

がやや薄まっていく。一方、ケース B では、誕生する第 2 世代が長期的に老年従属人口指数を低下させる効果を持ち、ケース A に比べて大きく指数が低下する。

- 年金ブロックでは、人口ブロックでの長期的な人口シミュレーションとの関係を見る観点から、まず、各ケースに基づくマクロ経済スライドによる給付調整を行う前の賦課保険料率の見通しを比較した。厚年グループで適用するケースである、受入れケース A, B1, B2 と基本ケースの賦課保険料率の関係を見てみると、人口ブロックで分析した男性の老年従属人口指数の関係との共通性が認められ、ケース A, B1, B2 とともに外国人労働者の受入れの開始に伴い、賦課保険料率は直ちに基本ケースに比べて低下する効果が見込めるが、ケース A では移入した外国人の高齢化によって、長期的にはその効果が薄まっていく。一方、ケース B1, B2 では、第 2 世代以降が長期的に賦課保険料率を低下させる効果を持つ。さらに、B2 では第 2 世代以降が高賃金となることから、引き下げ効果はさらに大きいものとなる。また、最終的な所得代替率については、平成 21 年財政検証における基本ケースが 50.1% であるのに対し、受入れケース A では 3.8% ポイント程度の上昇であり、代替率は上昇するものの、賦課保険料率の見通しなどを見ると長期的には移入者の高齢化による影響を免れていない。一方で、受入れケース B1 では 6.9% ポイント程度の上昇、受入れケース B2 では 7.3% ポイント程度の上昇となり、第二世代の影響が非常に大きい。また、国民年金での適用を行う受入れケース A' では所得代替率にほとんど変化はみられないが、受入れケース B' では 1.4% ポイント程度の上昇が見込まれる。
- 医療・介護ブロックでは、1 人当たり医療費と医療費加重の平均年齢に与える影響評価を行った。1 人当たり医療費は、将来推計人口が平成 24 年推計ベースの場合、2010 年の 28 万円を 1 としたときの比率をみると、2035 年で 1.30、2060 年で 1.49 となるが、将来推計人口を受入ケース B によるものに置き換えて同様に推計すると、2035 年で 1.25、2060 年で 1.37 となる。また、医療費加重の平均年齢は、将来推計人口が平成 24 年推計ベースの場合、2010 年で 62.5 歳、2035 年では 70.1 歳、2060 年で 73.8 歳に達するが、将来推計人口を受入ケース B に置き換えた場合、2035 年で 69.3 歳、2060 年で 72.0 歳に留まるものと見込まれる。両者とも、外国人受入れの効果は、受入れ期間が長期化するほど大きくなる。

これらの将来人口シミュレーションや、年金、医療・介護への影響評価の結果から、外国人労働者の受入れの影響について、長期的な観点に立った定量的評価を行うことが重要であることが明らかとなったといえよう。しばしば、外国人労働者受入れに関する議論は、当面の労働力不足を補うだけの短期的視点で行われることがあるが、本研究の成果によれば、受け入れた外国人は将来、高齢化して年金等の受給者に回る一方で、家族呼び寄せや出生行動等は新たな社会保障の支え手を生み出す原動力ともなっている。したがっ

て、外国人受入れに関する社会保障への影響評価については、これら全ての影響を織り込んだ長期的な評価を行うことが具体的な施策の議論にとって極めて重要である。

なお、本研究では外国人受入れの影響について、社会保障に対して将来人口が与えるインパクトの評価を対象として行ったが、外国人の受入れについては社会保障だけではなく、教育や治安の問題、また、文化的側面など、多様な角度からの議論も必要である。本研究は、そのような様々な観点からの議論を行うための一つの視点として、これまであまり行われてこなかった複数のシナリオに基づいた定量的な長期シミュレーション結果を研究成果として提示したものである。今後、外国人労働者の受入れや社会保障に関する政策議論にあたっては、本研究で提示したシミュレーションを活用しつつ、長期的かつ幅広い観点から定量的な議論を行うことが必要であるといえよう。

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表1 公的年金被保険者数の見通し(ケースA)

公的年金被保険者数の将来見通し(外国人受入ケースA)

年 度	公的年金被保険者計	第1号被保険者	被用者年金被保険者			第3号被保険者			公的年金被保険者数の減少率 ①	①に寿命の延び等を勘案して設定した一定率(0.3%)を加えた率②
			合計	厚生年金	共済組合	合計	厚生年金	共済組合		
平成(西暦)	百万人	百万人	百万人	百万人	百万人	百万人	百万人	百万人	%	%
21(2009)	68.9	19.8	38.9	34.4	4.4	10.3	9.0	1.3		
22(2010)	68.2	19.1	39.0	34.6	4.4	10.1	8.9	1.3	-0.3	-0.6
23(2011)	67.6	18.4	39.2	34.9	4.3	10.0	8.8	1.2	-0.7	-1.0
24(2012)	67.1	17.9	39.3	35.0	4.3	9.9	8.7	1.2	-1.0	-1.3
25(2013)	66.6	17.6	39.3	35.0	4.2	9.8	8.6	1.1	-1.0	-1.3
26(2014)	66.2	17.4	39.2	35.0	4.2	9.6	8.5	1.1	-0.9	-1.2
32(2020)	64.5	16.7	38.8	35.0	3.9	8.9	8.0	0.9	-0.4	-0.7
37(2025)	63.0	16.3	38.4	34.7	3.7	8.3	7.5	0.9	-0.4	-0.7
42(2030)	60.5	15.4	37.5	34.0	3.5	7.7	6.9	0.8	-0.7	-1.0
52(2040)	52.7	12.6	33.5	30.6	2.9	6.5	5.8	0.7	-1.4	-1.8
62(2050)	46.6	10.9	30.0	27.5	2.5	5.6	5.0	0.6	-1.2	-1.5
72(2060)	41.1	9.5	26.8	24.6	2.2	4.8	4.3	0.5	-1.3	-1.6
82(2070)	35.5	8.0	23.4	21.6	1.8	4.1	3.7	0.4	-1.5	-1.8
92(2080)	31.4	7.0	20.8	19.2	1.6	3.6	3.2	0.4	-1.2	-1.5
102(2090)	28.1	6.2	18.7	17.4	1.4	3.1	2.8	0.3	-1.1	-1.4
112(2100)	25.0	5.4	16.9	15.7	1.2	2.8	2.5	0.3	-1.2	-1.5
117(2105)	23.7	5.0	16.1	14.9	1.1	2.6	2.3	0.3	-1.1	-1.4

(注1) 被保険者数は年度間平均値である。

(注2) ①の公的年金被保険者数の減少率は4年度前から前々年度までの対前年度減少率の平均値(年平均)である。

※ マクロ経済スライドは、②の率を基礎とし、給付水準調整を行う。

表2 公的年金被保険者数の見通し(ケースB)

公的年金被保険者数の将来見通し(外国人受入ケースB)

