The role of municipal and provincial social expenditure in reducing local income inequality: The case of Austria

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Overview

Introduction

- Most welfare states have undergone major changes over the past decades.
- Population ageing, migration and rising within-inequality have put pressure on many welfare states.
- Generally, social expenditure per capita has been rising over the past decade:
  - EU: $+23\%$, Austria: $+25\%$
- Trend towards decentralization and focus on service provision.

Decentralizing Social Policy

- In recent years: tendency of fiscal decentralization
- Sub-national governments fulfill certain tasks that meet societal needs, such as security, education, health and well-being.
- However, different understandings of the role of the state vs. role of municipalities.
  - It is argued that decentralization can improve service provision efficiency as well as quality (Hooghe and Marks 2001).
  - The effect of different levels responsible for public social expenditure on economic equality was, so far, given little attention in research.

Research Questions

Research Questions

- What are the municipal, district-level and provincial characteristics influencing local income inequality?
- What are the contributions of municipal and provincial social public expenditure to the reduction of local income inequality?

A Brief Overview of the Literature

- Economic structure and factors linked to globalization:
  - Occupational switching
  - Productivity of workers
  - Job polarization
  - Firm agglomeration...
- Demographic structure of a municipality:
  - Migration
  - Population aging
  - Share of women in the labour marktet...
- "Pro-devolution" fraction vs. sceptics
- Who does it better then?

A Brief Overview of the Literature II

- Income inequality for disposable income is significantly lower than income inequality for market income.
    - In Austria, the Gini index for market-income is 0.36 and for disposable income 0.29.
- Public social expenditure can cushion income inequality, but investigations on the effect of different spending levels (e.g. provincial vs. municipal) are still rare.
    - Previous studies have showed that state level expenditure can lower inequality between states (see, e.g. Lee 2021, Moldogaziev et al. 2018).
    - Others focus on the role of municipal spending and hence, argue that the local level is crucial to reduce income inequalities (Lobao et al. 2021, Andreotti and Mingione 2016)
- There are a few studies that investigate the role of different governance levels in the alleviation of inequality with mixed results.

The Austrian Case

- Austria is one of the world's 25 federal countries with 9 provinces.
  - In terms of fiscal authority, all provinces can dispose of their own budgets.
  - However, most provincial revenues stem from taxes levied by the federal government (revenue sharing system).
  - Provinces have some legislative power (i.e. environmental protection, building regulations, regional planning, waste management and kindergartens).

- Lowest level of administrative governance: municipalities
  - Typical responsibilities of municipalities: the administration of the municipal budget, spatial planning, road construction, school maintenance and provision.
  - However, there are certain voluntary tasks municipalities can fulfill, such as water and waste management, community housing and social welfare.

Table: Description of variables

Variable Name	Description
Municipal variables	
Gini index (dependent variable)	Gini index based on adjusted household income
Party	Dummy, Political party of the mayor, ÖVP = Austrian People's Party (conservative), SPÖ = Social Democratic Party
Social expenditure pc	Aggregated social expenditure per capita (10-year lag)
Average income	Average total income (all individual earnings are aggregated)
Leeway pc	Total revenue minus total expenditure and debt payments per capita
Unemployment rate	Unemployment rate (ILO definition)
Urban-rural Typology	Dummy, 1 = Urban center 2 = Regional center 3 = Rural area close to center 4 = Rural area
Tourism	Dummy, 1 = more than 70 overnight visits per capita
Household size	Average householdsize
Number of children	Average number of children under 15 years
Single households with children	Share of households with one adult and at least one child under 15 years measured by all households
Dependency ratio	Share of people below 15 years and over 65 years measured by people between 16 and 64 years
Share tertiary education	Share of people with tertiary education measured by total number of inhabitants
Part time	Share of people working part time measured by all people in employment
Self-employment	Share of people that are self-employed measured by all people in employment
Female participation	Share of women in employment measured by all people in employment
Population change	Population change from 2008 to 2018

