POPULATION ESTIMATES ACCORDING TO URBAN AREAS TYPOLOGY

FROM THE RELEVANCE OF PRODUCTION TO THE DISSEMINATION OF NEW STATISTICAL INFORMATION

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RESIDENT POPULATION ESTIMATES

BACKGROUND

Annual resident population estimates have been disseminated since 1940 and by municipality since 1981

Increase demand for new territorial segmentations of annual resident population estimates → Spatial planning purposes by the central and local administration and for regional policy monitoring

Need for annual resident population data at LAU 2 level to obtain population data for territorial levels, namely by Urban Areas Typology

The Urban Areas classifies LAU 2 units according to three levels of urbanisation

- Predominantly urban
- Medium urban
- Predominantly rural
RESIDENT POPULATION ESTIMATES

FRAMEWORK

\[
\text{Pop}_{t+1} - \text{D}_{t+1} \quad \text{(Civil registers)}
\]

\[
\text{I}_{t+1} - \text{E}_{t+1} \quad \text{(Census data and IMMS + LFS)}
\]

\[
\text{Pop}_{t+1} \quad \text{(Estimated)}
\]

\[
\text{Natural increase} + \text{Net migration} = \text{Estimated and published annually}
\]
RESIDENT POPULATION ESTIMATES

FRAMEWORK

\[
\text{Pop}_{t+1} \quad + \quad \text{Natural increase} \quad + \quad \text{Net migration} \quad = \quad \text{Pop}_{t+2} \quad (\text{Estimated}) \quad \cdots \quad \text{Pop}_{t+10} \quad (\text{Estimated 2010})
\]

\[
\text{LB}_{t+1} - \text{D}_{t+1} \quad \text{(Civil registers)}
\]

\[
\text{I}_{t+1} - \text{E}_{t+1} \quad \text{(Census data and IMMS + LFS)}
\]

Estimated and published annually.
RESIDENT POPULATION ESTIMATES

FRAMEWORK

PT
NUTS 1
NUTS 2
NUTS 3

LAU 1

Pop₁₁ (Census 2001) + Natural increase + Net migration = Pop₂ (Estimated) ...

LB₁₁−D₁₁ (Civil registers)

Et₁ − Et+1 (Census data and IMMS + LFS)

ESTIMATED AND PUBLISHED ANNUALLY

LAU 2

Pop₁₁ (Census) + Natural increase + Net migration = Pop₂ (Estimated) ...

ESTIMATED BUT NOT PUBLISHED

Pop₁₁₀ (Estimated 2010)
RESIDENT POPULATION ESTIMATES

FRAMEWORK

PT
NUTS 1
NUTS 2
NUTS 3

Pop_{t1} (Census 2001) + Natural increase + Net migration = Pop_{t2} (Estimated) = ... = Pop_{t10} (Estimated 2010)

LAU 1

LB_{t+1} - D_{t+1} (Civil registers) + I_{t+1} - E_{t+1} (Census data and IMMS + LFS)

Migration rate obtained for LAU 1 is applied to LAU 2

LAU 2

Pop_{t+1} (Census) + Natural increase + Net migration = Pop_{t2} (Estimated) = ... = Pop_{t10} (Estimated 2010)

ESTIMATED AND PUBLISHED ANNUALLY

ESTIMATED BUT NOT PUBLISHED
RESIDENT POPULATION ESTIMATES

FRAMEWORK

<table>
<thead>
<tr>
<th>PT NUTS 1</th>
<th>NUTS 2</th>
<th>NUTS 3</th>
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<tbody>
<tr>
<td>LAU 1</td>
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<tr>
<td>Pop\textsubscript{t1} \textit{(Census 2001)}</td>
<td>Natural increase</td>
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| LAU 2     |        |        |
| Pop\textsubscript{t1} \textit{(Census)} | Natural increase | Net migration |
|           |        |        | Pop\textsubscript{t2} (Estimated) |
|           |        |        | ... |
|           |        |        | Pop\textsubscript{t10} (Estimated 2010) |