年 度	公的年金被保険者計	第1号被保険者	被用者年金被保険者			第3号被保険者			公的年金被保険者数の減少率 ①	①に寿命の延び等を勘案して設定した一定率(0.3%)を加えた率②
			合計	厚生年金	共済組合	合計	厚生年金	共済組合		
平成(西暦)	百万人	百万人	百万人	百万人	百万人	百万人	百万人	百万人	%	%
21(2009)	68.9	19.8	38.9	34.4	4.4	10.3	9.0	1.3		
22(2010)	68.2	19.1	39.0	34.6	4.4	10.1	8.9	1.3	-0.3	-0.6
23(2011)	67.7	18.4	39.2	34.9	4.3	10.1	8.9	1.2	-0.7	-1.0
24(2012)	67.2	17.9	39.3	35.0	4.3	10.0	8.9	1.2	-1.0	-1.3
25(2013)	66.8	17.6	39.3	35.0	4.2	10.0	8.8	1.1	-1.0	-1.3
26(2014)	66.5	17.4	39.2	35.1	4.2	9.9	8.8	1.1	-0.8	-1.1
32(2020)	65.4	16.7	38.9	35.0	3.9	9.8	8.8	0.9	-0.3	-0.6
37(2025)	64.4	16.3	38.5	34.8	3.7	9.6	8.8	0.9	-0.2	-0.5
42(2030)	62.5	15.4	37.7	34.2	3.5	9.4	8.6	0.8	-0.5	-0.8
52(2040)	55.9	12.6	34.0	31.0	2.9	9.3	8.7	0.7	-1.1	-1.4
62(2050)	51.5	10.9	31.0	28.5	2.5	9.5	8.9	0.6	-0.8	-1.1
72(2060)	47.2	9.5	28.4	26.2	2.2	9.3	8.8	0.5	-0.9	-1.2
82(2070)	42.9	8.0	25.7	23.9	1.8	9.2	8.8	0.4	-0.9	-1.2
92(2080)	40.1	7.0	23.8	22.2	1.6	9.3	8.9	0.4	-0.6	-0.9
102(2090)	37.7	6.2	22.3	20.9	1.4	9.2	8.9	0.3	-0.6	-0.9
112(2100)	35.4	5.4	20.9	19.6	1.2	9.2	8.9	0.3	-0.6	-0.9
117(2105)	34.4	5.0	20.2	19.1	1.1	9.1	8.9	0.3	-0.6	-0.9

(注1) 被保険者数は年度間平均値である。

(注2) ①の公的年金被保険者数の減少率は4年度前から前々年度までの対前年度減少率の平均値(年平均)である。

※ マクロ経済スライドは、②の率を基礎とし、給付水準調整を行う。

表3 厚生年金の財政見通し (ケース A)

厚生年金の財政見通し

前提: 外国人受入れ ケースA  
 (参考事項) 最終保険料率 18.3%  
 国庫負担の前提 平成21年度 2分の1完成  
 スライド調整期間(終了年度) 2035年度  
 所得代替率(終了年度時点) 53.9%

年度 (西暦)	保険料率 %	収 入				支 出		収支差引換	年度末積立金	年度末積立金 (21年度価格)	積立度合
		収入合計	保険料収入	国庫負担	運用収入	支出合計	基礎年金拠出金				
		兆円	兆円	兆円	兆円	兆円	兆円	兆円	兆円	兆円	
2009	16.704	34.9	23.9	7.2	2.1	35.8	13.1	-0.9	144.4	144.4	4.1
2010	16.058	35.0	24.8	7.4	2.5	36.7	13.5	-1.7	142.7	141.2	3.9
2011	16.412	36.8	26.3	7.6	2.7	37.8	13.9	-1.0	141.8	141.9	3.8
2012	16.766	38.6	27.7	7.8	2.8	39.2	14.4	-0.6	141.2	141.6	3.6
2013	17.120	40.6	29.1	8.1	3.1	40.4	15.0	0.1	141.3	138.8	3.5
2014	17.474	42.8	30.5	8.4	3.6	41.4	15.7	1.4	142.7	136.1	3.4
2015	17.828	45.1	32.1	8.7	4.1	42.9	16.4	2.2	144.9	133.2	3.3
2020	18.300	54.1	37.7	9.6	6.7	47.1	18.2	7.0	171.3	139.6	3.5
2025	18.300	60.9	42.3	10.1	8.5	50.2	19.5	10.7	217.0	156.3	4.1
2030	18.300	68.5	46.8	10.7	11.1	54.3	20.9	14.3	282.3	179.7	4.9
2040	18.300	95.1	59.9	14.6	16.6	73.2	26.9	11.9	420.2	209.0	5.6
2050	18.300	101.8	62.2	15.5	21.1	91.3	36.5	10.5	530.0	206.0	5.7
2060	18.300	118.3	71.0	22.5	24.9	111.1	44.9	7.2	621.7	188.7	6.5
2070	18.300	132.7	78.7	26.9	28.1	133.7	53.8	-1.0	650.0	154.2	4.9
2080	18.300	145.9	80.8	30.5	24.4	153.0	61.1	-7.0	604.8	112.0	4.0
2090	18.300	159.6	104.9	34.2	20.4	172.9	68.5	-13.3	502.1	72.7	3.0
2100	18.300	172.9	121.0	38.7	13.2	196.5	77.4	-23.6	315.7	35.7	1.7
2105	18.300	179.5	130.5	41.2	7.8	209.3	82.4	-29.8	179.5	17.9	1.0

(注1)長期的な経済前提は、物価上昇率1.0%、賃金上昇率2.5%、運用利回り4.1%である。  
 (注2)「積立度合」とは、前年度末積立金の当年度の支出合計に対する倍率である。  
 (注3)「21年度価格」とは、賃金上昇率により、平成21(2009)年度の価格に換算したものである。  
 (注4)厚生年金基金の代行部分を含む、厚生年金全体の財政見通しである。

表4 厚生年金の財政見通し (ケース B1)

厚生年金の財政見通し

前提: 外国人受入れ ケースB1  
 (参考事項) 最終保険料率 18.3%  
 国庫負担の前提 平成21年度 2分の1完成  
 スライド調整期間(終了年度) 2025年度  
 所得代替率(終了年度時点) 57.0%

年度 (西暦)	保険料率 %	収 入				支 出		収支差引換	年度末積立金	年度末積立金 (21年度価格)	積立度合
		収入合計	保険料収入	国庫負担	運用収入	支出合計	基礎年金拠出金				
		兆円	兆円	兆円	兆円	兆円	兆円	兆円	兆円	兆円	
2009	16.704	34.9	23.8	7.2	2.1	35.8	13.1	-0.9	144.4	144.4	4.1
2010	16.058	35.0	24.7	7.4	2.5	36.7	13.5	-1.7	142.6	141.1	3.9
2011	16.412	36.6	26.2	7.6	2.7	37.6	13.9	-1.0	141.6	141.8	3.8
2012	16.766	38.6	27.7	7.8	2.8	39.2	14.4	-0.6	141.0	141.4	3.6
2013	17.120	40.5	29.1	8.1	3.1	40.5	15.1	0.1	141.1	138.6	3.5
2014	17.474	42.7	30.5	8.4	3.6	41.3	15.7	1.4	142.9	135.8	3.4
2015	17.828	45.1	32.0	8.8	4.1	42.7	16.4	2.4	144.9	133.2	3.3
2020	18.300	54.2	37.6	9.6	6.9	46.4	18.2	7.9	174.9	142.6	3.6
2025	18.300	61.7	42.2	10.6	8.6	50.5	20.5	11.2	223.7	161.2	4.2
2030	18.300	69.9	46.7	11.8	11.3	55.9	23.2	14.0	289.3	184.2	4.9
2040	18.300	87.2	54.0	16.4	16.7	70.1	32.7	11.1	421.0	209.4	5.4
2050	18.300	105.1	63.1	21.3	20.8	95.6	42.5	9.5	521.4	202.6	5.4
2060	18.300	124.1	73.9	26.1	24.1	117.9	54.4	6.2	602.6	183.0	5.1
2070	18.300	143.0	84.7	33.2	25.1	144.4	66.4	-1.4	622.9	147.7	4.3
2080	18.300	162.2	100.3	39.3	23.6	168.5	76.7	-5.3	584.1	108.2	3.5
2090	18.300	186.8	119.7	46.5	20.6	197.0	93.0	-10.2	508.4	73.6	2.6
2100	18.300	213.0	142.6	55.9	14.6	233.9	111.7	-20.9	352.0	39.8	1.6
2105	18.300	227.3	156.3	61.3	9.7	255.1	122.6	-27.7	227.3	22.7	1.0