Data and Descriptives

Variable Name	Description
District-level variables	
Start ups pc	Number of start ups per capita
Companies > 100 employees	Share of companies with more than 100 employees measured by all companies
Secondary sector	Share of people working in the secondary sector measured by all people in employment
Tertiary sector	Share of people working in the tertiary sector measured by all people in employment
Share high-skilled sector	Share of people working in telecommunication, banking and finance, insurance services, legal services, accounting and consulting, advertising and marketing, and engineering and architecture
Universities	Number of universities in the district
Provincial variables	
Prov. social expenditure pc	Aggregated social expenditure per capita
RD expenditure pc	Provincial spending on research and development per capita
GRP pc	Gross regional product per capita
Prov. Political party	Dummy, Political party of the governor, ÖVP = Austrian People's Party (conservative), SPÖ = Social Democratic Party

Data and Descriptives

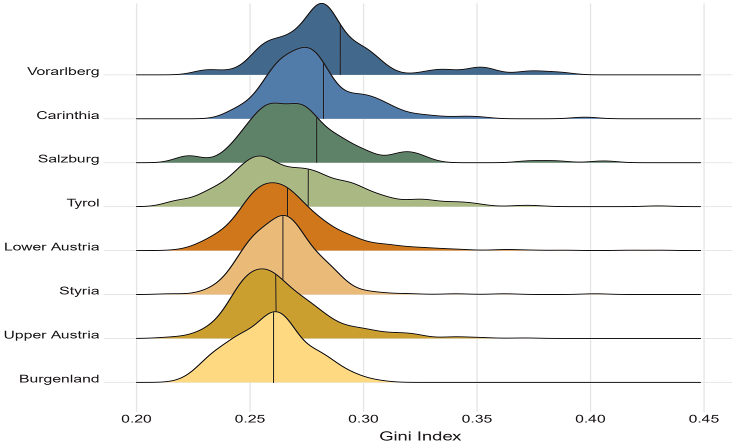


Figure: Distribution of ginis within provinces

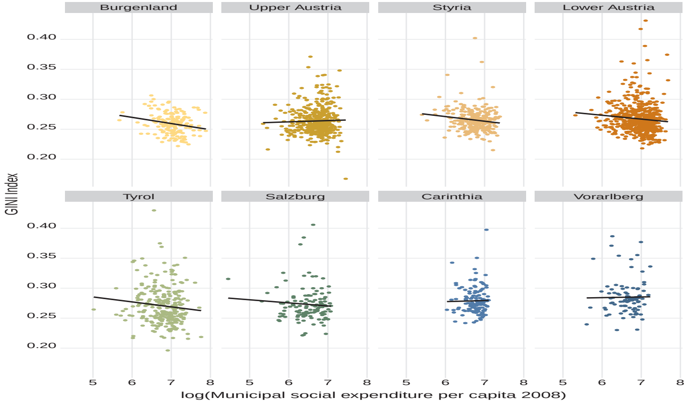


Figure: Gini index (2018) and municipal social expenditure (2008)

Method

- When conducting research on phenomena which are characterized by hierarchical data structures, employing a single-level model might lead to various estimation problems, such as the aggregation bias, misestimated precision and the "unit of analysis" problem. (Raudenbush and Bryk 2002).
- Multi-level (hierarchical) model:
  - Municipalities are nested within districts which are nested within provinces.
  - In a multi-level model each spatial level can be expressed as a sub-model.

Method II

$$\text{Level 1: } y_{ikl} = \delta_{0kl} + \sum_{p=1}^{P} \delta_{pkl} x_{pikl} + e_{ikl} \qquad (1)$$

where y_{ikl} represents the inequality (Gini index) of municipality i in district k in province l, δ_{0kl} is the intercept for district k in province l, x_{pikl} are $p = 1, \ldots, P$ municipal characteristics that predict municipal inequality, δ_{pkl} are the corresponding level-1 coefficients and e_{ikl} is a level-1 random effect referring to the deviation of municipality ikl from its predicted value. e_{ikl} is normally distributed with a mean of zero and variance σ^2.

$$\text{Level 2: } \delta_{pkl} = \beta_{p0l} + \sum_{q=1}^{Q_p} \beta_{pql} z_{qkl} + r_{pkl} \qquad (2)$$

where β_{p0l} is the intercept of province l in modelling the district effect, z_{qkl} are $q = 1, \ldots, Q_p$ district characteristics, β_{ql} are the corresponding level-2 coefficients and r_{pkl} is a level-2 random effect following a multivariate normal distribution with mean vector of zeros and variance-covariance matrix Σ.

$$\text{Level 3: } \beta_{pql} = \phi_{pq0} + \sum_{s=1}^{S_{pq}} \phi_{pqs} v_{sl} + u_{pql} \qquad (3)$$

where ϕ_{pq0} is the intercept term in the province-level model, v_{sl} are the $s = 1, \ldots, S_{pq}$ province characteristics, ϕ_{pqs} are the corresponding level-3 coefficients and u_{pql} is a random province effect following a multivariate normal distribution with mean vector of zeros and variance-covariance matrix Ω.

