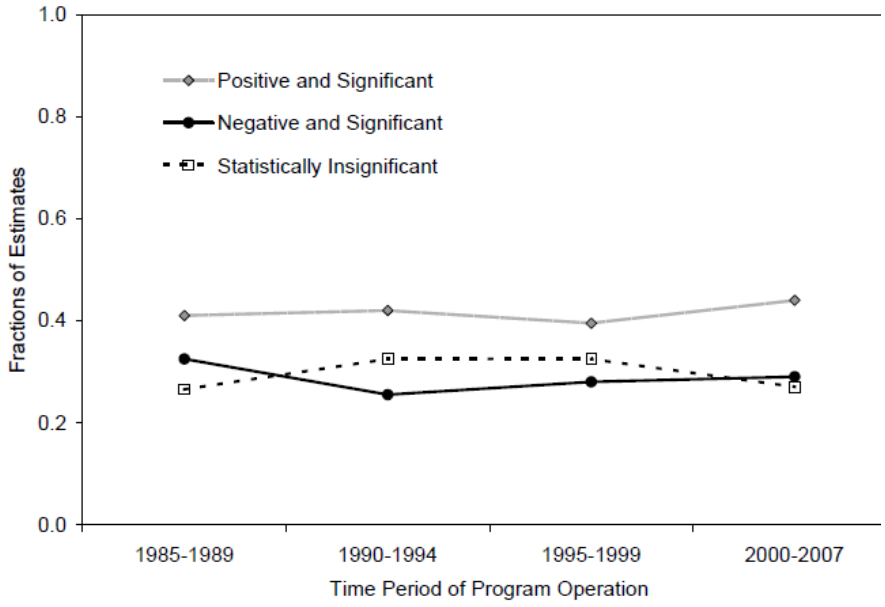
RELATIV



Card, Kluve, Weber 2009

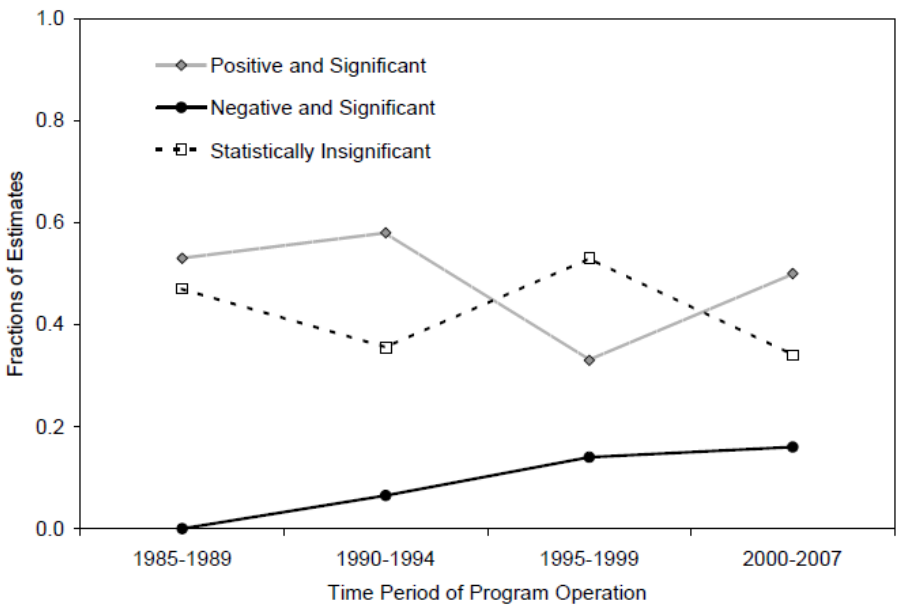
short-term (1y)

Figure 1a: Distribution of Short-term Program Effects Over Time



medium-term (2y)

Figure 1b: Distribution of Medium-term Program Effects Over Time



Card, Kluve, Weber 2009

Table 5: Summary of Estimated Impacts of ALM Programs

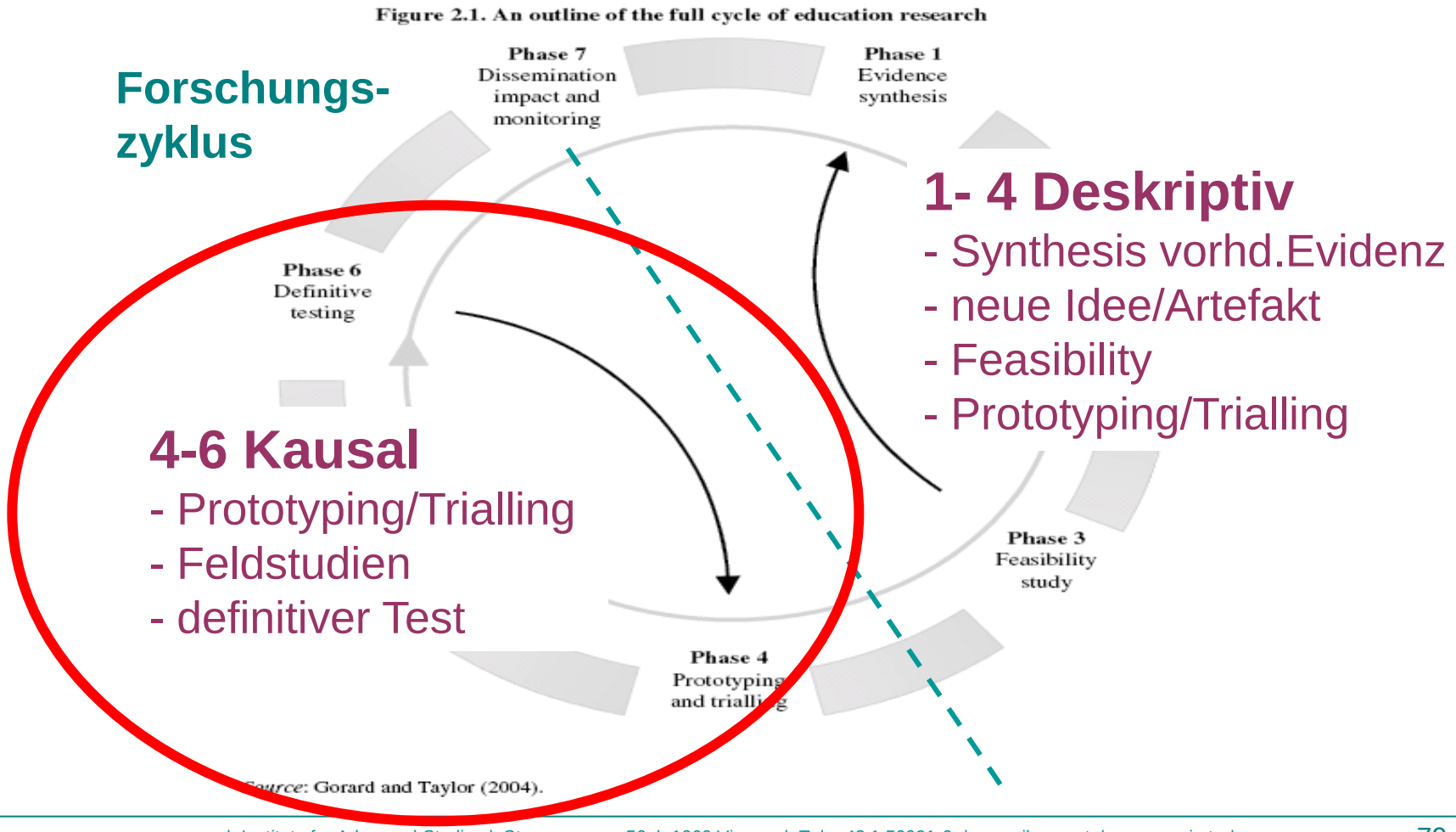
	Percent of Estimates that are:		
	Significantly Positive (1)	Insignificant (2)	Significantly Negative (3)
I. Short Term Impact Estimates (~12 Months)			
a. Overall Sample (N=183)	39.3	32.8	27.9
b. Austria, Germany & Switzerland (N=59)	28.8	33.9	37.3
c. Scandinavia (N=50)	46.0	30.0	24.0
d. Anglo Countries (N=17)	70.6	11.8	17.7
II. Medium Term Impact Estimates (~24 Months)			
a. Overall Sample (N=108)	50.0	39.8	10.2
b. Austria, Germany & Switzerland (N=45)	53.3	35.6	11.1
c. Scandinavia (24)	37.5	50.0	12.5
d. Anglo Countries (N=15)	73.3	26.7	0.0
III. Long Term Impact Estimates (36+ Months)			
a. Overall Sample (N=50)	54.0	40.0	6.0
b. Austria, Germany & Switzerland (N=23)	60.9	39.1	0.0
c. Scandinavia (N=15)	40.0	46.7	13.3
d. Anglo Countries (N=10)	50.0	40.0	10.0