(注1)長期的な経済前提は、物価上昇率1.0%、賃金上昇率2.5%、運用利回り4.1%である。  
 (注2)「積立度合」とは、前年度末積立金の当年度の支出合計に対する倍率である。  
 (注3)「21年度価格」とは、賃金上昇率により、平成21(2009)年度の価格に換算したものである。  
 (注4)厚生年金基金の代行部分を含む、厚生年金全体の財政見通しである。

表5 厚生年金の財政見通し (ケース B2)

厚生年金の財政見通し

前提: 外国人受入れ ケースB2  
 (参考事項) 最終保険料率 18.3%  
 国庫負担の前提 平成21年度 2分の1完成  
 スライド調整期間(終了年度) 2025年度  
 所得代替率(終了年度時点) 57.4%

年度 (西暦)	保険料率 %	収 入				支 出		収支差引換	年度末積立金	年度末積立金 (21年度価格)	積立度合
		収入合計	保険料収入	国庫負担	運用収入	支出合計	基礎年金拠出金				
		兆円	兆円	兆円	兆円	兆円	兆円	兆円	兆円	兆円	
2009	16.704	35.0	23.9	7.2	2.1	35.8	13.1	-0.8	144.5	144.5	4.1
2010	16.058	35.1	24.8	7.4	2.5	36.7	13.5	-1.6	142.8	141.3	3.9
2011	16.412	36.9	26.3	7.6	2.7	37.8	13.9	-0.9	141.9	140.0	3.8
2012	16.766	38.7	27.8	7.8	2.8	39.2	14.4	-0.5	141.4	141.8	3.6
2013	17.120	40.6	29.2	8.1	3.1	40.5	15.1	0.2	141.5	138.0	3.5
2014	17.474	42.9	30.6	8.4	3.6	41.3	15.7	1.5	143.1	136.4	3.4
2015	17.828	45.2	32.1	8.8	4.1	42.8	16.4	2.5	145.5	133.7	3.3
2020	18.300	54.5	37.7	9.8	6.8	47.5	18.8	7.0	173.0	141.0	3.5
2025	18.300	61.7	42.3	10.8	8.5	51.7	21.0	10.0	216.6	156.1	4.0
2030	18.300	69.8	46.8	12.1	10.8	57.3	23.7	12.5	275.3	175.3	4.6
2040	18.300	86.4	54.2	16.8	15.3	78.0	33.5	8.4	385.9	192.0	4.8
2050	18.300	103.4	63.6	21.7	18.1	97.9	43.4	5.5	452.1	175.7	4.6
2060	18.300	121.2	74.8	26.8	19.6	119.9	53.7	1.3	488.0	146.1	4.1
2070	18.300	139.7	88.4	32.6	18.7	145.1	65.1	-5.5	482.3	109.6	3.2
2080	18.300	161.4	101.7	37.6	16.2	167.4	75.1	-6.0	399.7	74.0	2.4
2090	18.300	189.9	131.6	45.1	14.0	194.2	89.2	-5.3	345.9	50.1	1.8
2100	18.300	222.6	160.8	50.3	11.5	230.0	100.5	-7.5	281.5	31.8	1.3
2105	18.300	242.8	178.6	54.0	9.9	250.6	108.7	-7.8	242.8	24.3	1.0

(注1)長期的な経済前提は、物価上昇率1.0%、賃金上昇率2.5%、運用利回り4.1%である。  
 (注2)「積立度合」とは、前年度末積立金の当年度の支出合計に対する倍率である。  
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 (注4)厚生年金基金の代行部分を含む、厚生年金全体の財政見通しである。

### Ⅲ. 資料編



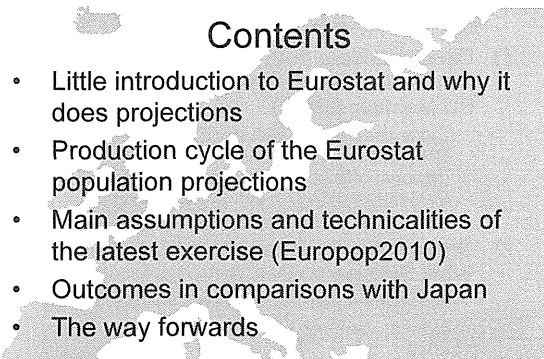
# Projecting demographic scenarios for European countries

- The Eurostat experience -

Giampaolo LANZIERI  
Visiting JSPS Research Fellow

*With the support of the JSPS Invitation Fellowship Programs for Research in Japan. This presentation is given to inform interested parties about research work and to encourage discussion. The views expressed are exclusively those of the author and do not necessarily represent the views of the European Commission / Eurostat.*

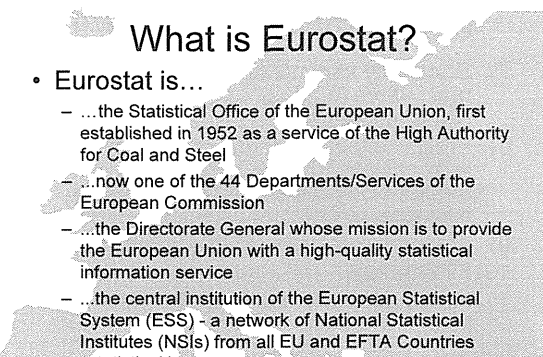
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# Contents

- Little introduction to Eurostat and why it does projections
- Production cycle of the Eurostat population projections
- Main assumptions and technicalities of the latest exercise (Europop2010)
- Outcomes in comparisons with Japan
- The way forwards


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# What is Eurostat?

- Eurostat is...
  - ...the Statistical Office of the European Union, first established in 1952 as a service of the High Authority for Coal and Steel
  - ...now one of the 44 Departments/Services of the European Commission
  - ...the Directorate General whose mission is to provide the European Union with a high-quality statistical information service
  - ...the central institution of the European Statistical System (ESS) - a network of National Statistical Institutes (NSIs) from all EU and EFTA Countries (*statistical law*)

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# Why Eurostat does projections?

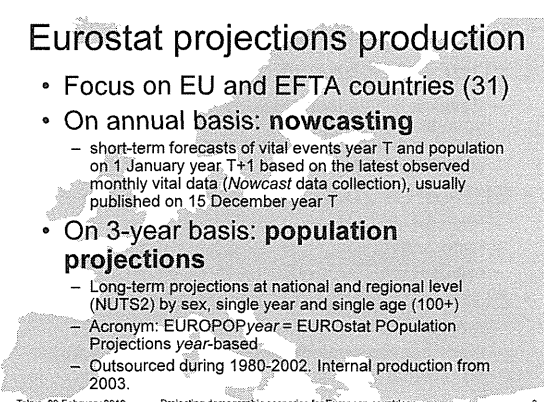
- Population projections are primary input to **economic and budgetary projections**, used for the assessment of the long run sustainability of public finances in the EU (pensions reforms, etc.)
- Eurostat receives a **mandate** from ECOFIN (the Council of Ministers of Economics and Finance of the EU Member States)
- Eurostat projections are therefore the **EU official projections** (but alternatives do exist)

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# The cycle of population projections in Eurostat

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# Eurostat projections production

- Focus on EU and EFTA countries (31)
- On annual basis: **nowcasting**
  - short-term forecasts of vital events year T and population on 1 January year T+1 based on the latest observed monthly vital data (*Nowcast data collection*), usually published on 15 December year T
- On 3-year basis: **population projections**
  - Long-term projections at national and regional level (NUTS2) by sex, single year and single age (100+)
  - Acronym: EUROPOP year = EUROstat POpulation Projections year-based
  - Outsourced during 1980-2002. Internal production from 2003.

