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Fiscal Adjustment and Income Inequality

Sub-national Evidence from Brazil

João Pedro Azevedo
Antonio C. David
Fabiano Rodrigues Bastos
Emilio Pineda

The World Bank
Europe and Central Asia Region
Poverty Reduction and Economic Management Team
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Abstract

The paper combines state-level fiscal data with household survey data to assess the links between sub-national fiscal policy and income inequality in Brazil over the period 1995–2011. The results indicate that a tighter fiscal stance at the sub-national level is not associated with a deterioration in inequality measures. This finding contrasts with the conclusions of several papers in the burgeoning literature on the effects of fiscal consolidation on inequality using national data for OECD economies. In addition, the authors find that a tighter stance is typically positively associated with a measure of "shared prosperity". Hence, the results caution against extrapolating policy implications of the literature focusing on advanced economies to other settings.

This paper is a product of the Poverty Reduction and Economic Management Team, Europe and Central Asia Region in collaboration with colleagues from the IMF and the IADB. It is part of a larger effort by the World Bank to provide open access to its research and make a contribution to development policy discussions around the world. Policy Research Working Papers are also posted on the Web at http://econ.worldbank. org. This paper was also issued as IMF Working Paper 14/85. The authors may be contacted at jazevedo@worldbank.org, adavid@imf.org, FRodriguesBastos@imf.org, emiliopi@iadb.org..

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João Pedro Azevedo
World Bank Group

Antonio C. David
International Monetary Fund

Fabiano Rodrigues Bastos
International Monetary Fund

Emilio Pineda
Inter-American Development Bank

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I. INTRODUCTION

The redistributive consequences of economic adjustment following the great recession of 2007/09 have been at the center of policy discussions in both advanced and emerging economies. Social discontent has been brewing even in economies with a positive track record of sustained growth and reductions in poverty and inequality. In this context, there has been an increased policy interest in the macroeconomic determinants of income inequality and, in particular, the link between inequality and fiscal policy. While the empirical literature on the microeconomic determinants of inequality is vast, especially in Latin America, much less attention has been paid to the underlying macroeconomic setting. This paper attempts to bridge this gap by combining fiscal data with household survey information at the state level for Brazil over the period 1995-2011 to assess the links between sub-national fiscal policy and income inequality.

The rich data available for Brazil provides a unique opportunity for assessing this issue. Brazil is organized politically and administratively as a federal system consisting of 26 states and one federal district. The states are characterized by heterogeneous levels of inequality and fiscal outcomes, but share common institutions and federal regulations. The period under analysis is marked by important changes in fiscal institutions as states had to increase their primary balances in order to comply with debt renegotiation programs agreed with the federal government in the late 1990's. Even those states that did not have significant debt levels were bound by new fiscal rules. This fiscally-constrained environment reshaped revenue and expenditure policies at the sub-national level after 2000.

Against this backdrop, income inequality decreased significantly over the last two decades. The Gini coefficient declined from 57.7 in 1995 to 52.2 percent in 2011, although it remains among the highest in the world. Microeconomic studies have linked inequality reduction in Brazil to changes in labor income, including changes in both the supply and demand for skilled workers, and to the emergence of effective social transfer programs at the federal level (Azevedo and others, 2013, Pecora and Menezes, 2013, Barros and others, 2010, Lopez-Calva and Rocha, 2012, and, Foguel and Azevedo, 2007).

Our paper sheds further light into this issue by exploiting the role of macroeconomic factors, namely the fiscal policy at the sub-national level. The results indicate that a tighter fiscal stance in Brazilian states, measured by changes in their cyclically adjusted primary balance, is not linked to a deterioration in inequality. This conclusion differs from the results of several papers that analyze the impact of fiscal consolidations on inequality at the national level for OECD countries, which typically conclude that fiscal consolidations are associated with increases in inequality. In addition, we find that a tighter fiscal stance at the sub-national level is often positively associated with a measure of "shared prosperity". Our findings caution against extrapolating policy implications of the literature focusing on advanced economies to other settings.

The paper is structured as follows. Section II provides a literature review on the relationship between income inequality and macroeconomic factors with a focus on fiscal policy. Section III presents stylized evidence on fiscal dynamics and income inequality for Brazilian states.