Notes: See note to Table 1 for definition of country groups. Significance is based on t-ratio for estimate bigger or smaller than 2.0.

Kausale Analyse

Forschungszyklus

Forschungs-zyklus

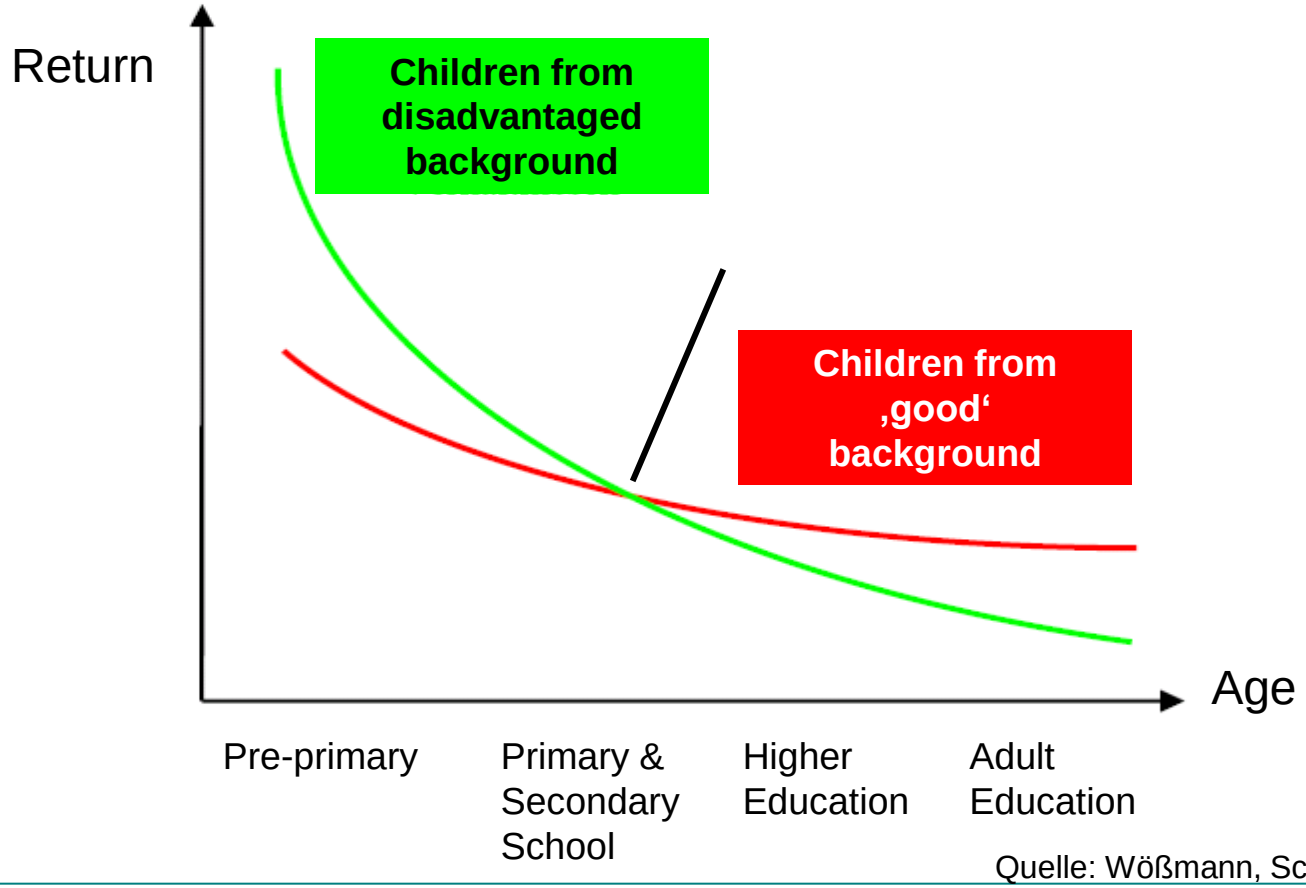


1- 4 Deskriptiv
- Synthesis vorhd.Evidenz
- neue Idee/Artefakt
- Feasibility
- Prototyping/Trialling