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## The production cycle (1/4)

- 1) Direct mandate from ECOFIN (Council of Ministers of Economics and Finance of the EU Member States)
  - Close cooperation with the EPC Ageing Populations and Sustainability Working Group (national official **economists**) and with the Eurostat Working Group on Population Projections (NSIs **demography experts**)
- 2) Organisation of Joint Eurostat/UNECE Work Session on Demographic Projections
  - Review of the state of the art in the domain
  - Events: Vienna 2005, Bucharest 2007, Lisbon 2010

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## The production cycle (2/4)

- 3) Preparation of the methodology and provisional results
  - In-house activity
  - National level
  - Data from Eurobase (official data) plus – if needed – few adjustments, usually in cooperation with NSI
- 4) Discussion at the Joint Eurostat WG on "Population Projections" and EPC WG on "Ageing populations and Sustainability"
  - About 70 experts from Member States and EFTA countries
  - In-depth screening of EUROPOP
- 5) Fine-tuning of EUROPOP
  - Eventual further consultation

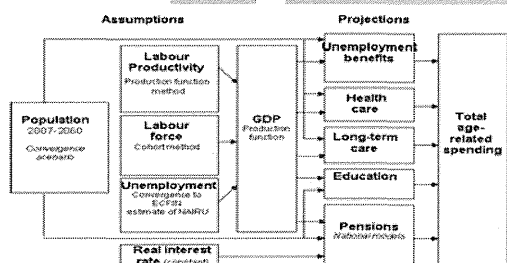
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## The production cycle (3/4)

- 6) Public release of EUROPOP national level
  - Entry into the process of age-related expenditure projections



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## The production cycle (4/4)

- 7) Sensitivity variants upon request from main users (e.g. higher life expectancy, higher migration, etc.)
- 8) Preliminary calculations of projections at regional level (NUTS2), based on methodology developed by NIDI some time ago
- 9) Transmission to the NSIs for feedbacks
- 10) Fine-tuning
- 11) Public release of EUROPOP regional level

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## Past exercises

- EUROPOP2004: **Trend Scenario**
  - Baseline + 6 variants: high population, low population, younger age profile population, older age profile population, high fertility and zero migration
  - regional (NUTS2-level) projections (up to 2031)
- EUROPOP2008: **Convergence Scenario**
  - main results and "no migration" variant
  - faster/slower convergence variants (not released)
  - regional (NUTS2 level) projections (up to 2031)
- EUROPOP2010: **Convergence Scenario**
  - main results and "no migration" variant
  - same convergence distributions of EuroPOP2008
  - no regional projections

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## Assumptions and Technicalities of EuroPOP2010



## A varied continent

- Small and big countries: from Liechtenstein (30k inhabitants) to Germany (80,000k)
- Several changes of the borders/territorial coverage (Cyprus, France, Germany, ex-Czechoslovakia, ex-URSS, ex-Yugoslavia)
- Differing data availability and quality

*Call for simple and robust method!*

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## The main assumption

The socio-economic differences across European countries (belonging to the EU or EFTA) will fade out in the very long run

### Demographic convergence

*But:*

No full convergence reached within the time horizon of the projections!

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## How is this implemented?

- A hypothetical year in which full convergence between countries is achieved is defined (*convergence year*)
- Reference distributions are defined for the convergence year (*convergence values*)
- The values observed in the base year are the *starting values*
- *Intermediate values* are obtained by interpolation between starting and convergence values.
- *Target values* are those intermediate values in the *target year* of the projections.

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## Cross-countries consistency

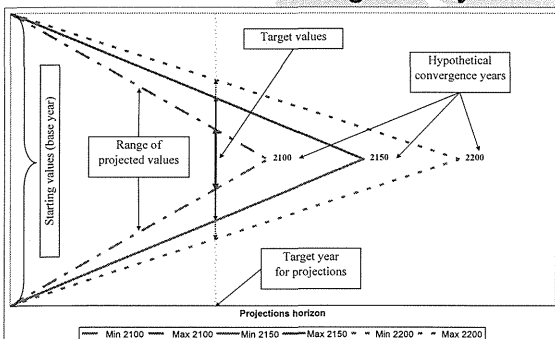
- The full convergence is never achieved within the projections horizon (unless it is an explicit assumption), but the range of values is smaller in the target year
- The closer the convergence year, the quicker the convergence (i.e., the smaller the range)
- A change of the convergence year and/or convergence values affects all countries; a change in a starting value only the corresponding country

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## Ex.: different convergence years



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## Basic choices

- In both Convergence exercises (Europop2008 and Europop2010) the convergence year has been set in 2150
- The same convergence year has been applied to every component, although in principle they may also be different (slower/faster convergence for some of them)
- Latest target year for population is 2061 => assumptions required until 2060 included

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## Projections methodology

- Multistate (dynamic) projections
  - no real difference from standard cohort-component method when using only age-sex breakdown
  - but possibility of further breakdowns (e.g. by regions, by national/foreign background,...) and consistency rules
- LIPRO software (Van Imhoff and Keilman 1992)

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## Data preparation

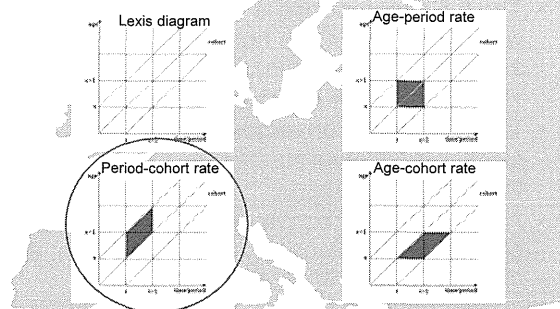
- Collection of raw official period-cohort data from countries (usually regular Eurostat data collections)
- Modelling of the age-sex patterns of each component for each country
- Computation of assumed future period-cohort rates for each component and country

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## Occurrence-exposure rates



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## Fertility

## Fertility scenario in summary

- Second Demographic Transition continues in Europe (Sweden more advanced and its TFR=1.85 taken as reference for convergence)
- Fertility is expected to recover for the countries with lower levels
- Countries with rapidly rising fertility will slow down the increase
- Fertility differentials between countries tend to become smaller

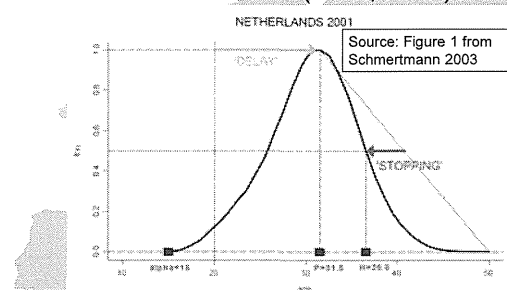
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## Fertility modelling