Section IV presents the econometric methodology for linking inequality and fiscal performance at the state-level along with the results. Section V discusses the robustness of the results obtained and section VI concludes.

II. BACKGROUND ON THE LITERATURE

Macroeconomic Factors and Inequality Dynamics

The literature on the impact of macroeconomic conditions on inequality typically focuses on two main channels: unemployment and inflation (Marrero and Rodriguez, 2012, Jantti and Jenkins, 2010, and Bittencourt, 2009). The empirical evidence confirms that the unemployment rate tends to be positively correlated with inequality. Nevertheless, the effects of inflation on inequality are likely to be non-linear. High inflation can lead to an increase in inequality as poorer segments of the population cannot protect themselves against the "inflation tax". However, it is possible that moderate inflation is associated with reductions in inequality as real debt burdens are eroded, as the evidence for developed economies suggests (Marrero and Rodriguez, 2012). On the other hand, Bittencourt (2009) provides a recent analysis for Brazil during the period 1983-1994, which indicates that extreme rates of anticipated and unanticipated inflation have significantly increased inequality.

Economic theory points to ambiguous effects of overall economic growth on inequality (Garcia-Penalosa, 2010). For instance, if growth is driven by increased human capital accumulation, it is likely to lead to a reduction in the relative wage of skilled workers (as the relative supply of skilled labor increases) and therefore to a reduction in inequality. On the other hand, when growth is driven by technological change that is skill-biased, it is likely that faster growth will lead to more inequality, as the wage premium for skilled workers increases. The empirical evidence on the impact of overall growth on inequality is also mixed. Cross-country studies tend to find evidence of both positive and negative correlations (Duflo and Banerjee, 2003).

In turn, inequality is also likely to have an important impact on macroeconomic variables, most notably on overall economic growth. Aghion, Caroli, and Garcia-Penalosa (1999) provide a survey of the topic from the perspective of new growth theories. Political economy and institutional implications of highly polarized societies and their consequences for macroeconomic policies and outcomes have also been highlighted by several authors (Acemoglu and others, 2003).

Fiscal Policy and Inequality

The recent empirical literature on the effects of the fiscal policy stance on inequality has focused mostly on OECD/Advanced economies and used data at the national level. Wolff and Zacharias (2007) show that net government spending reduces inequality at the national level in the US and this is mostly due to expenditures rather than taxes. Agnello and Sousa (2012) look at the impact of fiscal consolidation on inequality in a panel of 18 industrialized countries and find that inequality increases during periods of fiscal consolidation. In addition, consolidation is particularly detrimental to inequality if led by expenditure cuts. On the other

hand, fiscal consolidations that are driven by revenue increases are associated with reductions in inequality.

Nevertheless, Ball and others (2013) find that both expenditure and taxed-based fiscal consolidations at the national level have typically raised inequality for a panel of OECD countries, even if the distributional effects of spending-based adjustments tends to be larger relative to tax-based adjustments. These conclusions are largely confirmed for a broader panel of countries that also includes emerging markets in a study by Woo and others (2013). These authors find positive and statistically significant elasticities of spending-based consolidations on inequality (of around 1.5 to 2), but the coefficients for tax-based consolidations are not statistically significant.

Several papers in this fiscal consolidation literature use so-called "action-based" data at the national level constructed for OECD economies by Devries and others (2011). The Devries and others data focuses on discretionary changes in taxes and expenditures motivated by a desire to reduce the budget deficit and as such these authors attempt to exclude fiscal policy changes that would be a response to prospective economic conditions. Such consolidation episodes are identified by examining contemporaneous policy documents. We use more "conventional" measures of the fiscal stance as described in the next section. Another difference is that these papers tend to focus on large fiscal adjustments, whereas we also consider gradual changes. Moreover, the literature tends to consider data at the national (central government) level, while we focus on evidence at the sub-national level.

Afonso, Schuknecht and Tanzi (2010) look at the impact of public social spending on income distribution for a sample of OECD countries. They find that social spending is linked to a more equal income distribution when it is coupled with good educational achievement and that there is a low marginal product of higher spending in terms of equality. But the impact of overall government spending on inequality in developing countries is less clear-cut. Lim and McNelis (2014) do not find a systematic link between the ratio of government spending to GDP and the Gini coefficient across regions of the world.