4-6 Kausal
- Prototyping/Trialling
- Feldstudien
- definitiver Test

'Sozialer Fakt'
Lebensverlaufs Erträge nach Bildungszyklus

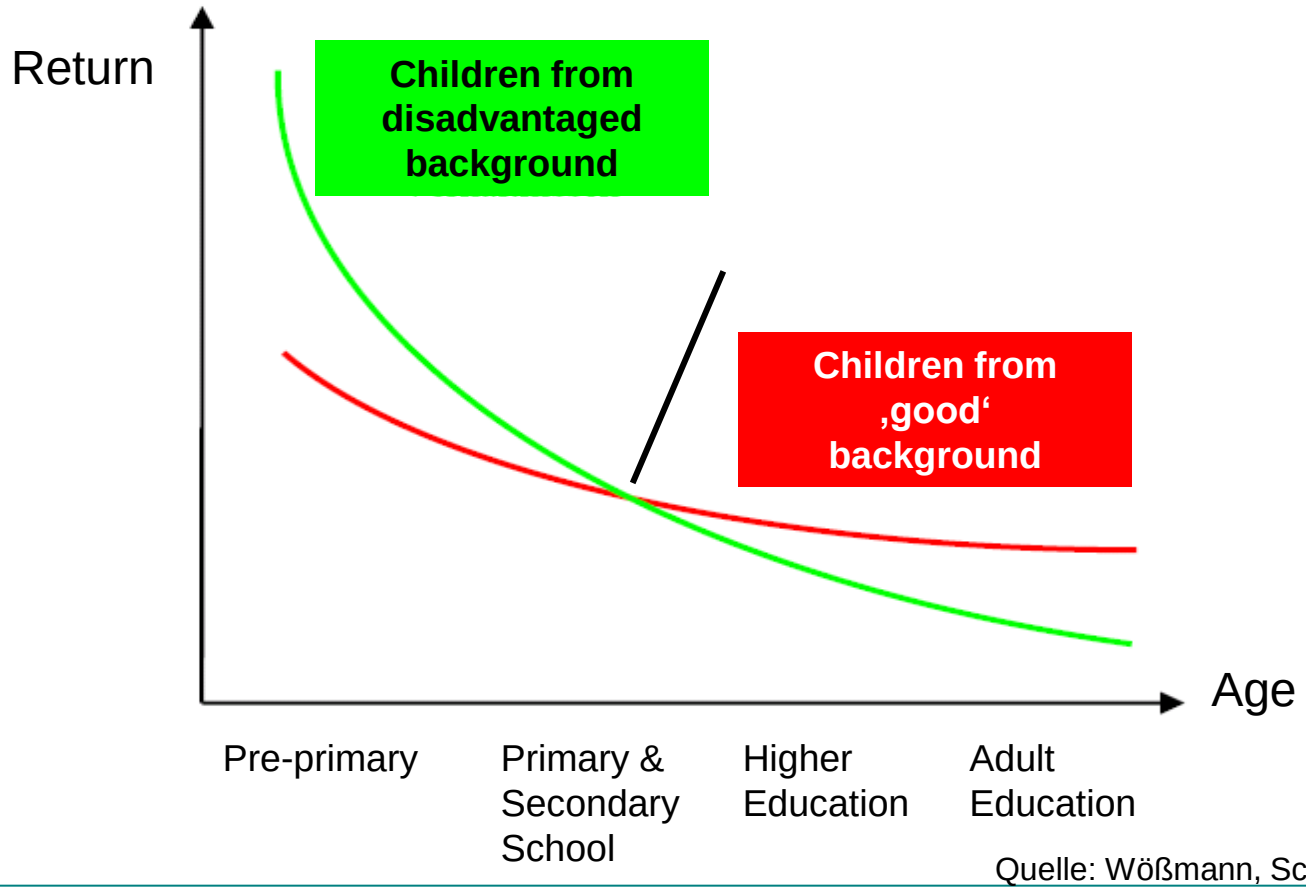
- in politischem Papier der EU-Kommision verbreitet…



Quelle: Wößmann, Schütz 2006, EENEE, EU-Commission

Long-term returns to investment in education over the life-cycle

- Stylized long-term returns during the phases of the life-cycle for children from ‚bad' and ‚good' social background



Quelle: Wößmann, Schütz 2006, EENEE, EU-Commission

Long-term returns to investment in education over the life-cycle

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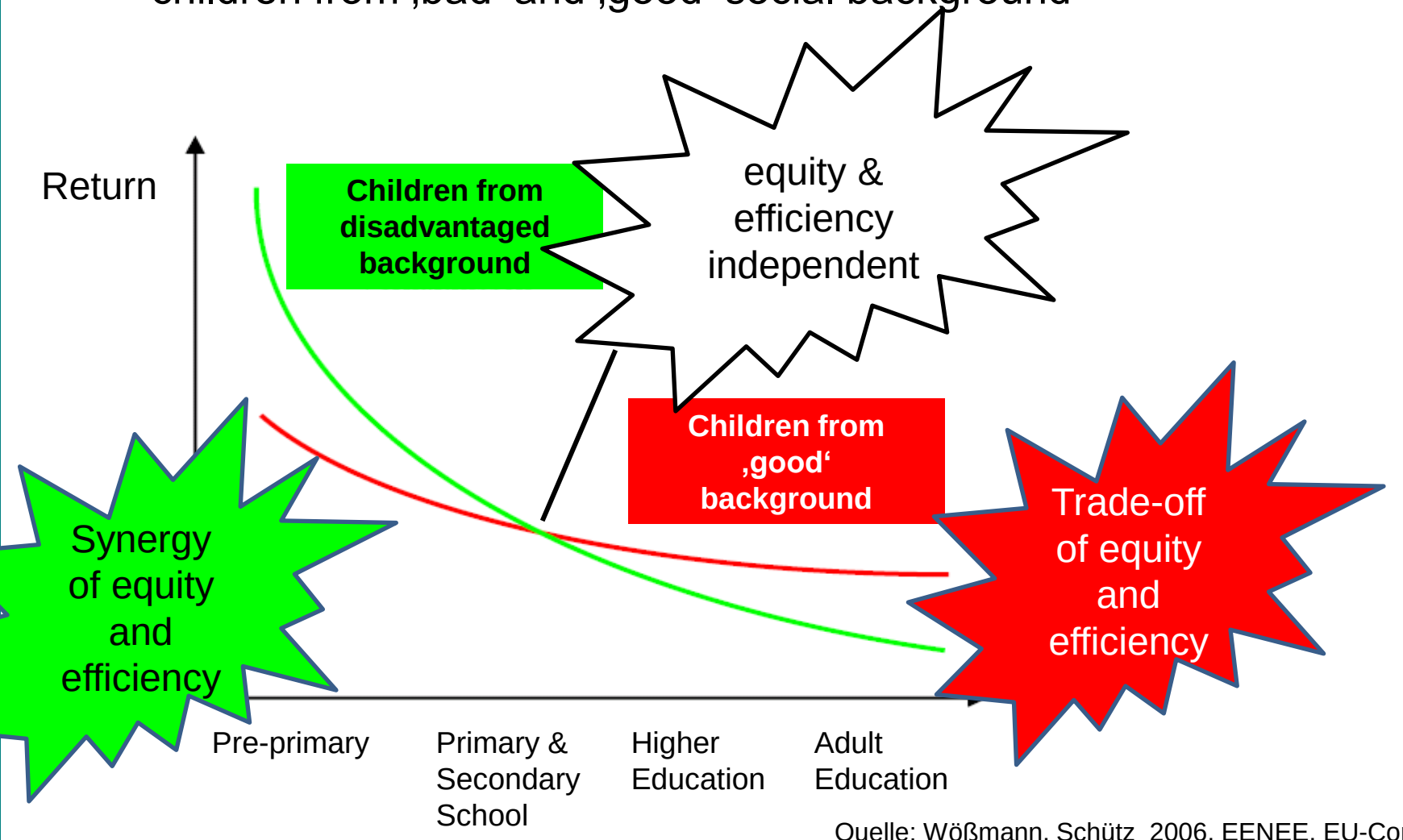

Quelle: Wößmann, Schütz 2006, EENEE, EU-Commission

Die empirische Basis

- INTERPRETING THE EVIDENCE ON LIFE CYCLE SKILL FORMATION, F.Cunha, J.J.Heckman, L.Lochner, D.V. Masterov, Working Paper 11331, NBER, NATIONAL BUREAU OF ECONOMIC RESEARCH, http://www.nber.org/papers/w11331

Das Modell

- 19 Gleichungen auf S.62-77

7 A Model of Skill Formation

We use simple economic models to organize the evidence presented in part II as summarized in Figures 1A and 1B. We define the concepts of recursive productivity or "self-productivity" and complementarity and show how the skill multiplier (as defined in this section) and the notion of complementarity help to organize the empirical evidence surveyed in part II. These concepts are essential for understanding why early interventions are more effective than later interventions and why there is no trade-off between equity and efficiency in the early years of childhood but why there is such a trade-off in the later years.