- Schmertmann model (2003, 2005):



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## Fertility convergence values

- Overall good performance for European fertility patterns of Schmertmann model
- Convergence distribution:
  - $\alpha = 14$  years (age reached)
  - Peak of fertility  $P = 31$  years of age
  - Half-fall after the peak  $H = 37$  years of age
  - TFR = 1.85 live births per woman
  - MAC = 30.5 years
- Neglected the bulge in the fertility rates at younger ages in few countries

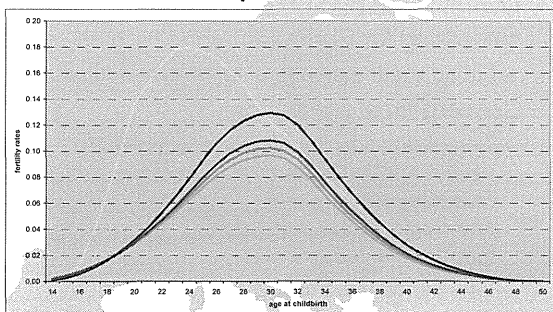
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## Fertility assumptions

- Schmertmann modelling for each country on latest available year(s), adjusted to the observed TFR
- Linear interpolation between latest modelled rates and the convergence values
- SRB=1.062 equal across countries and years (males = 515, females = 485)

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## Example: Austria

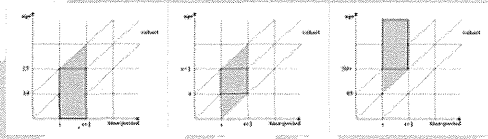


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## From PC to AP fertility rates

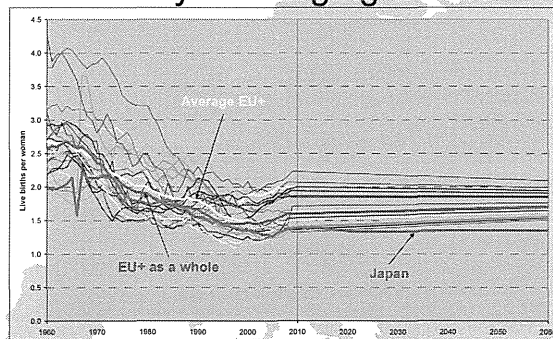
- Eurostat TFR is computed from AP rates
- Then:

$$\hat{f}_x^{AP} = \begin{cases} 0.5 \cdot (f_{x-1}^{PC} + f_x^{PC}) & x = 14, \dots, 49 \\ f_{x-1}^{PC} & x = 50 + \end{cases}$$



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## Fertility converging trends



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## What the literature says about fertility

- General postponement of childbearing should come to an end => expected recovery of TFR
- Some scholars warn about the "low-fertility trap"
- Excerpt from Goldstein *et al.* (2009)
  - "The prominent forecasting agencies such as the United Nations and Eurostat are likely to be right in their medium variant assumption that TFR levels in most countries will rise to 1.5 or above in the decades ahead. The fear of an accelerated downward spiral of fertility, articulated on numerous occasions over the last decade, seems unsubstantiated." Population and Development Review 35(4) p.691

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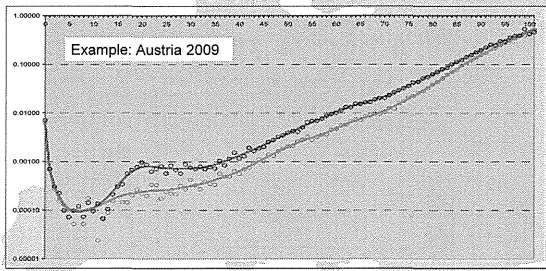
### Mortality scenario in summary

- Mortality improvements will continue, but at slowing pace, as they can be expected almost completely only from older ages
- Smaller gender differences (in work, lifestyles, etc.) will bring a reduction of mortality of sex differentials
- Mortality differentials between countries tend to become smaller, thanks to the diffusion (easier within EU/EFTA countries) of advanced medical treatments, healthier lifestyles, etc.

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### Mortality modelling

- Smoothing of mortality rates based on regression splines (R package "Demography" by R. Hyndman)



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### Mortality convergence values

- Overall good performance of spline smoothing for European mortality patterns
  - but no linear increase of  $\log(mx)$  at adult ages
- Convergence distribution:
  - extrapolation to the far future using BMS variant of Lee-Carter model (Booth *et al.* 2002) on a selected group of 12 countries (merged in one single entity), representing the mortality forerunners in Europe
  - data period used for the model: 1977-2005

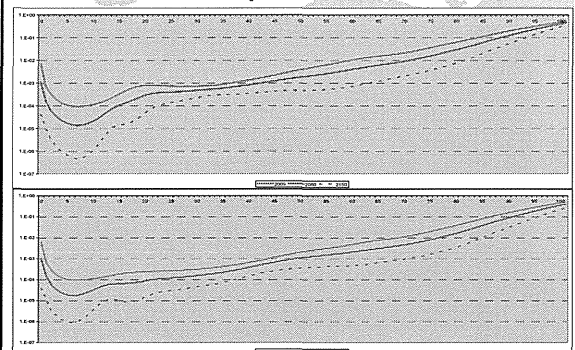
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### Mortality assumptions

- Splines modelling for each country on latest available year(s)
- Control for closeness of  $e_0$  and  $e_{65}$  estimates from smoothed rates with actual ones (jump at the start year).
- Exponential interpolation between smoothed rates and the convergence values
- (Control for) reduction of sex differentials

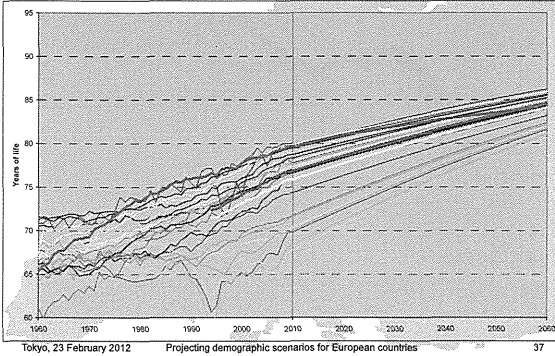
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### Example: Austria

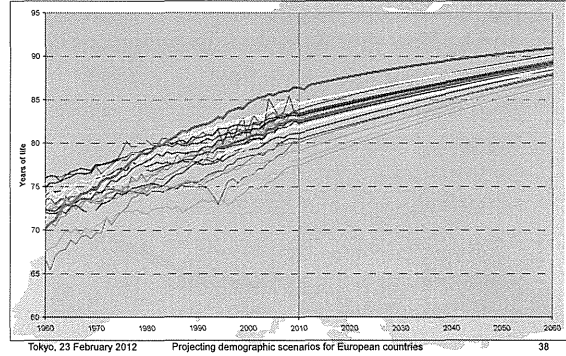


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## Mortality converging trends: e0M



## Mortality converging trends: e0F



## What the literature says about mortality

- General agreement on continuing mortality improvements
- Various stages of health transition to explain convergences/divergences in mortality (Vallin and Meslé 2002)
- Central-eastern European countries recovering from unfavourable trends (e.g. Meslé 2004)