The impact of fiscal policy on inequality in developing economies is typically shaped by lower levels of taxes and transfers relative to advanced economies, which is compounded by greater reliance on regressive taxes (such as consumption taxes) and low coverage and benefit levels of transfer programs (Bastagli, Coady, and Gupta, 2012). Furthermore, overall in-kind public expenditures (on health and education for example) have been found to be regressive in several developing countries, reflecting the lack of access by lower income households to public services (Bastagli, Coady, and Gupta, ibid.).

Lustig and others (2012) undertake a static analysis of the incidence of fiscal policy for several Latin American countries, including Brazil. They find that typically the extent of inequality reduction due to direct taxes and transfers is relatively small compared to what is observed for Western Europe. In the case of Brazil, taxes and transfers lead to a 3 percentage points reduction in the Gini coefficient compared to 15 percentage points for Western European countries. In Brazil, this is mostly explained by the fact that the government spends less (as a share of GDP) on progressive transfers. Using data from the 2009 household budget

survey (*Pesquisa de Orçamento Familiar, POF*) they conclude that direct taxes (such as personal income taxes) in Brazil appear to be progressive, but their impact on inequality is relatively small because of their small size relative to GDP, whereas indirect taxes are regressive. Lustig and others (2012) also examine the incidence of direct cash transfers and conclude that it varies significantly depending on the program. Bolsa Familia is well targeted to the poor, but other programs such as the Special Circumstances Pensions (SCP) benefit relatively more the top quintile.

Azevedo and others (2013) show that between 2001 and 2011, approximately 40 percent of the reduction of inequality in Brazil can be attributed to changes in the labor markets, in particular to higher hourly earnings of low-skilled workers. Transfers (public and private) and noncontributory pensions[1], contributed 20 percent and 18 percent to the reduction of inequality respectively. Demographic factors are one last important component in the reduction of inequality in this period - Brazil, as many other Latin American countries, is currently benefiting from its demographic dividend. The current UN World Population projections suggest that by 2020 the total-dependency ratio in Brazil will start to rise again. The fiscal implications for this can be significant, especially given the associated higher health and noncontributory pension expenditures.

The regressive nature of the overall tax system in Brazil is emphasized by Soares and others (2009). As of 2007, based on national accounts data, these authors estimate that indirect taxes accounted for over 40 percent of the total gross tax burden (excluding government transfers), whereas income and property taxes accounted for less than 30 percent.[2] Most of the taxation of income and property can be decomposed into corporate income taxes (close to 39 percent of the total taxation of income and property); property taxes, including the financial transactions tax (close to 27 percent); and personal income taxes (21 percent). In addition, these authors estimate that income and property taxes accounted for close to 44 percent of the increase in tax buoyancy (tax to GDP ratio) between 1997 and 2007, whereas indirect taxes accounted for about 33 percent of the increase.

Ferreira, Leite and Ravaillon (2010) look at the importance of changes in sectoral growth, heterogeneity in initial conditions, and macroeconomic and redistributive policy variables (social expenditures and inflation) on poverty dynamics in Brazil over the period 1985-2004, focusing on state-level data, as we do in this paper. They find significant differences in the poverty reducing effect of growth across sectors, but they argue that the largest source of poverty reduction over the period were government macroeconomic stabilization and redistribution policies, in particular, the large reduction in inflation and the expansion of Federal social security and social assistance programs. In contrast, state and municipal

[1] The *Benefício de Prestação Continuada* (BPC) program is a noncontributory pension addressed to poor elders over 65 years old and disable individuals with a per capita family income no greater than 25% of the minimum wage (around US$ 2.5 a day in 2012) . The BPC benefit started being paid in 1996 (one minimum wage for each beneficiary).

[2] These taxes are estimated by the authors to amount to about 10 percent of GDP.

"social" public expenditures were found to have had an adverse effect on poverty (regressive incidence), whereas state-level investment spending had no significant effect.