Method III

- We include both a spatial lag in the dependent and independent variables resulting in a Spatial Durbin Model (LeSage 2015).
- We define a spatial weights matrix with the dimension $N \times N$ where municipalities are defined as neighbors when:

$$w_{jm} = \begin{cases} \frac{1}{d_{jm}} & \text{if } j \neq m \text{ and } d_{jm} \leq d_{max} \\ 0 & \text{if } j = m \text{ and } d_{jm} > d_{max} \end{cases}$$

where w_{jm} refers to the spatial weight of the relationship between municipality j and its neighboring municipality m. d_{max} is specified as 15 minutes driving time between municipalities.

- The level one equation (1) can then be re-written as:

$$y_{j[ikl]} = \delta_{[0kl]} + \sum_{p=1}^{P} \delta_{pkl} x_{pj[ikl]} + \sum_{m=1}^{I} w_{jm} y_{m[ikl]} \rho + \sum_{m=1}^{I} w_{jm} x_{m[ikl]} \gamma + e_{j[ikl]} \quad (4)$$

where the notation stays the same as in equation (1). Additionally, the spatial weights w_{jm} and the respective spatial autoregressive parameters ρ and γ are included.

Estimation

- "Bayesian Inference is a Way of Thinking, Not a Basket of 'Methods"' (Sims, 2007)
  - acknowlegdes uncertainty about the unknown parameters of a model
  - views unknown parameters as random variables
  - does so by utilizing elementary probability theory (e.g. the definition of conditional probability, Bayes' Theorem, and the law of total probability).
- The centerpiece of the Bayesian methodology is **Bayes theorem**:

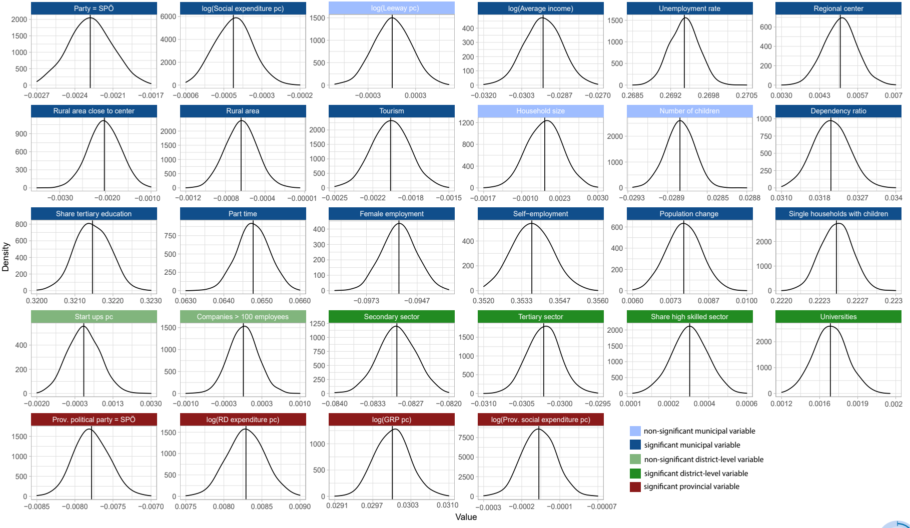
$$P(\theta|y) = \frac{P(y|\theta)P(\theta)}{P(y)} \tag{5}$$

- Bayesians treat $p(\theta|y)$ as being of fundamental interest: "Given the data, what do we know about θ?"
  - $p(\theta|y)$ is referred to as the posterior density.
  - $p(y|\theta)$ is the likelihood function.
  - $p(\theta)$ is the prior density.