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## Migration

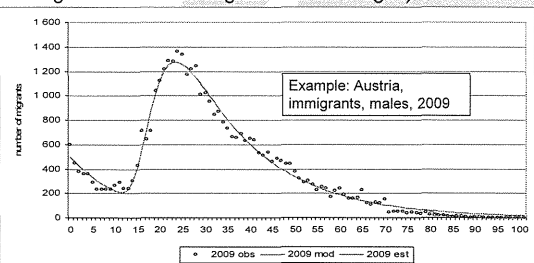
## Migration scenario in summary

- The ageing and the possible shrinking of the European populations call for an increasing number of immigrants
- However, an increasing demographic contribution of migrants in shrinking population may lead to challenging social developments
- Other areas of the world may come up in the future which may divert migratory flows
- Net migration levels tend then to decrease over time (although rates may keep stable or increase), but adjustments are added in case of shrinking population in working age

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## Migration modelling

- Rogers-Castro (1981) model with 7 parameters (i.e., no bulge for retirement migration at older ages)



## Migration convergence values

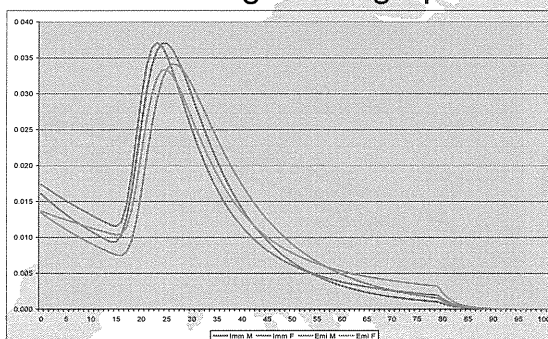
- Rogers-Castro models are fitted by sex and by flow (immigrants and emigrants)
- The 4 convergence distributions have been identified taking the median values of the parameters estimated over 46 age patterns for each component (184 data series) observed in latest years
- Ages 95 and over are set to zero
- Ages between 79 and 95+ are exponentially interpolated

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## Normalized migrants age patterns



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## Migration assumptions on levels

- Starting values are the latest observed migration flows (total immigrants and emigrants)
- Convergence values are the average of the starting values of immigration and emigration => net migration is zero in the convergence year (but not each level!)
- To smooth the effect of the economic crisis and considering the volatility of migration, double linear interpolation between starting and convergence values

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## The double linear interpolation

- For each country, an intermediate point is defined as average of migration levels observed in the latest years (2002-2009)
- The intermediate point, through which values have to pass, is set in 2020
- Values 2010-2019 are obtained by linear interpolation between starting and intermediate values, and 2021-2060 between intermediate and convergence values

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## Exceptions...

- Eastern Europe countries
  - Those with negative intermediate values in 2020 would have negative net migration all over the projections period
  - For 6 countries the convergence has been anticipated to 2035, then from that year on net migration is zero and not negative
- High migration inflows countries
  - Some countries would have a relatively high cumulative net migration at the end of the period
  - For 10 countries the intermediate point has thus been reduced of one third.

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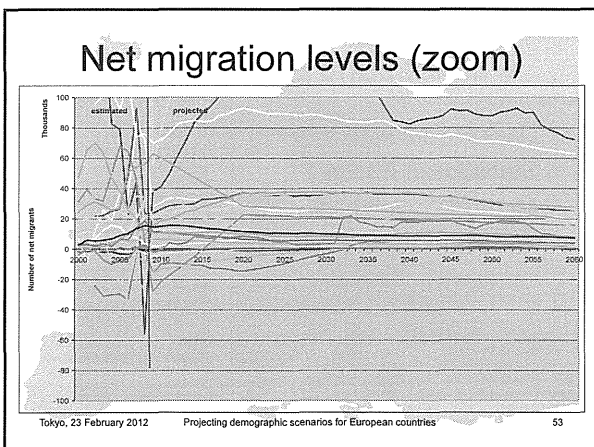
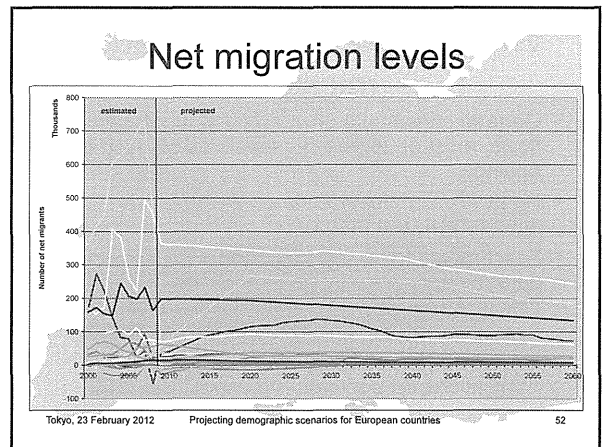
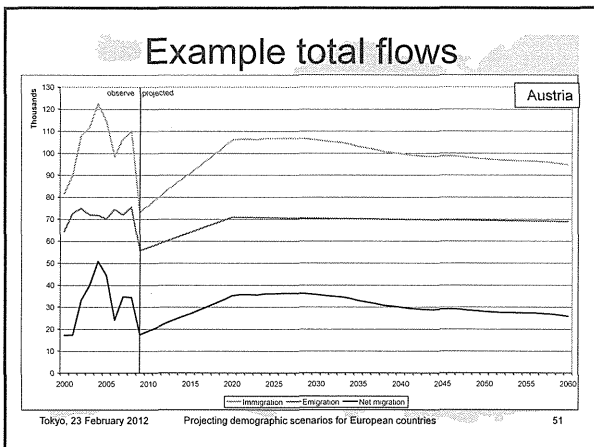
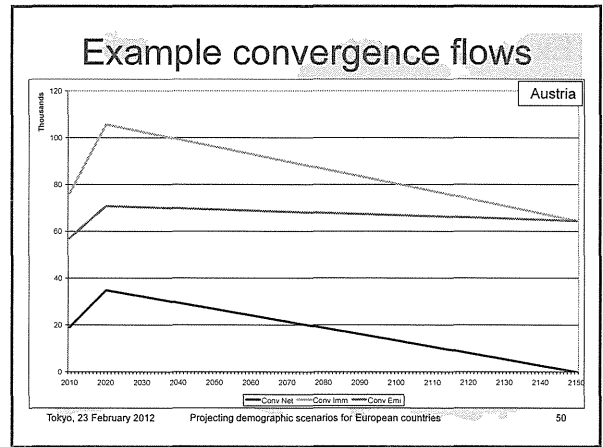
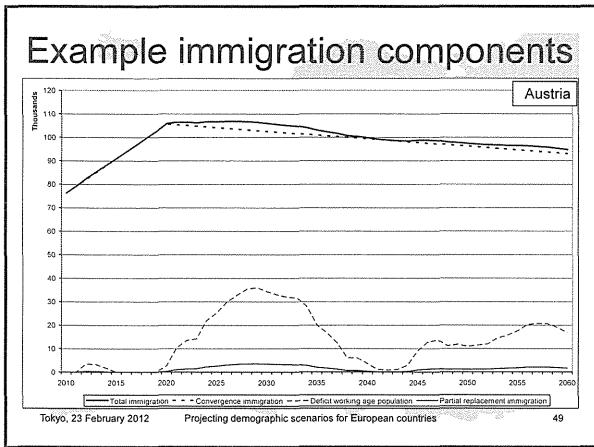
## Further assumptions on levels

- The total immigration and emigration flows as from the convergence assumption are equally divided by sex
- A partial replacement migration may be then added:
  - First run of the projections and control of the projected working age population so obtained
  - If pop 15-64 shrinks, then 10% of that reduction is added to immigration (no emigration involved)
- The final levels of migration are finally the sum of the convergence and replacement components, which may well be not linear over time

