### \*Earnings inequality in the Brazilian formal sector: The role of firms, education and top incomes (J-Divergence)

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\* 19 These slides https://www.cps.fgv.br/cps/bd/curso/19-J-divergence-measurements-ofeconomic-inequality.pdf \*\*\* paper https://www.wider.unu.edu/publication/earnings-inequality-brazilian-formal-sector

Key Reference: Alvarez, Benguria, Engbom and Moser (2018)

Background of RAIS based Distributive Studies - Most of the analyses on Brazilian income distribution is based on household surveys in particular Pesquisa Nacional de Amostras a Domicílio (PNAD - IBGE), the main Brazilian National Household Survey). However, RAIS has a few advantages. First, it allows combining workers and firms information to understand formal wage inequality determinants. In particular, the incorporation of individual firms fixed effects explains the bulk of earnings distribution levels and changes (Alvarez et all 2017; Machado et all 2017). Second, it is the only nationwide data source available with long spells of panel data. This longitudinal aspect allows studying the mobility of workers across sectors and individual firms as well as the life-cycle profile of these characteristics (Machado et al. 2017). Third, RAIS also offers the possibility of analyzing short run employment and wage dynamics because it contains information on a monthly basis that allows aggregation to higher time measurement periods. This may facilitate international data comparisons since the measurement unit varies across countries. Fourth, RAIS provides a unique perspective on certain policy related issues. The evaluation of legal employment quotas for People With Disabilities (PWD), and for the youth that requires certain shares of firms employment allocated for these groups is only possible using the establishment as the unit of information and unit of analysis (Neri et al. 2003). RAIS also allows to measure how biding are minimum wages in the bottom of formal employment earnings distribution (Engbom and Moser 2017). On the other extreme, RAIS permits to measure wages at the very upper tail of earnings distribution which has been driving inequality in the US among other countries. And last, and perhaps most importantly, it allows to check the robustness of other types of data sources mentioned. In spite of all these advantages, RAIS was very little used up to know on understanding levels and changes in Brazilian earnings distribution.



# **Formal Labour Market in Brazil: Cumulative Growth Incidence Curve 1994 – 2015**





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#### J-divergence measurements of economic inequality

T & L Theil (1967) indexes can be defined as:

$$T = \frac{1}{N} \sum_{i=1}^{N} \frac{x_i}{\mu} \ln\left(\frac{x_i}{\mu}\right) \qquad \mathbf{e} \qquad L = -\frac{1}{N} \sum_{i=1}^{N} \ln\left(\frac{x_i}{\mu}\right),$$

Where  $x_{i is}$  individual *i income*, *N* is population size and  $\mu$  is mean income.

J-divergence (Jeffreys, 1946) measure is the simple sum of Theil T and Theil L indexes (J = T+L) expressed as:

$$J = \frac{1}{N\mu} \sum_{i=1}^{N} (x_i - \mu) \ln\left(\frac{x_i}{\mu}\right).$$

J-Divergence can also be expressed in terms of its within and between groups components, in terms of the sum of Theil-T and Theil-L respective components:  $J = T + L = Te + Le + \sum_{h=1}^{k} Yh Th + \sum_{h=1}^{k} \pi h Lh$ 





**Key point: J-divergence** implies in shares (Always non negative) for each income-bracket and individuals. It allows to move from variables to specific groups (higher education, top 1% incomes, etc).

Rohde (2016); Hecksher, Courseil and Silva (2017), Neri and Hecksher (2018); Morley (1999)

If we are interested only in contributions of groups situated in the top part of the income distribution the Theil –T could be used as well. The Theil-T presents always positive contributions to those above the mean (Morley 1999; Neri and Camargo 1999).

Gross Contribution to Inequality J-Divergence				oivergence	CATEGORIES
Level 2015	Education: Completed College	Firm Size: >1000 Employees	Income Brackets: Top 0,1%	Income Brackets: Top 1%	Income Brackets:Top 5%
	48,7%	34,8%	7,13%	27,57%	52,2%

Specific Groups Contributions to Inequality: J-Divergence: Top 1% & 0.1% Incomes



## Main Points (RAIS)

Describes the evolution and the close causes of formal earnings inequality in the Brazilian formal sector using RAIS (33 million observations yearly.

Gini of labor earnings in RAIS fell 12.5% between 1995 and 2015, concentration index from PNAD survey labor fell 19.3 per cent.

RAIS allows to measure wages at the very upper tail of earnings distribution. In spite of overall inequality fall, the monotonic decrease of earnings increase goes until the 90 percentile, in the same direction not timing as PIT-based measures.

J-Divergence allows to capture the role played by specific groups. We apply it to isolate the role of top incomes. Between 1995 and 2015 the share of inequality explained by the top 10%, 1% and 0.1% incomes rose 20.2 per cent, 43.1 per cent and 91 per cent, respectively. Similarly, in spite of falling mean schooling returns, the share of inequality explained by those with high school diploma rises 29.5 %.

Main close determinants of inequality level. Schooling explains 32.8% of total inequality in 2015. Individual firm-effects reach 64.7%

Main determinants of inequality change. Schooling 33.3% of inequality between 2001-15. Individual firm-effects reach 75,9%!

#### \*\*J-divergence measurements of per capita income inequality

Rohde, N. (2016) – **Summary:** The paper uses a symmetric entropy statistic to study income inequality. The index quantifies the information content of a two-way message that transforms the empirical income distribution into an egalitarian reference distribution, and then back to the original. This allows the measure to be interpreted as an average of *n* income-to-mean divergences such that the inequality estimate can be broken down into contributions across population subgroups. Various properties of the index are analyzed and an application comparing the USA, Germany and Britain is provided. We focus on the sensitivity of inequality to the tails of the income distribution and show that the extreme right even if incomes are measured at the household level, averaged over a 5-year period and taken after government taxes and transfers.

**Dominance of the richest in Brazilian income inequality: application of J-divergence to household and tax data** Hecksher et al. (2017) **\*\* Summary:** The share of the income inequality explained by the 10% richest in Brazil is higher than 50%. Higher in Brazil than for the US (45%), Germany (44%) and Great Britain (41%). Inequality was measured using an index which is still not much used in the socioeconomic literature, the J-divergence. It can be defined as the sum of Theil's T and L indices, but unlike these and the Gini index, can be easily decomposed as the sum of the individual contributions to the total inequality. Equivalised per capita household total monthly income PNAD were used to estimate the J-divergence from 1981 to 2015, and the corresponding shares of the inequality explained by each vintile of the income distribution. By integrating PNAD and income tax data for 2014, more than 50% of the resulting inequality of adult personal income is driven by the top percentile.



### J-Divergence of equivalent per capita Household (HH) income groups,

Source: PNAD/IBGE from Hecksher et al. (2017)



F income sources (labor, rents, social security, Bolsa Familia etc N household members Per capita HH Income usual:  ${}^{1}\Sigma N$   $\Sigma F$  V

 $\frac{1}{N}\sum_{i=1}^{N}\sum_{f=1}^{F}Y_{if}$ 

general case:

 $\frac{1}{N^{\theta}}\sum_{i=1}^{N}\sum_{f=1}^{F}Y_{if}$ 

 $0 \le \theta \le 1$ ;  $\theta$  is an economy of scale parameter

 $If \theta = 1$  per capita HH income

If  $\theta = 0$  Total HH income

If  $\theta = 1/2$  Equivalized per capita ,HH income – Square root rule



### % Share of equivalent per capita income

Source: PNAD/IBGE from Hecksher et al. (2017)