Estimation II

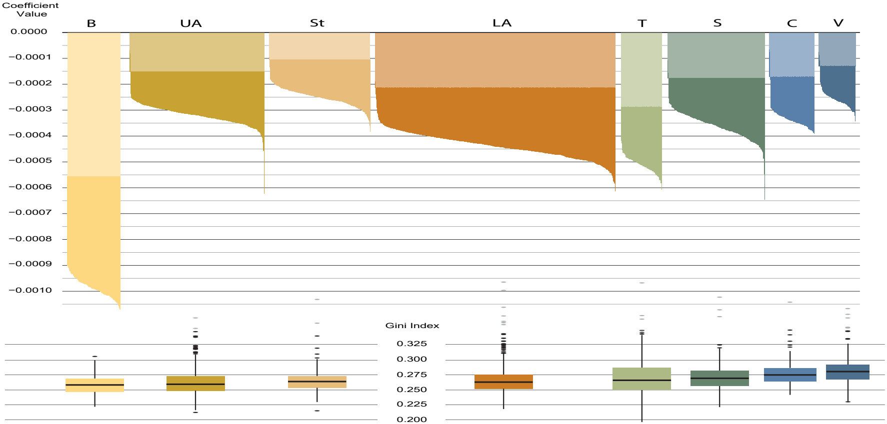
- Integrated nested Laplace approximation (INLA) first proposed by Rue et al. (2009)
  - more computationally efficient, provides more accurate results
  - available for latent Gaussian models
  - rather than estimating the joint posterior distribution of the model parameters: focusing on individual posterior marginals of the model parameters
- INLA uses a combination of analytical approximations and numerical integration to obtain approximated posterior distributions of the parameters.

Results



Party = SPÖ
log(Social expenditure pc)
log(Leeway pc)
log(Average income)
Unemployment rate
Regional center
Rural area close to center
Rural area
Tourism
Household size
Number of children
Dependency ratio
Share tertiary education
Part time
Female employment
Self−employment
Population change
Single households with children
Start ups pc
Companies > 100 employees
Secondary sector
Tertiary sector
Share high skilled sector
Universities
Prov. political party = SPÖ
log(RD expenditure pc)
log(GRP pc)
log(Prov. social expenditure pc)
Density
Value
non-significant municipal variable
significant municipal variable
non-significant district-level variable
significant district-level variable
significant provincial variable

Figure: Mean effect of municipal and provincial social expenditure pc and Gini indices for each province



Conclusion and Outlook

Findings

- Negative relationship between 10-year lag of social expenditure (on municipal as well as provincial level) and Gini index.
- There are large differences between the provinces in how a one percent increase in public spending translates into a reduction of inequality.
  - Similarities between the coefficients of municipal and provincial social public expenditure can be found. Accordingly, the average municipal effect is similar to the respective provincial effect suggesting that the effects of public spending are localized for each province.
- Relevant drivers of local inequality on all administrative levels.
  - This suggests that municipal features depend on wider regional characteristics due to the economic and social interdependence of municipalities nested in the same district or province.

Limitations and Outlook

Limitations and Outlook

- Focus on income instead of wealth:
  - The effect of e.g. property as a long-term asset, protecting against short-term economic shocks and securing the social status of future generations, is not included as specific data is not available
- Prevailing measures of inequality tend to neglect that costs to cover basic needs differ between regions.
  - Residual income, measured as the post-tax disposable household income deducted by costs for necessities, could allow for a better understanding of the locally varying effect of income.

Literature I

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- Lobao, Linda, Alexandra Tsvetkova, Gregory Hooks, and Mark Partridge (2021): "Seeing the local state: Poverty and income inequality across the United States during the great recession". In: *Sociology of Development* 7 (3), pp. 253–284.

Literature II

Moldogaziev, Tima T, James E Monogan, and Christopher Witko (2018): "Income inequality and the growth of redistributive spending in the United States (US) states: is there a link?" In: *Journal of Public Policy* 38 (2), pp. 141–163.

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Rue, Håvard, Sara Martino, and Nicolas Chopin (2009): "Approximate Bayesian inference for latent Gaussian models by using integrated nested Laplace approximations". In: *Journal of the royal statistical society: Series b (statistical methodology)* 71 (2), pp. 319–392.