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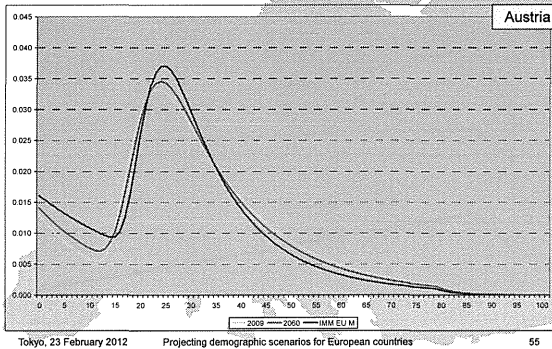


### Migration assumptions by age

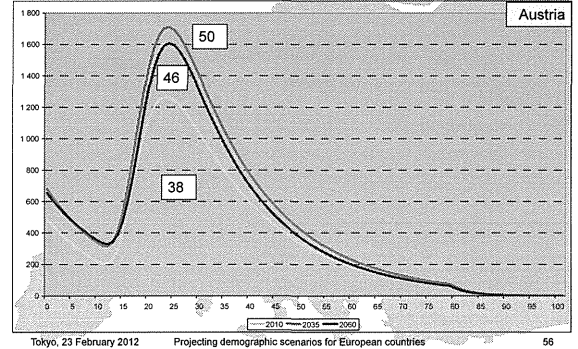
- Rogers-Castro modelling for each country on latest available year(s) using non-linear estimation in Excel
- Linear interpolation between normalized models and the convergence values
- Age- and sex-specific values are finally proportionally changed to match the given level of the sex-specific flow (immigrants or emigrants)

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## Ex.: age and sex immigrants patterns



## Ex.: immigrants by age and sex



## What the literature says about migration

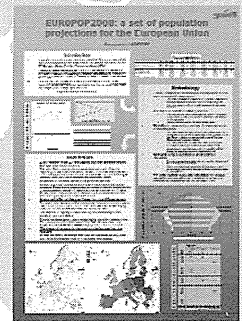
- General consensus on continuing immigration flows, most on increasing levels as solution to ageing
- However, high incertitude on which levels actually will take place
- Few models try to link migration with some determinants (usually economic ones), but difficult to apply for the medium/long term, or formalise experts' opinions (Bayesian models)
- Almost none (but Coleman 2006) looks at the implications on population composition

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## Technicalities in summary

- The long-term scenario is based on the idea of convergence
- There are almost no short/medium-term trends
- The events are period-cohort based (but no cohort analysis)
- Fertility and mortality assumptions are formulated in terms of age- and sex-specific rates and not as aggregated indicators
- Migration assumptions are formulated in total numbers for each flow (in and out)
- Age- and sex-specific distributions change year by year over the projections period



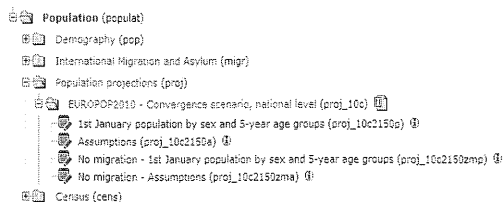
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## Projections data dissemination

- Main results freely available in Eurobase
- Further detailed data upon request (for free)

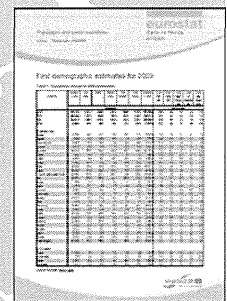


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## Publications on projections

- Data in Focus (Nowcast)
- Statistics in Focus
- Methodologies and Working Papers



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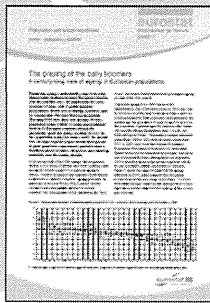
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## Publications on projections

- Data in Focus
- Statistics in Focus
- Methodologies and Working Papers



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## Publications on projections

- Data in Focus
- Statistics in Focus
- Methodologies and Working Papers
  - Proceedings of the Eurostat/UNECE Work Session on Demographic Projections
  - “Fewer, older and multicultural? Projections of the EU populations by national/foreign background”
  - “Eurostat Population Projections 2010-based (EUROPOP2010): methodology and main results of the Convergence scenario” (*forthcoming*)

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## Some references

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- Lanzieri (2009): "EUROPOP2008: a set of population projections for the European Union". Paper for the XXVI IUSSP International Conference, Marrakech.
- Rogers A. and L.J. Castro (1981): "Model Migration Schedules". IIASA Research Report RR-81-03, Laxenburg (AT).
- Schmertmann (2003): "A system of model fertility schedules with graphically intuitive parameters". *Demographic Research* 9(5):81-110.
- van Imhoff and Keilman (1992): "LIPRO 2.0: An Application of a Dynamic Demographic Projection Model to Household Structure in the Netherlands". NIDI-CBGS publication n.23. Swets&Zeitlinger Publisher.

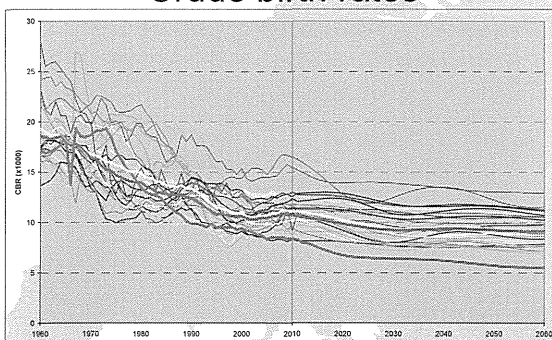
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## Selected outcomes of EuroPOP2010