In the models presented in this section, parents make decisions about their children. We ignore how the parents get to be who they are and the decisions of the children about their own children. We develop a more generationally consistent model in section 8, after developing the basic framework of the technology of skill formation.

Suppose that there are two periods in a child's life, "1" and "2", before the child becomes an adult. Adulthood is a distinct third period. The child works for a fixed number of periods after the two periods of childhood. Models based on the analysis of Becker and Tomes (1986) assume only one period of childhood. We assume that there are two kinds of skills: S^C and S^N. For example, S^C can be thought of as cognitive skill and S^N as noncognitive skill. Our treatment of ability is in contrast to the view of the traditional literature on human capital formation that views IQ as innate ability. In our analysis, IQ is just another skill. What differentiates IQ from other cognitive and noncognitive skills is that IQ is subject to accumulation during critical periods. That is, parental and social interventions can increase the IQ of the child, but they can do so successfully only for a limited time. Recall our evidence that an enriched early intervention like the Abecedarian program raised IQ but Head Start and Perry Preschool — directed towards later ages — did not. Compare Figure 15A for the Abecedarian program with Figure 14A for the later-intervention Perry program.[68]

Let I_t^k denote parental investments in child skill k at period t, $k = C, N$ and $t = 1, 2$. Let h be the level of human capital as the child starts adulthood. It depends on both components of (S_2^C, S_2^N). The parents fully control the investment of the child. A richer model, developed in Cunha and Heckman (2004), incorporates, among other features, investment decisions of the child as influenced by the parent through preference formation processes.

We first describe how skills evolve over time. Assume that each agent is born with initial conditions $S_0 = (S_0^C, S_0^N)$. At each stage t let $S_t = (S_t^C, S_t^N)$ denote the vector of skill or ability stocks. The technology of production of skill k at period t is:

$$S_t^k = f_t^k\left(S_{t-1}, I_t^k\right) \tag{3}$$

for $k = C, N$ and $t = 1, 2$. We assume that f_t^k is twice continuously differentiable, increasing and concave in I_t^k.[69] In this model, stocks of both skills and abilities produce next period skills and the productivity of investments. Cognitive skills can promote the formation of noncognitive skills and vice versa.

We define adult human capital h as a combination of different period 2 skills:

$$h = g\left(S_2^C, S_2^N\right). \tag{4}$$

The function g is assumed to be continuously differentiable and increasing in (S_2^C, S_2^N). This model assumes that there is no comparative advantage in the labor market or in life itself.[70]

Period 1 is a *critical period* for S^C if

$$\frac{\partial S_2^C}{\partial I_2^C} = \frac{\partial f_2^C\left(S_1, I_2^C\right)}{\partial I_2^C} \equiv 0 \text{ for all } S_1, I_2^C,$$

but

$$\frac{\partial S_1^C}{\partial I_1^C} = \frac{\partial f_1^C\left(S_0, I_1^C\right)}{\partial I_1^C} > 0 \text{ for some } S_0, I_1^C.$$

This says that investments in C are productive in period 1 but not in period 2. In the analysis of part II, the early periods (before age 8) are critical periods for IQ but not for achievement tests or for noncognitive skills.

Period 1 is a *sensitive period* for S^C if

$$\left.\frac{\partial S_2^C}{\partial I_2^C}\right|_{S_1=s, I_2^C=i} < \left.\frac{\partial S_1^C}{\partial I_1^C}\right|_{S_0=s, I_1^C=i}.$$

Thus 1 is a sensitive period if, at the same level of inputs, investment is more productive in stage 1 than in stage 2. The evidence in part II suggests that early investments in both cognitive and noncognitive abilities and skills are more productive than later investments.

As defined in the introduction, and clarified in the Appendix, direct complementarity of skill l acquired in period 1 on the output of investment k in producing skill k in period 2 is defined by

$$\frac{\partial^2 S_2^k}{\partial I_2^k \partial S_1^l} > 0.$$

Early stocks of abilities and skills promote later skill acquisition by making it more productive. Students with greater early cognitive and noncognitive abilities are more efficient in later learning of both cognitive and noncognitive skills. Thus the enriched early environments of the Abecedarian, Perry and CPC programs promote greater efficiency in learning in high schools and reduce problem behaviors. See the evidence in Figures 13-15 on reduction in remedial education and problem behavior for the treatment group in these programs.

This technology also is sufficiently rich to capture learning phenomena in rodents and rhesus monkeys documented by Meaney (2001) and Cameron (2004). Emotionally nurturing early environments create preconditions for later cognitive learning. More emotionally secure young animals explore their environments more actively and learn more quickly. This is an instance of complementarity.

To fix ideas, consider the following specialization of our model. Ignore the effect of initial conditions and assume that first period skills are just due to first period investment:

$$S_1^C = f_1^C\left(S_0, I_1^C\right) = I_1^C$$

and

$$S_1^N = f_1^C\left(S_0, I_1^C\right) = I_1^N,$$

where I_1^C and I_1^N are scalars. For the second period technologies, we assume a CES structure:

$$\begin{aligned} S_2^C &= f_2^C\left(S_1, I_2^C\right) \\ &= \left\{\gamma_1\left(S_1^C\right)^\alpha + \gamma_2\left(S_1^N\right)^\alpha + (1-\gamma_1-\gamma_2)\left(I_2^C\right)^\alpha\right\}^{\frac{1}{\alpha}} \quad \text{where} \quad \begin{array}{l} 1 \geq \gamma \\ 1 \geq \gamma \\ 1 \geq 1-\gamma_1-\gamma_2 \geq 0 \end{array} \end{aligned} \tag{5}$$

and

$$\begin{aligned} S_2^N &= f_2^N\left(S_1, I_2^N\right) \\ &= \left\{\phi_1\left(S_1^C\right)^\sigma + \phi_2\left(S_1^N\right)^\sigma + (1-\phi_1-\phi_2)\left(I_2^N\right)^\sigma\right\}^{\frac{1}{\sigma}} \quad \text{where} \quad \begin{array}{l} 1 \geq \phi_1 \geq 0 \\ 1 \geq \phi \\ 1 \geq 1 \end{array} \end{aligned} \tag{6}$$

where $\frac{1}{1-\alpha}$ is the elasticity of substitution in the inputs producing S_2^C and $\frac{1}{1-\sigma}$ is the elasticity of substitution of inputs in producing S_2^N where $\alpha \in (-\infty, 1]$ and $\sigma \in (-\infty, 1]$. Notice that I_2^N and I_2^C are direct complements with (S_1^C, S_1^N) irrespective of the substitution parameters α and σ, except in limiting cases.

The CES technology is well known and has convenient properties. It imposes direct complementarity even though inputs may be more or less substitutable depending on α or σ.[71] We distinguish between direct complementarity and CES-substitution/complementarity in this section. Focusing on the technology for producing S_2^C, when $\alpha = 1$, the inputs are perfect substitutes in the intuitive use of that term (the elasticity of substitution is infinite). The inputs S_1^C, S_1^N and I_2^C can be ordered by their relative productivity in producing S_2^C. The higher γ_1 and γ_2, the higher the productivity of S_1^C and S_1^N respectively. When $\alpha = -\infty$, the elasticity of substitution is zero. All inputs are required in the same proportion to produce a given level of output so there are no possibilities for technical substitution, and

$$S_2^C = \min\left\{S_1^C, S_1^N, I_2^C\right\}.$$

In this technology, early investments are a *bottleneck* for later investment. Compensation for adverse early environments through late investments is impossible. These polar cases generalize the cases developed in Part I.