QUALITY ASSESSMENT

Pop Census 2011
RESIDENT POPULATION ESTIMATES

QUALITY ASSESSMENT

WITHIN QUALITY STANDARDS FOR DISSEMINATION
RESIDENT POPULATION ESTIMATES

QUALITY ASSESSMENT

LaU 1

Census 2011

Population estimates 31/12/2010

Threshold

LaU 2

Census 2011

Population estimates 31/12/2010

OUT OF QUALITY STANDARDS FOR DISSEMINATION
RESIDENT POPULATION ESTIMATES

QUALITY ASSESSMENT

MEASUREMENTS FOR QUALITY ASSESSMENT
Resident population estimates

Quality assessment

Comparison between threshold deviation (estimates for LAU 1 units compared to Census population) and deviation obtained for LAU 2 estimates

Decision:
Population estimates for LAU 2 are publishable? If not, find the LAU 2 aggregations suit for publishing.
**POPULATION ESTIMATES BY LAU 2**

**MEASUREMENTS FOR QUALITY ASSESSMENT**

Percent Error for region $i$

$$PE_i = \left( \frac{e_i - c_i}{c_i} \right) \times 100$$

Absolute Percent Error for region $i$

$$APE_i = \left| \frac{e_i - c_i}{c_i} \right| \times 100$$

Mean Algebraic Percent Error for region $i$

$$MALPE = \frac{\sum_{i=1}^{n} \left( \frac{e_i - c_i}{c_i} \right)}{n} \times 100$$

Mean Absolute Percent Error for region $i$

$$MAPE = \frac{\sum_{i=1}^{n} \left| \frac{e_i - c_i}{c_i} \right|}{n} \times 100$$

$e_i$ – Estimated population for region $i$; $c_i$ – Census population for region $i$

Bryan, 1999; Coleman and Swanson, 2007; Swanson et al, 2000
PT absolute deviation from Census 2011: **0.71%**
(PE = 0.71% → overestimation)

NUTS III max. absolute deviation from Census 2011: **7.55%**
(PE = -7.55% → underestimation; region: RAM)

NUTS III min. absolute deviation from Census 2011: **0.03%**
(PE = 0.03 → overestimation; region: Douro)
Territorial levels of population estimates published

LAU 1

LAU 1 max. absolute deviation from census 2011: **27.49%**
(PE = 27.49% → overestimation; Municipality: Mourão)

LAU 1 min. absolute deviation from census 2011: **0.05%**
(PE = -0.05% → underestimation; Municipality: Torres novas)
Territorial levels of population estimates evaluated for publishing

**LAU 2**

**Lau 2 max. absolute deviation from census 2011: 76.54%**
(PE = 76,54% → overestimation)

**Lau 2 min. absolute deviation from census 2011: 0%**
(in 18 parishes, population estimates were exactly the same as census population)
**POPULATION ESTIMATES BY LAU 2**

**Quality Assessment**

Comparison between LAU 2 areas and LAU 1 areas was made using the MAPE and APE measures.

In other words, from the average of deviations for LAU 2 estimates we subtracted the deviation measurement obtained for LAU 1.

*E.g.*, for LAU 1 Lisboa:

\[
\text{MAPE} = 14.70\% \quad \text{APE} = 14.28\%
\]

\[
\begin{align*}
\text{APE}_{\text{min}} &= 2.22\% \\
\text{APE}_{\text{max}} &= 46.20\%
\end{align*}
\]

The difference

\[
\text{MAPE} - \text{APE} = 0.42
\]

This means that estimates for LAU 2 units have a higher measurement error than the estimation obtained for the LAU 1 unit.
ESTIMATES FOR LAU 2 UNITS HAVE A HIGHER MEASUREMENT ERROR THAN THE ESTIMATION OBTAINED FOR THE LAU 1 UNIT.