III. Fiscal Institutions and Fiscal Structure at the State-level in Brazil

Brazil's current fiscal federalism arrangements were shaped by the 1988 Constitution, which created an environment of fiscal decentralization with transfer mechanisms inspired by equity concerns. The first ten years after the 1988 Constitution witnessed a sequence of sub-national fiscal crises, which originated in great part from the lack of fiscal discipline and moral hazard associated with federal bail-out packages. High sub-national indebtedness turned into a macroeconomic risk factor for the entire country.

In 1997, the federal government and the states engaged in a debt restructuring agreement, whereby the former would take on most of the states' debt stock, while the latter would be given 30 years to repay the assumed debt. The debt restructuring agreement introduced binding constraints to the fiscal behavior of the states and explicit commitments to a detailed fiscal adjustment program. These changes were reinforced by the 2000 Fiscal Responsibility Law (LRF), which is considered to be a landmark of fiscal reform in Brazil. Among other features, the LRF imposed quantitative restrictions such as caps on payroll expenditure, as well as limits on the debt level as a share of tax revenue (Sturzenegger and Werneck, 2006).

Hence, since 2000, there has been a new environment in which fiscal decentralization was accompanied by constraints limiting sub-national debt build-up. The fiscal performance of sub-national entities improved quickly thereafter. Nevertheless, the sub-national fiscal adjustment period also involved costs. States and municipalities faced current expenditures with considerable downward rigidity, which absorbed the bulk of revenue growth. Given the limitation on new borrowing, public investment became the adjustment variable for sub-national public finances in many instances. This situation led to the accumulation of infrastructure weaknesses as well other repressed investment needs.

Over time, the main state-level tax (*ICMS*) which is a value-added tax on consumption of goods and services became the center of fiscal federalism tensions. States began to compete with each other and offer *ICMS* exemptions to attract firms, which further compressed fiscal space for public investment. Moreover, as discussed in Sturzenegger and Werneck, (2006), most federal revenue transfers to state governments stem from the revenue-sharing of a tax on manufactured products (the *IPI*). Thus, Brazilian states rely mostly on tax revenue from so-called "indirect taxes" rather than taxes on income or property.

However, there is large heterogeneity regarding the relative importance of the ICMS and federal revenue transfers across states. The median ICMS to GDP ratio in 2012 is around 8 percent. For richer states, the ICMS corresponds to more than 50 percent of total revenue, while federal revenue transfers amount to very little. The opposite is true for states with a less developed economic base. On the expenditure side, the median investment to GDP ratio is around 1.5 percent with strong heterogeneity as well – for instance, in 2012, the lowest investment to GDP ratio was 0.3 percent while the highest was 8.2 percent. Another important expenditure category is compensation of employees, which reached around 9 percent of GDP in 2012 for the median state.

IV. DATA DESCRIPTION: INEQUALITY DYNAMICS AND FISCAL POLICY AT THE STATE LEVEL IN BRAZIL

The Data

Annex A presents a description of data definitions and sources. The measures of inequality in income per capita (after public and private transfers, but before taxes) and the employment rate variable were constructed using data from an annual household survey (*Pesquisa Nacional por Amostra de Domicilios*, PNAD) undertaken by Brazil's Institute of Geography and Statistics (IBGE) and compiled by the Socio-Economic Database for Latin America and the Caribbean (SEDLAC), a joint effort of the Centro de Estudios Distributivos Laborales y Sociales of the Universidad Nacional de La Plata and the World Bank's Poverty, Gender and Equity group for Latin America. PNAD is a representative survey both at the national and state level, but the surveys are not undertaken during Census years (2000 and 2010 in our sample).[3]

State-level fiscal data were constructed based on a dataset compiled by the National Treasury Department at the Ministry of Finance. The dataset provides comprehensive information on revenue, expenditures, assets, and liabilities. Some financing items such as disbursements and other financing flows, as well as financing outflows such as amortization payments, are classified "above the line" in the dataset. Hence, we adjust the revenue and expenditure concepts to include only non-financing items. As a result, the difference between our adjusted revenue and expenditure measures equals the nominal fiscal balance and, if interest rate payments are also subtracted, the difference equals the primary fiscal balance.[4] We also used the Treasury database to obtain information on "social" public expenditures both at the state and municipal level, which comprises expenditure on education and culture, health and sanitation as well as social security and social assistance (similar to what was used in Ferreira, Leite and Ravaillon, 2010).