The evidence from numerous studies previously cited shows that IQ is no longer malleable after age 10. Taken at face value, this implies that if S^C is IQ, for all values of I_2^C, $S_2^C = S_1^C$. Period 1 is a critical period for IQ but not necessarily for other skills and abilities. More generally, period 1 is a critical period if

$$\frac{\partial S_t^C}{\partial I_t^C} = 0 \text{ for } t > 1.$$

For parameterization (5), this is obtained by imposing $\gamma_1 + \gamma_2 = 1$.

The evidence on adolescent interventions surveyed in part II shows substantial positive results for noncognitive skills (S_2^N) and at most modest gains for cognitive skills. Technologies (5) and (6) can rationalize this pattern. Since the populations targeted by adolescent intervention studies tend to come from families with poor backgrounds, we would expect I_1^C and I_1^N to be below average. Thus, S_1^C and S_1^N will be below average. Interventions make I_2^C and I_2^N relatively large for the treatment group in comparison to the control group in the adolescent intervention experiments. At stage 2, S_2^C (cognitive ability) is essentially the same in the control and treatment groups, while S_2^N (noncognitive ability) is higher for the treated group. Large values of $(\gamma_1 + \gamma_2)$ (associated with a small coefficient on I_2^C) or small values of $(\phi_1 + \phi_2)$ (so the coefficient on I_2^N is large) and high values of α and σ can produce this pattern. Another case that rationalizes the evidence is when $\alpha \to -\infty$ and $\sigma = 1$. Under these conditions:

$$S_2^C = \min\left\{S_1^C, S_1^N, I_2^C\right\}, \tag{7}$$

while

$$S_2^N = \phi_1 S_1^C + \phi_2 S_1^N + (1-\phi_1-\phi_2) I_2^N. \tag{8}$$

The attainable period 2 stock of cognitive skill $\left(S_2^N\right)$ is limited by the minimum value of S_1^C, S_1^N, I_2^C. In this case, any level of investment in period 2 such that $I_2^C > \min\left\{S_1^C, S_1^N\right\}$ is ineffective in incrementing the stock of cognitive skills. Period 1 is a bottleneck period. Unless sufficient skill investments are made in S_C in period 1, it is not possible to raise skill S_C in period 2. This phenomenon does not appear in the production of the noncognitive skill, provided that $(1-\phi_1-\phi_2) > 0$. More generally, the higher σ and the larger $(1-\phi_1-\phi_2)$, the more productive is investment I_2^N in producing S_2^N.

To complete the CES example, assume that adult human capital h is a CES function of the two skills accumulated at stage two:

$$h = \left\{\tau\left(S_2^C\right)^\rho + (1-\tau)\left(S_2^N\right)^\rho\right\}^{\frac{\phi}{\rho}}, \tag{9}$$

where $\rho \in (0, 1)$, $\tau \in [0, 1]$, and $\phi \in (-\infty, 1]$. In this parameterization, $\frac{1}{1-\rho}$ is the elasticity of substitution across different skills in the production of adult human capital. Equation (9) reminds us that the market, or life in general, requires use of multiple skills. Being smart isn't everything. In general, different tasks

require these skills in different proportions. One way to remedy early skill deficits is to make compensatory investments. Another way is to motivate people from disadvantaged environments to pursue tasks that do not require the skill that deprived early environments do not produce. A richer theory would account for this choice of tasks and its implications for remediation.[72] For the sake of simplifying the argument, we work with equation (9) that captures the notion that skills can trade off against each other in producing effective people. Highly motivated, but not very bright, people may be just as effective as bright but unmotivated people. That is one of the lessons from the GED program. (See Heckman and Rubinstein, 2001.)

The analysis is simplified by assuming that investments are general in nature: $I_1^C = I_1^N = I_1$, $I_2^C = I_2^N = I_2$.[73] Cunha and Heckman (2004) develop the more general case of skill-specific investments which requires substantially more notational complexity.

With common investment goods, we can solve out for S_1^C and S_1^N in terms of I_1 to simplify (5) and (6) to reach

$$S_2^C = \left\{(\gamma_1+\gamma_2)(I_1)^\alpha + (1-\gamma_1-\gamma_2)(I_2)^\alpha\right\}^{\frac{1}{\alpha}} \quad (10)$$

and

$$S_2^N = \left\{(\phi_1+\phi_2)(I_1)^\sigma + (1-\phi_1-\phi_2)(I_2)^\sigma\right\}^{\frac{1}{\sigma}}. \quad (11)$$

If we then substitute these expressions into the production function for adult human capital (9), we obtain

$$h = \left\{\tau\left[\tilde{\gamma}(I_1)^\alpha + (1-\tilde{\gamma})(I_2)^\alpha\right]^{\frac{\phi}{\alpha}} + (1-\tau)\left[\tilde{\phi}(I_1)^\sigma + \left(1-\tilde{\phi}\right)(I_2)^\sigma\right]^{\frac{\phi}{\sigma}}\right\}^{\frac{1}{\phi}} \quad (12)$$

where $\tilde{\gamma} = \gamma_1 + \gamma_2$, $\tilde{\phi} = \phi_1 + \phi_2$. Equation (12) expresses adult human capital as a function of the entire sequence of childhood investments in human capital. Current investments in human capital are combined with the past stock of skills in order to increment the stock of these skills.

A conveniently simple formulation of the problem arises if we assume that $\alpha = \sigma = \phi$ so that CES substitution among inputs in producing outputs and CES substitution among skill in producing human capital are the same. This produces the convenient and familiar-looking CES expression for adult human capital stocks:

$$h = \left\{\gamma I_1^\phi + (1-\gamma) I_2^\phi\right\}^{\frac{\phi}{\phi}}, \quad (13)$$

where $\gamma = \tau\tilde{\gamma} + (1-\tau)\tilde{\phi}$ and $\phi = \alpha = \sigma$. The parameter γ is *a skill multiplier*. It arises because I_1 affects the accumulation of S_1^C and S_1^N. These stocks of skills in turn affect the productivity of I_2 in forming S_2^C and S_2^N. Thus γ captures the net effect of I_1 on h through both self-productivity and direct complementarity.[74] $\frac{1}{1-\phi}$ is a measure of how easy it is to substitute between I_1 and I_2 where the substitution arises from both the task performance (human capital) function in equation (9) and the technology of skill formation. Within the CES technology, ϕ is a measure of the ease of substitution of inputs. In this analytically convenient case, the parameter ϕ plays a dual role. First, it informs us how easily one can substitute across different skills in order to produce one unit of adult human capital h. Second, it also represents the degree of complementarity (or substitutability) between early and late investments in producing skills. In this second role, the parameter ϕ dictates how easy it is to compensate for low levels of stage 1 skills in producing late skills.