## Crude birth rates

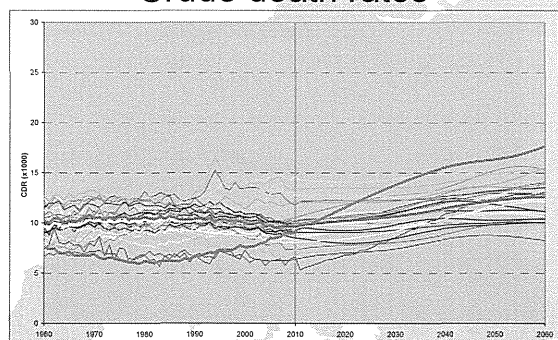


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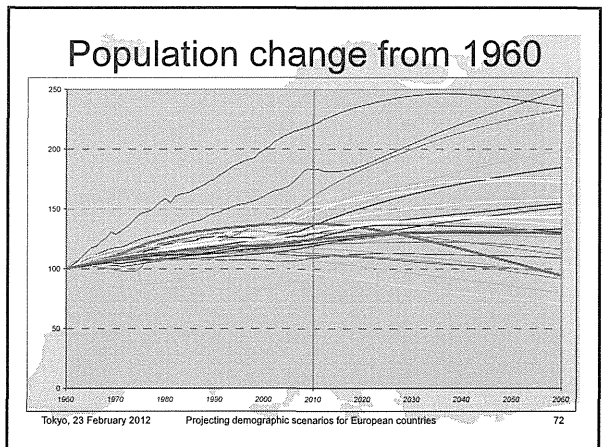
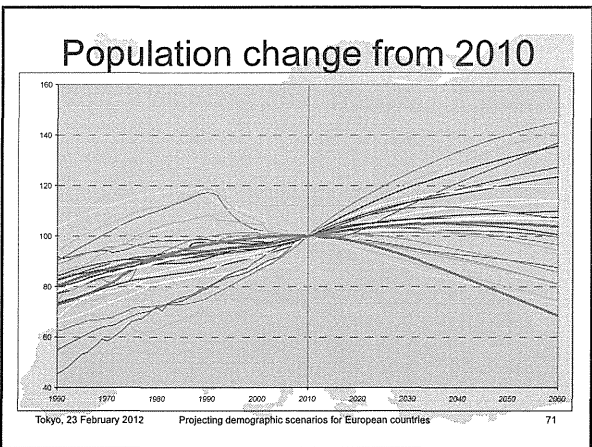
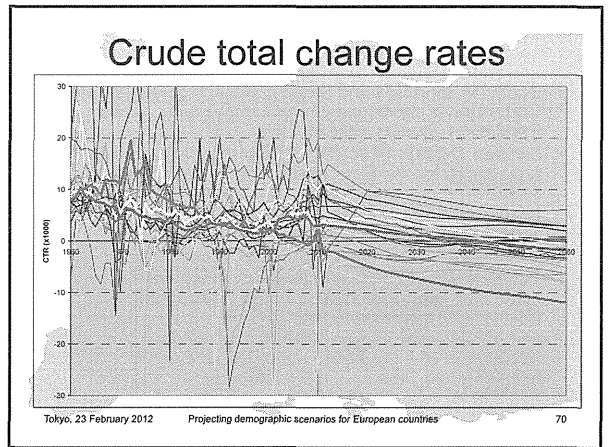
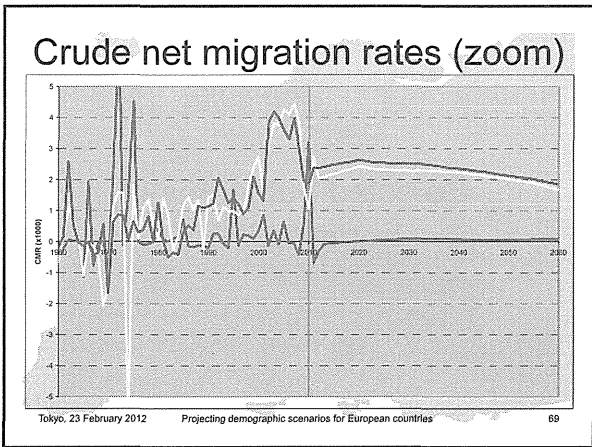
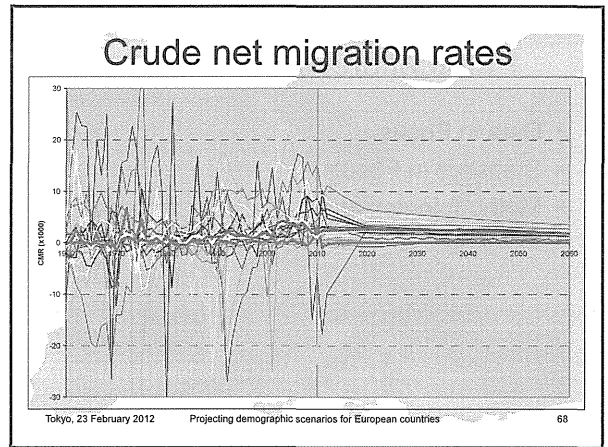
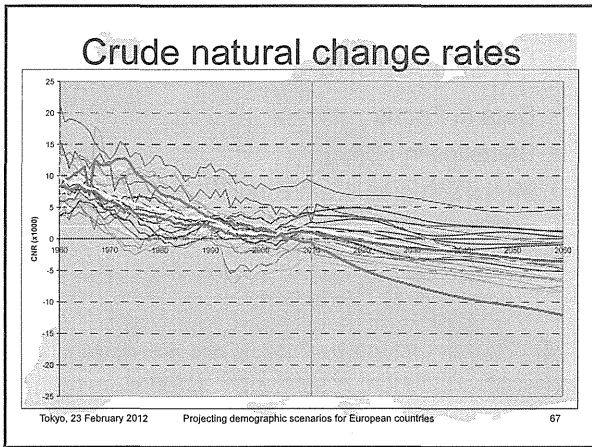
## Crude death rates



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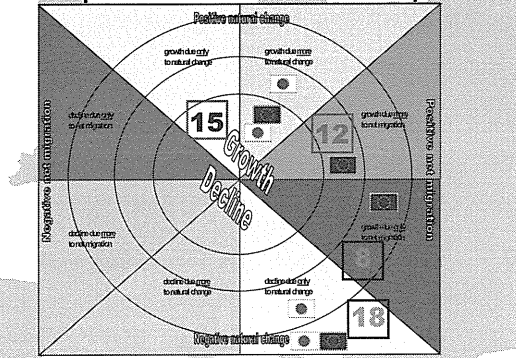
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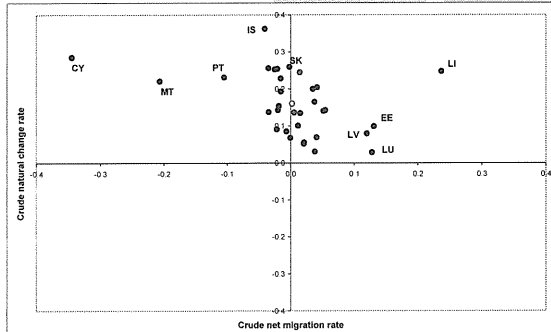
# The paths of EU+ and Japan



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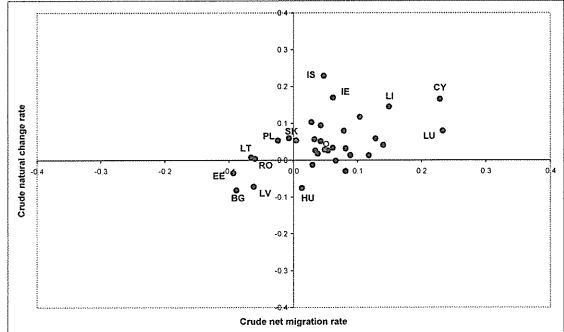
With which European country Japan has higher similarity as for the population change?

## 1960-1984



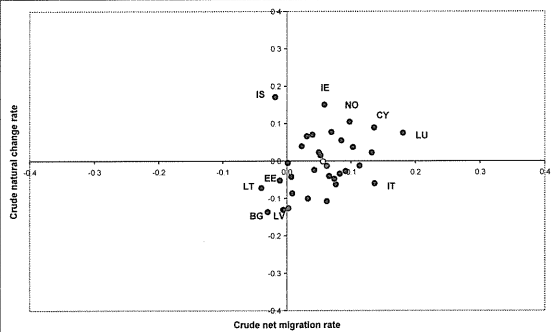
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## 1985-2009



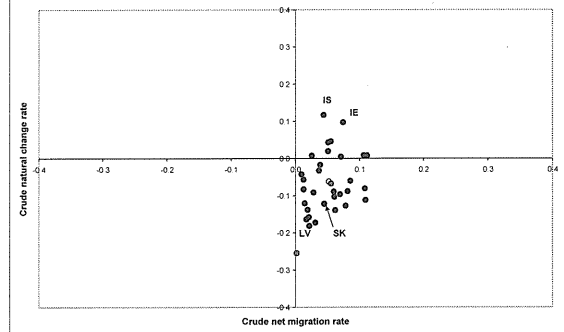
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## 2010-2034



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## 2035-2059



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