Moreover, we used Regional National Accounts Statistics from IBGE to obtain a series for state-level GDP and the respective deflators. Finally, we also use information on federal social transfers at the state level from a dataset constructed by the Institute for Applied Economic Research (IPEA). This comprises information on three main federal social programs: *Bolsa Familia*, *Beneficio de Prestacao Continuada*, and *Renda Mensal Vitalicia*. These federal social transfers are direct cash transfers to households.

[3] We linearly interpolate values for these years based on information from adjacent years. We also exclude households that reported zero income so that different measures of inequality could be computed in a comparable manner. Sensitivity analysis shows that our results remain broadly the same when households with zero income are included in the calculation of inequality indicators.

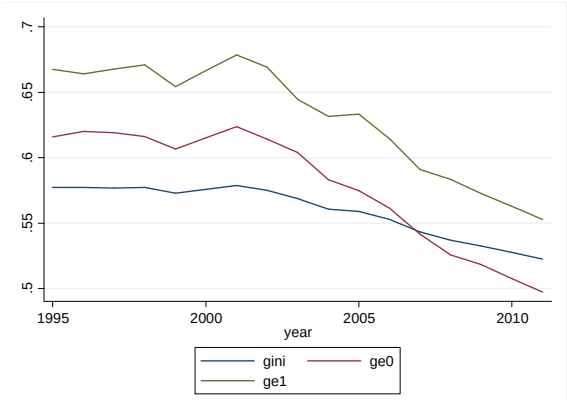
[4] The National Treasury dataset used is publicly available at https://www.tesouro.fazenda.gov.br/pt/prefeituras-governos-estaduais/sobre.

Descriptive Analysis

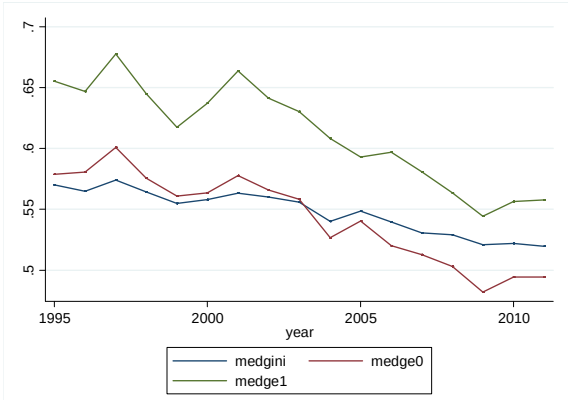
Figure 1 depicts trends in a number of inequality measures over the period of interest. As the first panel illustrates, overall per capita income inequality at the national level has declined significantly irrespective of the measure of inequality considered (the Gini coefficient, as well as the GE(0) and GE(1) measures are depicted). Median inequality across states has also fallen over the period. The Figure also illustrates that for the GE(0), GE(1) and GE(2) indicators, the "between dimension" accounts for only 3 to 8 percent of total inequality in Brazil and remains relatively constant over time. Thus, our focus on "within-state" inequality in the analysis of the macroeconomic correlates of inequality presented in subsequent sections of the paper is justified. Moreover, the 2000s were years of fiscal adjustment for Brazilian states. The median primary balance moved to a surplus in the late 1990s, and varied around one percent of state GDP for most of the subsequent decade, before falling closer to zero after the global financial crisis (bottom-right panel of the figure).

Figure 1. Income Inequality and sub-National Primary Balance: 1995-2011

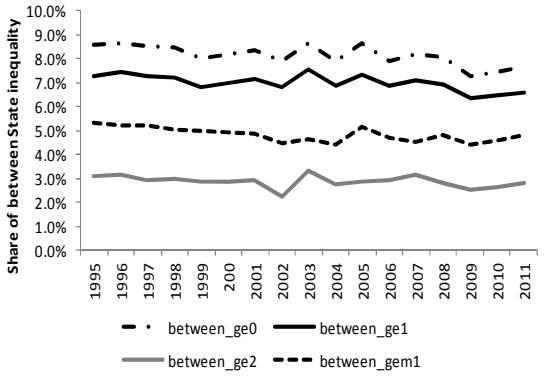
Overall decrease in inequality at the national level.