[74] To repeat an observation made in part I, observe that direct complementarity between I_1 and I_2 is given by

$$\frac{\partial^2 h}{\partial I_1 \partial I_2}$$

As long as $\rho > \phi$, I_1 and I_2 are direct complements, because

$$\text{sign}\left(\frac{\partial^2 h}{\partial I_1 \partial I_2}\right) = \text{sign}(\rho - \phi).$$

This definition of complementarity is to be distinguished from the notion based on the elasticity of substitution between I_1 and I_2, which is $\frac{1}{1-\phi}$. When $\phi < 0$, I_1 and I_2 are sometimes called complements. When $\phi > 0$, I_1 and I_2 are sometimes called substitutes. When $\rho = 1$, I_1 and I_2 are always direct complements, but if $1 > \phi > 0$, they are CES substitutes.

In principle, compensation can come through two channels: (i) through skill investment or (ii) through choice of market activities, substituting deficits in one skill by the relative abundance in the other through choice of tasks. We do not develop the second channel of compensation in this chapter, deferring it to later work.

When ϕ is small, low early investments I_1 are not easily remediated by investments I_2 in producing human capital. The other face of CES complementarity is that when ϕ is small, high early investments should be followed with high late investments. In the extreme case when $\phi \to -\infty$, (13) converges to $h = (\min\{I_1, I_2\})^\rho$, which case we analyzed in part I. Note that the Leontief case contrasts with the case of perfect CES substitutes, which arises when $\phi = 1$: $h = [\gamma I_1 + (1-\gamma) I_2]^\rho$. When we impose the further restriction that $\gamma = \frac{1}{2}$, we generate the model that is implicitly assumed in the literature of human capital investments that collapse childhood in a single period. In this special case the only thing that matters is the total amount of human capital investments, regardless of how it is distributed across childhood periods. In the case of perfect CES substitutes, it is possible in a physical productivity sense, to compensate for early investment deficits by later investments, although it may not be economically efficient to do so.

When $\rho = 1$, we can rewrite (13) as

$$h = I_1\left\{\gamma + (1-\gamma)\omega^\phi\right\}^{\frac{1}{\phi}},$$

where $\omega = I_2/I_1$. Fixing I_1 (early investment), an increase in ω is the same as an increase in I_2. The marginal productivity of late investment is

$$\frac{\partial h}{\partial \omega} = (1-\gamma) I_1\left\{\gamma + (1-\gamma)\omega^\phi\right\}^{\frac{1-\phi}{\phi}}\omega^{\phi-1}.$$

For $\omega > 1$ and $\gamma < 1$, marginal productivity is increasing in ϕ and $(1-\gamma)$. Thus, provided that late investments are greater than earlier investments, the more substitutable I_2 is with I_1 (the higher ϕ) and the lower the skill multiplier γ, the more productive are late investments. Figure 17A graphs the isoquants for $\frac{\partial h}{\partial \omega}$. It shows that a high ϕ trades off with a high γ. As $(\phi, 1-\gamma)$ increases along a ray, $\frac{\partial h}{\partial \omega}$ increases. For a fixed skill multiplier γ, the higher ϕ, the higher the marginal productivity of second period investment. If, however, $\omega < 1$, then $\frac{\partial h}{\partial \omega}$ could be decreasing as $(\phi, 1-\gamma)$ increases along a ray and the trade-off between ϕ and $(1-\gamma)$ along a $\left(\frac{\partial h}{\partial \omega}, \omega\right)$ isoquant is reversed.

If I_1 is large relative to I_2 (*i.e.*, $\omega < 1$), for a fixed γ the marginal product of I_2 is decreasing in ϕ. More CES complementarity implies greater productivity (see Figure 17B)[75]. The empirically relevant case for the analysis of investment in disadvantaged children is $\omega > 1$, so greater CES-substitutability and a smaller skill multiplier produce a higher marginal productivity of remedial second period investment.

It is important to distinguish the case when it is technologically efficient to compensate for adverse early environments from the case when it is economically efficient to do so. If γ is near 1, it may be very costly to remediate shortfalls in early investments even though it is technically possible to do so. We return to this point below.

In analyzing the optimal timing of investment, it is convenient to work with the technology embodied in (13). We now show how the ratio of early to late investments varies as a function of ϕ, γ, and ρ. Consider the following model in which parents maximize the present value of net wealth of their children.[76] In order to do that, parents decide how much to invest in period "1," I_1, how much to invest in period "2," I_2, and how much to transfer in risk-free assets, b, given total parental resources M. Period "1" could include *in utero* investments. Parents cannot extract resources from children, so $b \geq 0$. From period "3" to period T, the age of retirement from the workforce, persons are assumed to work full time. Let r denote the time-invariant interest rate, set exogenously and assumed to be constant for all periods, and let q denote the present value of future earnings per efficiency unit of human capital $\{w_t\}_{t=3}^T$:

$$q = \sum_{t=3}^{T}\left(\frac{1}{1+r}\right)^{t-3} w_t.^{77}$$

Lifetime earnings of children when they start working at period "3" are given by $qg(I_1, I_2)$, where g is the function determining the adult stock of human capital. Discounted to period 1, the present value of lifetime earnings is $\frac{q}{(1+r)^2} g(I_1, I_2)$. The problem of the parents is to maximize the present value of the child's net wealth:

$$\max_{I_1, I_2, b}\left\{\frac{1}{(1+r)^2}\left[qg(I_1, I_2) + b\right]\right\},$$

subject to the standard budget constraint

$$I_1 + \frac{1}{1+r} I_2 + \frac{1}{(1+r)^2} b = M, \quad (14)$$

and the constraint that parents cannot leave negative bequests to their children

$$b \geq 0, \quad (15)$$

where $g(I_1, I_2)$ is as defined in equation (13) and is concave in I_1 and I_2.

When $\phi = 1$, early and late investments are perfect CES substitutes. The optimal investment strategy for this technology in this simple environment is straightforward. The price of early investment is \$1. The price of the late investment is $\$\frac{1}{(1+r)}$. Thus the parents can purchase $(1+r)$ units of I_2 for every unit of I_1. The amount of human capital produced from one unit of I_1 is γ, while $\$(1+r)$ of I_2 produces $(1+r)(1-\gamma)$ units of human capital. Therefore, the parent invests early if $\gamma > (1-\gamma)(1+r)$ and late otherwise. Two forces act in opposite directions. High productivity of initial investment (the skill multiplier) drives the agent toward making early investments. Intertemporal prices (the interest rate) drive the agent to invest late. It is optimal to invest early if $\gamma > \frac{1+r}{2+r}$.

As $\phi \to -\infty$, the CES production function converges to the Leontief case and the optimal investment strategy is to set $I_1 = I_2$. CES complementarity dominates and the profile of investments is such that $\frac{I_1}{I_2}$ converges to one. In this extreme case, CES complementarity has a dual face. Investments in the young are essential. At the same time, later investments are needed to harvest early investments. On efficiency grounds, early disadvantages should be perpetuated, and compensatory investments at later ages are economically inefficient.

For $-\infty < \phi < 1$, the first-order conditions are necessary and sufficient given concavity of the technology in terms of I_1 and I_2. Let μ, λ denote the Lagrange multipliers associated with restrictions (14) and (15), respectively. The first-order conditions for I_1, I_2, and b are

$$\frac{q}{(1+r)^2}\rho\gamma\left\{\gamma I_1^\phi + (1-\gamma) I_2^\phi\right\}^{\frac{\rho-\phi}{\phi}} I_1^{\phi-1} = \mu, \quad (16)$$

$$\frac{q}{(1+r)^2}\rho(1-\gamma)\left\{\gamma I_1^\phi + (1-\gamma) I_2^\phi\right\}^{\frac{\rho-\phi}{\phi}} I_2^{\phi-1} = \mu, \quad (17)$$

$$\mu - 1 = \lambda(1+r)^2. \quad (18)$$

Notice that if restriction (15) is not binding, then $\lambda = 0$, $\mu = 1$ and optimal early a[illegible] are only functions of (q, r). In this case, unconstrained families that make bequests will all invest the same in their children. The only difference is in the transfers of assets to their children. If $M_A > M_B$ then $b_A > b_B$.