Sims, Christopher A (2007): "Bayesian methods in applied econometrics, or, why econometrics should always and everywhere be Bayesian". In: *Hotelling lecture, presented June* 29, p. 2007.

Appendix: Estimation III

- Integrated nested Laplace approximation (INLA) first proposed by Rue et al. (2009)
  - more computationally efficient, provides more accurate results
  - available for latent Gaussian models
    - = structured additive regression models. The response variable y_i is assumed to belong to an exponential family, where the mean μ_i is linked to a structured additive predictor η_i through a link function $g(\cdot)$, so that $g(\mu_i) = \eta_i$. η_i accounts for the effects of the model parameters $\boldsymbol{\psi}$, and $\boldsymbol{x}$ denotes a latent field, $\boldsymbol{x} = (\boldsymbol{\eta}, \boldsymbol{\psi})$.

$$\text{Model: } y_i|\eta_i, \theta_1 \sim N(\mu_i|\eta_i, \theta_1) \tag{6}$$

$$\text{Latent Gaussian prior for } \boldsymbol{\eta}\text{: } \boldsymbol{\eta}|\theta_2 \sim N(\mu_2(\boldsymbol{\psi}\theta_2), \Sigma(\theta_2)) \tag{7}$$

$$\text{Latent Gaussian prior for } \boldsymbol{\psi}\text{: } \boldsymbol{\psi}|\theta_3 \sim N(\mu_3(\theta_3), \Sigma(\theta_3)) \tag{8}$$

$$\text{Prior for non-Gaussian } \boldsymbol{\theta}\text{: } \boldsymbol{\theta} = (\theta_1, \theta_2, \theta_3) \sim \prod \tag{9}$$

Appendix: Estimation IV

- We are thus interested in the posterior marginals of the hyper-parameters $\boldsymbol{\theta}$ and the latent field $\boldsymbol{x}$.
- Aim: Approximate the marginal posteriors:
  - $\pi(x_i|\boldsymbol{\theta}, \boldsymbol{y}) \approx \tilde{\pi}(x_i|\boldsymbol{\theta}, \boldsymbol{y})$
  - $\pi(\boldsymbol{\theta}|\boldsymbol{y}) \approx \tilde{\pi}(\boldsymbol{\theta}|\boldsymbol{y})$

  with the approximation

$$\tilde{\pi}(x_i|\boldsymbol{y}) = \int \tilde{\pi}(x_i|\boldsymbol{\theta}, \boldsymbol{y}) \tilde{\pi}(\boldsymbol{\theta}|\boldsymbol{y}) \, d\boldsymbol{\theta} \tag{10}$$

$$\tilde{\pi}(\theta_j|y) = \int \tilde{\pi}(\boldsymbol{\theta}|\boldsymbol{y}) \, d\boldsymbol{\theta}_{-j} \tag{11}$$

$\rightarrow$ Simplified Laplace approximation

Table: Results: Mean, standard deviation and quantiles of coefficients

	Mean	SD	0.025Q	0.75Q	0.975
Municipal variables					
Party = SPÖ	-0.00228	0.00019	-0.00266	-0.00215	-0.00190
log(Social expenditure pc)$_{2008}$	-0.00043	0.00007	-0.00056	-0.00039	-0.00030
log(Leeway pc)	0.00001	0.00026	-0.00050	0.00018	0.00051
log(Average income)	0.02940	0.00081	0.02783	0.02885	0.03098
Unemployment rate	0.26941	0.00025	0.26892	0.26957	0.26988
Regional center	0.00506	0.00056	0.00397	0.00542	0.00621
Rural area close to center	-0.00198	0.00035	-0.00265	-0.00221	-0.00129
Rural area	-0.00058	0.00016	-0.00091	-0.00069	-0.00027
Tourism	-0.00201	0.00016	-0.00234	-0.00190	-0.00169
Household size	-0.00007	0.00030	-0.00147	0.00228	0.00268
Number of children	-0.02720	0.03100	-0.02115	0.02710	0.02892
Dependency ratio	0.03208	0.00039	0.03130	0.03234	0.03283
Share tertiary education	0.32146	0.00045	0.32057	0.32178	0.32232
Part time	0.06477	0.00042	0.06395	0.06505	0.06557
Female employment	-0.09563	0.00089	-0.09732	-0.09504	-0.09390
Self employment	0.35369	0.00070	0.35231	0.35417	0.35507
Population change	0.00779	0.00060	0.00662	0.00820	0.00898
Single households with children	0.22248	0.00014	0.22222	0.22257	0.22274