ESTIMATES FOR LAU 2 UNITS HAVE A LOWER MEASUREMENT ERROR THAN THE ESTIMATION OBTAINED FOR THE LAU 1 UNIT.

SIMILAR MEASUREMENT ERRORS FOR LAU 1 UNITS AND THE CORRESPONDING LAU 2 UNITS.
In 34 LAU 1 units the average error for the respective LAU 2 units is considerably wider than the deviation obtained for the LAU 1.

Max dif.

MAPE – APE = 19.53%
MAPE = 26.32%
APE = 6.79%

These results indicate a discrepancy between LAU 2 and LAU 1 measurement errors.
Quality of LAU 2 estimates are not adequate for publishing.

Next step: LAU 2 aggregations by Urban Areas Typology.

LAU 2 aggregations by NUTS III regions.
DEVIATION MEASUREMENTS WERE CALCULATED FOR AGGREGATIONS OF LAU 2 LEVEL UNITS BY URBAN AREA TYPOLOGY IN EACH NUTS III REGION

**Predominantly urban areas**
- **Max. Deviation:** 14.19%
- **Min. Deviation:** 0.05%

**Medium urban areas**
- **Max. Deviation:** 9.04%
- **Min. Deviation:** 0.12%

**Predominantly rural areas**
- **Max. Deviation:** 11.34%
- **Min. Deviation:** 0.24%
Most APE values obtained for the three urban areas (predominantly urban, medium urban and predominantly rural areas) in each NUTS III region are smaller than the maximum LAU 1 APE value.

Furthermore, all deviations for urban areas are smaller than the maximum LAU 1 APE (27.49%)
New Statistical Indicators
NUTS III by Urban Typology

Ten additional statistical demographic indicators by Urban Areas Typology have been disseminated according to the new NUTS version (NUTS 2013)

2011 data series: 2011-2014

- Resident population by sex (No.)
- Resident population by age groups – life cycles (No.)
- Population density (No./ km²)
- Crude birth rate (%)
- Crude death rate (%)
- Ageing ratio (No.)
- Sex ratio (No.)
- Proportion of resident population with 14 years old or under (%)
- Proportion of resident population aged between 15 and 64 years (%)
- Proportion of resident population with 65 or more years old (%)

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AGEING RATIO

NUMBER OF ELDERLY PERSONS (65 AND OVER) BY THE NUMBER OF YOUNG PERSONS (0-14 YEARS) - 2014

NOTE: In each typology, units belonging to the same NUTS III region assume the same value.

There is a clear higher aging ratio in interior regions.

All typologies show a predominance of older people.
An additional set of statistical demographic indicators by new territorial segmentation is now published.

They constitute new statistical information to assess territorial differences and disparities, as well as important assets for spatial planning and regional policy monitoring.

There is now the possibility of using the indicators on resident population (number) to derive per capita indicators and other indicators that require the population as a denominator.
A parallel line of work has been developed → strengthening the estimation model in the internal migration component, using administrative data → restrictions of access to data sources has limited the development of alternative model to estimate migration.

Next steps

Assess the possibility of strengthening the estimation model in the internal migration component, using administrative fiscal data (cadastre)


• INE (2012a) Proposta metodológica para o cálculo das estimativas da população, para a década 2001-2011, por freguesia, sexo e idade com diferenciação do movimento migratório (Cenário 3), Maio de 2012, Lisboa: INE.

• INE (2012b) Avaliação de estimativas da população: comparação entre estimativas de população residentes e dados provisórios dos Censos 2011 ao nível dos municípios por sexo e idades, Março de 2012, Lisboa: INE.

• INE (2011a) Avaliação de estimativas da população: comparação de dados ao nível dos municípios, Agosto de 2011, Lisboa: INE.

• INE (2011b) Proposta metodológica para a análise dos desvios das estimativas da população face aos Censos, Outubro de 2011, Lisboa: INE.

• INE (2011c) Avaliação de estimativas da população: comparação de dados ao nível das freguesias, Dezembro de 2011, Lisboa: INE.