For an interior solution, if we take the ratio of (16) to (17) and rearrange terms w[illegible]

$$\frac{I_1}{I_2} = \left[\frac{\gamma}{(1-\gamma)(1+r)}\right]^{\frac{1}{\phi-1}}. \quad (19)$$

Figure 18 plots the ratio of early to late investments as a function of the skill multiplier γ, under different values of the complementarity parameter ϕ. When $\phi \to -\infty$, we obtain the Leontief technology and there is high CES-complementarity between early and late investments. In this case, the ratio is not sensitive to variations in γ. CES-complementarity dominates, and the optimal investment profile distributes investments equally across different periods. When $\phi = 0$, the function g is given by the Cobb-Douglas function:

$$h = (I_1)^{\rho\gamma} (I_2)^{\rho(1-\gamma)}.$$

In this case, from equation (19), $\frac{I_1}{I_2}$ is close to zero for low values of γ, but explodes to infinity as γ approaches one.

Another way to express these conclusions is to work in terms of growth rates of investment, which yields the expression

$$\log\left(\frac{I_2}{I_1}\right) = \left(\frac{1}{1-\phi}\right)\log\left(\frac{1-\gamma}{\gamma}\right) + \left(\frac{1}{1-\phi}\right)\log(1+r) \quad (20)$$

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This expression does not depend on ρ. In the special case $\gamma = \frac{1+r}{2+r}$, investment will be the same in both periods regardless of the value assumed by ϕ. More generally, the growth rate of investments over time varies with the complementarity between early and late investments, ϕ, with the skill multiplier for human capital, γ, and with the interest rate. *Ceteris paribus*, the higher the CES complementarity, (*i.e.*, the lower ϕ), the lower the growth rate of investments over time. The reason is that if investments complement each other strongly, optimality implies that they should be equal. *Ceteris paribus*, the higher the skill multiplier, γ, the lower the growth rate of investments should be over time. Intuitively, if early investments have a substantial impact in determining future stocks of human capital, optimality implies that early investments should also be high. Finally, the higher the interest rate, the higher the growth rate of investments. This result reflects the opportunity costs of investing today relative to investing tomorrow. The higher the interest rate today, the cheaper it is to postpone investments.

The lessons we take from this simple analysis are summarized in Table 10. When CES complementarity is high, the skill multiplier γ plays a limited role in shaping the ratio of early to late investments. High early investments should be followed by high late investments. As the degree of CES complementarity decreases, the role of the skill multiplier increases, and the higher the multiplier, the more investments should be concentrated in early ages.

This simple model also has implications for the timing of interventions. If $M_A > M_B$ and family A is unconstrained while family B is constrained, then for family B, $\lambda_B > 0$, $\mu_B = \left[1 + \lambda_B (1+r)^2\right]$. Consequently, in equilibrium, the marginal return to one dollar invested in the poor child from family B is above the marginal return to the same dollar invested in the rich child from family A, so family B underinvests compared to the less constrained family A.

There is no trade-off between equity and efficiency in *early* childhood investments. Government policies to promote early accumulation of human capital should be targeted to the children of poor families. However, the optimal second period intervention for a child from a disadvantaged environment depends critically on the nature of human capital aggregation and function (13), the technology of skill production. If I_1 and I_2 are perfect CES complements, then a low level of I_1 cannot be compensated at any level of investment by a high I_2.

On the other hand, suppose that $\phi = 1$, so the reduced form technology can be written with inputs as perfect CES substitutes:

$$h = [\gamma I_1 + (1-\gamma) I_2]^{\rho}, \ 0 \leq \gamma \leq 1. \quad (21)$$

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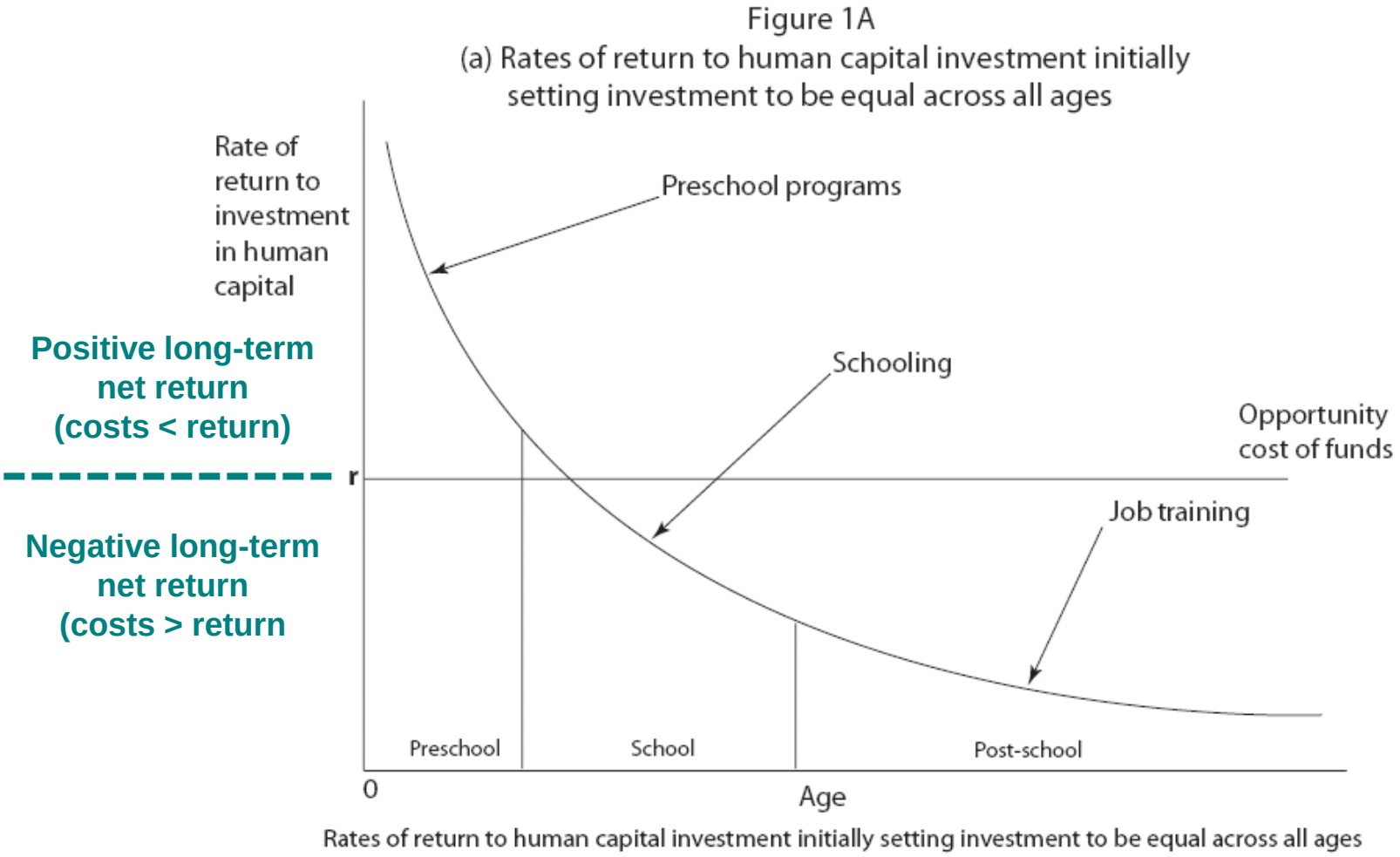
Then a second-period intervention can, in principle, eliminate initial skill deficits (low values of I_1). At a sufficiently high level of second-period investment, it is technically possible to offset low first period investments. However, it may not be cost effective to do so. For example, if $\rho = 1$ and $q(1-\gamma) < 1 + r$, then the gains from future earnings do not justify the costs of investment. It would be more efficient to give the child a bond that earns interest rather than to invest in human capital in order to put the child at a certain level of income.