Appendix: Results

Table: Results: Mean, standard deviation and quantiles of coefficients

	Mean	SD	0.025Q	0.75Q	0.975
Municipal variables					
W × log(Social expenditure pc)$_{2008}$	-0.00069	0.00070	-0.00086	-0.00039	-0.00030
W × log(Leeway pc)	0.00001	0.00073	-0.00138	0.00049	0.00135
W × log(Average income)	0.00743	0.00045	0.00658	0.00773	0.00832
W × Unemployment rate	0.05659	0.00012	0.05635	0.05682	0.05721
W × Household size	-0.00148	0.00042	-0.00270	-0.00106	0.00028
W × Number of children	0.08752	0.00024	0.08706	0.08768	0.08797
W × Dependency ratio	0.00324	0.00066	0.00197	0.00368	0.00452
W × Share tertiary education	0.13358	0.00073	0.13104	0.13504	0.13599
W × Part time	0.07343	0.00013	0.07318	0.07369	0.0.07412
W × Female employment	-0.11924	0.00088	-0.12101	-0.00733	-0.00629
W × Self employment	0.10671	0.0.0065	0.10546	0.10794	0.11256
W × Population change	-0.03004	0.00068	-0.03134	-0.02957	0.00287
W × Single households with children	-0.17313	0.00077	-0.17465	-0.17253	-0.17167
Observations			2,094		

Appendix: Results

	Mean	SD	0.025Q	0.75Q	0.975
District-level variables					
Start ups pc	0.00005	0.00070	-0.00131	0.00053	0.00145
Companies $>$ 100 employees	0.00001	0.00025	-0.00048	0.00017	0.00051
Secondary sector	-0.08291	0.00033	-0.08355	-0.08269	-0.08228
Tertiary sector	-0.03021	0.00021	-0.03062	-0.03007	-0.02979
Share high-skilled sector	0.00032	0.000018	0.00009	0.00047	0.00057
Universities	0.00168	0.00015	0.00139	0.00177	0.00197
Observations			93		
Provincial variables					
Prov. Political party = SPÖ	-0.00778	0.00023	-0.00821	-0.00763	-0.00732
log(RD expenditure pc)	0.00829	0.00024	0.00782	0.00845	0.00877
log(GRP pc)	0.02999	0.00030	0.02939	0.02979	0.03054
log(Prov. social expenditure pc)$_{2008}$	-0.00016	0.00004	-0.00024	-0.00012	-0.00007
Observations			8		

Significant variables are indicated in **bold**.

Appendix: Results

Table: Mean direct, indirect and total effects

Variabes	Direct	Indirect	Total
Party = SPÖ	**-0.002338**	**-0.001837**	**-0.004175**
log(Social expenditure pc)$_{2008}$	**-0.000030**	**-0.000009**	**-0.000039**
log(Average income)	**0.003172**	**0.002200**	**0.005372**
log(Leeway pc)	0.000001	0.000002	0.000003
Unemployment rate	**0.299726**	**0.099752**	**0.399478**
Regional center	**0.004191**	-0.010564	**-0.006373**
Rural area close to center	**0.001350**	-0.009683	**-0.008333**
Rural area	**0.000404**	-0.008742	**-0.008338**
Tourism	**-0.002649**	**-0.004180**	**-0.006829**
Household size	0.000206	-0.019780	-0.019574
Number of children	-0.025600	0.092201	0.066601
Dependency ratio	**0.031779**	**0.006477**	**0.038256**
Share tertiary education	**0.318672**	**0.066369**	**0.385040**
Part time	**0.080727**	**0.044671**	**0.125398**
Female employment	**-0.095139**	**-0.111670**	**-0.206809**
Self-employment	**0.375093**	**0.267935**	**0.643027**
Population change	**0.002632**	-0.000474	**0.002158**
Single households with children	**0.280366**	**-0.046524**	**0.233842**
Rho		0.25	

Note: Significant variables are indicated in **bold**.


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