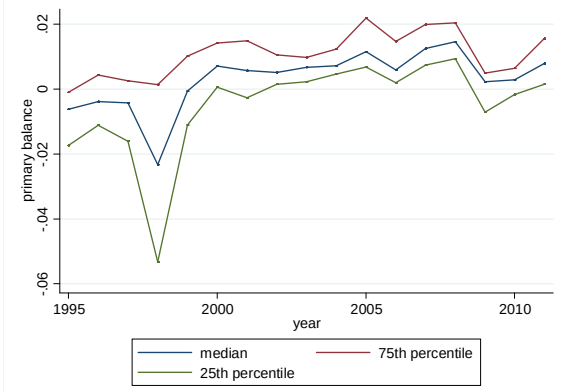
Median (across states) inequality measures have also fallen.



Stable share of "between-states" inequality for different indicators



Primary Balance/GDP, median, 75th and 25th pctles (across states)



V. MODELING APPROACH AND RESULTS

We follow a parsimonious empirical specification summarized in Equation 1 for $i = 1,...,N$ states; $t = 1,...,T$ time periods and $m = 1,...,M$ control variables. The variable y_{it} represents one of the PNAD-based income inequality measure (we focus on the log of the Gini index) at the state level; Δpb are changes in the cyclically-adjusted primary balance as a share of state GDP (a measure of the fiscal stance); *X* is a set of controls; α_i are state-specific fixed-effects; ε_{it} is the error term, assumed to be white noise. When estimating equation 1, we also include time dummies and a time trend in the specification.

$$y_{i,t} = \rho y_{i,t-1} + \psi \Delta pb_{i,t-1} + \sum_{m=1}^{M} \beta_m X_{m,i,t-1} + u_{i,t} \qquad (1)$$
$$u_{i,t} = \alpha_i + \lambda_t + \varepsilon_{i,t}$$

We consider the following macroeconomic and fiscal variables as controls in the baseline regressions: the employment rate; the state-level GDP per capita growth rate; inflation (measured by changes in the state GDP deflator); state and municipal "social" expenditure as a share of state-GDP; Federal social transfers as a share of state GDP. See annex A for data definitions and sources.

The construction of the cyclically-adjusted primary balance warrants a more detailed explanation. We focus on adjustments of revenue and expenditure to the output gap and do not consider the impact of equity or commodity price fluctuations. We believe that this is justified given the results discussed in IMF (2011) suggesting that, at the national level, revenue elasticites relative to cycles in equity and commodity prices appear to be very small. We follow the "aggregated method" described in Bornhorst and others (2011) and focus on the sensitivity of aggregate revenues and expenditures to the output gap at the state-level. The results presented in subsequently sections continue to hold when we consider the unadjusted primary balance.

The output gap is calculated by applying the Hodrick-Prescott filter to the log of the real state-level GDP series with a smoothing parameter of 6.25, as suggested by Ravn and Uhlig (2002) for annual data. We experimented with different smoothing parameters that might be more appropriate for cycles in developing countries, which tend to have shorter duration (Rand and Tarp, 2002), as well as with the use of alternative filters (for example, the Christiano and Fitzgerald filter), but found that these variations in the methodology do not substantially affect the estimates of the output gap.

We use the revenue and expenditure elasticities estimated by Arena and Revilla (2009) for Brazilian states over the period 1991-2006. These authors estimate a total revenue elasticity

of around 1.7 and total expenditure elasticity of 1.3.[5] Thus, the cyclically-adjusted primary balance as a share of state GDP is given by Equation 2, where *R* denotes state-level primary revenue, *G* denotes state-level primary expenditures, Y is state-GDP, Y^P is potential output, and ε are the respective elasticities.

$$capb_t = \frac{R_t}{Y_t}\left(\frac{Y_t^P}{Y_t}\right)^{\varepsilon_R} - \frac{G_t}{Y_t}\left(\frac{Y_t^P}{Y_t}\right)^{\varepsilon_G} \qquad (2)$$