We previously discussed the concepts of critical and sensitive periods in terms of the technical possibilities of remediation. These were defined in terms of the technology of skill formation. Here, we consider the net effects operating through investment and market substitution. The higher ϕ, the greater are the possibilities for alleviating early disadvantage. When $\phi = 1$, as in this example, it is always technically possible to remediate early disadvantage. But it may not be economically efficient to do so. From an economic point of view, critical and sensitive periods should be defined in terms of the costs and returns of remediation, and not solely in terms of technical possibilities. We next embed the technology developed in this section into a market setting where choices and credit constraints can be clearly articulated.

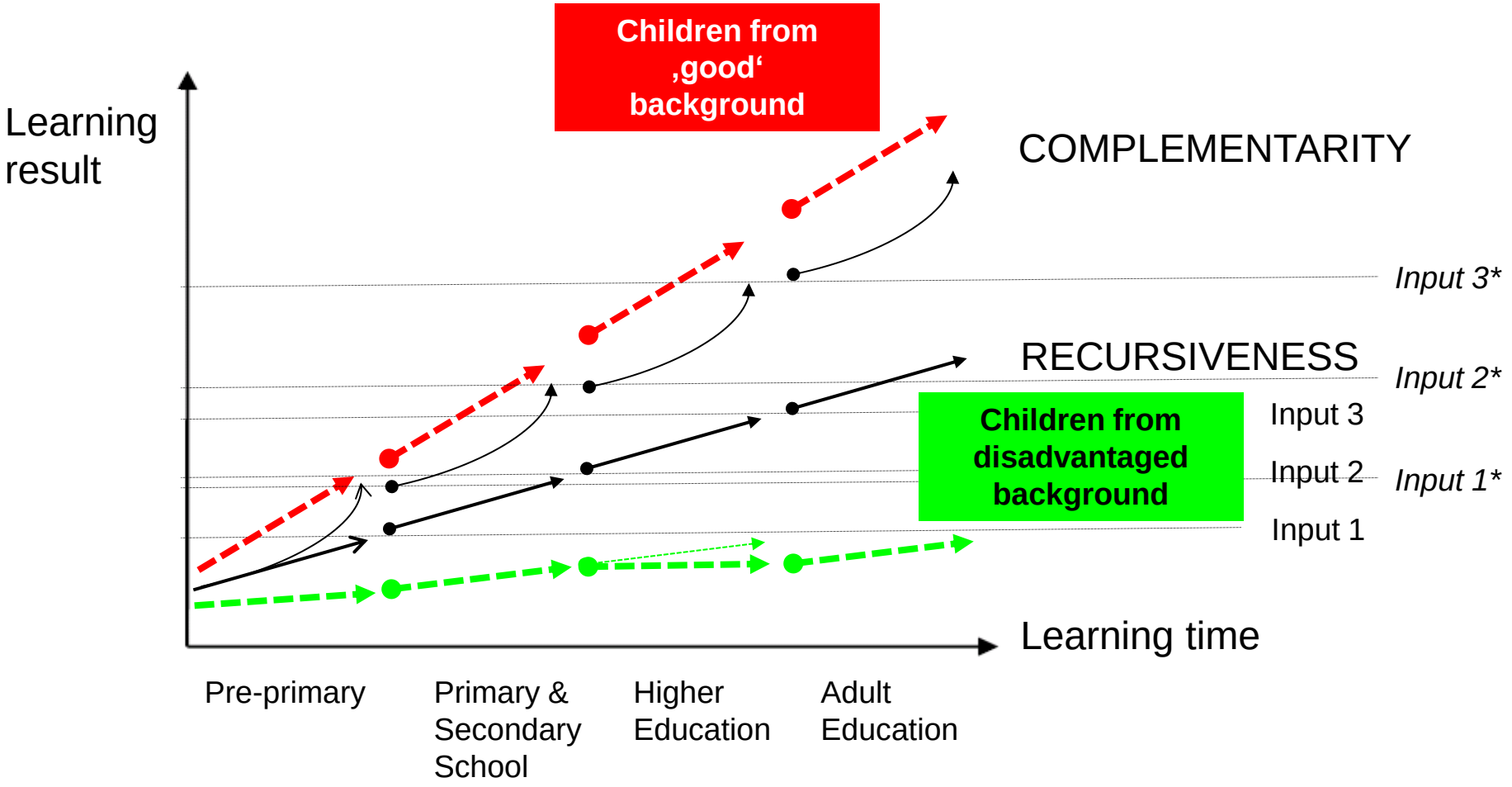
Long-term returns to education over the life-cycle

- Original figure from US-research



Quelle: Cunha et al. 2006 [http://www.nber.org/papers/w11331]

The ‚skills multiplier'
Recursiveness & complementarity



Beispiele zur Verwendung von Ziffern

- Deskriptive Informationen, Strukturen, Vergleiche
- Bildungsberichterstattung, quantitativer Teil
- Benchmarks
- Evaluierung
- Kausale Analysen

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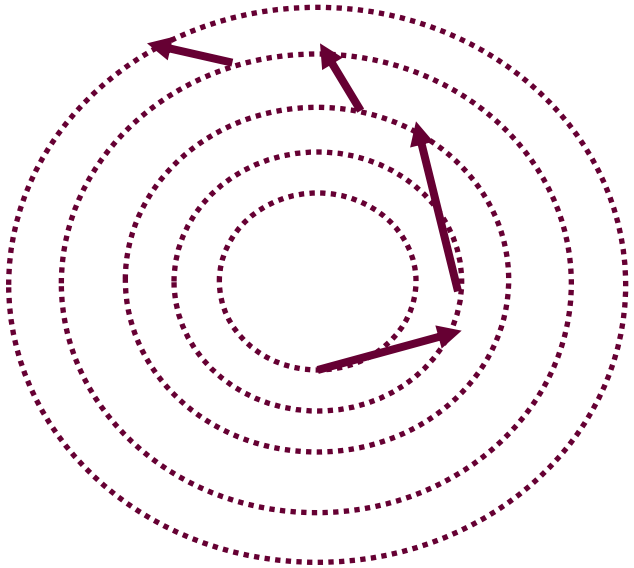

‚…mühsam ernährt sich das Eichhörnchen…

The End

Material