Our measure of the fiscal stance differs from the "action-based" fiscal consolidation measures constructed by Devries and others (2011) and used in several papers in the literature for OECD economies. The construction of a similar "action-based" measure for Brazilian states is more difficult given that historical policy documents providing information on discretionary changes in taxes and expenditures are not readily available at the sub-national level. Furthermore, we are also considering the effects of gradual continuous adjustment in our analysis rather than focusing exclusively on large consolidation episodes, as it is frequently done when analyzing fiscal consolidation (Alesina and Ardagna, 2012). Finally, a structurally-adjusted primary balance (i.e. the primary balance adjusted not only for cyclical fluctuations, but also for one-off fiscal operations) would provide a better measure of the fiscal stance. However, it was not possible to remove one-off fiscal operations at the state-level in a consistent and systematic way due to lack of information and accounting challenges. In any case, one-off fiscal operations are more likely to occur at the federal level and in this context; we believe that the use of the cyclically-adjusted balance is adequate.

Descriptive statistics for selected variables are presented in Annex B. We test for unit root and cross-sectional dependence in the main variables (Annex C). The Pesaran (2007) test, which allows for cross-sectional heterogeneity and models cross-sectional dependence as an unobserved common factor, suggests that all variables are stationary and therefore conventional panel techniques might be appropriate for the analysis. Nevertheless, there is strong evidence that cross sectional dependence is a problem, as indicated by the Pesaran (2004) test.

Cross-sectional dependence can arise because of spill-overs and/or spatial effects among the states or because of the presence of common (unobserved) factors. Estimators conventionally used in panel data analysis require the assumption of cross-sectional independence across panel members. In the presence of cross-sectionally correlated error terms, these methods do not produce consistent estimates and can lead to incorrect inference (Kapetanios, Pesaran and Yamagata, 2011). We attempt to mitigate cross-sectional dependence through different strategies.

[5] Our results still hold when we assume a unit elasticity for revenues and a zero elasticity for expenditures as it is commonly done in the literature.

Fixed Effects Models

We first present results of the estimation of Equation 1 using fixed-effects models that take into account state characteristics that are time invariant. In order to mitigate possible endogeneity problems, we use lagged values of the control variables and therefore assume that they are weakly exogenous. We also address cross-sectional dependence problems by including time effects in the regressions and by using Driscoll and Kraay (1998) corrected standard errors.

The results presented in Table 1 indicate that the employment rate is an important factor in explaining inequality over the period. Furthermore, both real GDP per capita growth and the inflation rate are linked to increases in inequality, but only the coefficients obtained for the inflation rate are statistically significant, mirroring some of the results of the literature. This highlights the importance of macroeconomic stabilization in inequality reduction, a well established result in the Brazilian context.

More importantly for our purposes, fiscal variables seem to matter. Somewhat intriguingly, a tighter fiscal stance is associated with less inequality. In addition, as expected, the highly progressive social transfers at the federal level are strongly associated with reductions in inequality with economically large coefficients. Finally, the level of social expenditures at the state and municipal level appears to be associated with higher levels of inequality with positive and statistically significant coefficients for all specifications, in line with the results obtained by Lim and McNelis (2014)[6] for Latin American countries and with results by Ferreira, Leite and Ravaillon (2010) for Brazil.[7]

The effect of changes in the cyclically-adjusted primary balance remains significant when we control for average years of education and average returns to education at the state level (specifications 7 and 8 in the Table). The short-run coefficients for the effects of changes in the primary surplus as a share of GDP on inequality range from -0.18 to -0.15 (the long-run effects are around -0.4). These coefficients can be interpreted as semi-elasticities (note that the dependent variable is expressed in logs).

GMM Estimation

It is possible that the results obtained with fixed effects specifications are due to shortcomings in statistical techniques. Hence we re-estimate the models using GMM techniques, namely the system (Blundell-Bond) GMM estimator (see Roodman, 2009 for a discussion), which allow us to handle the potential endogeneity of some regressors by using lagged values of these variables as instruments. We transform instruments using forward orthogonal deviations and present robust standard errors, which are consistent in the presence

[6] One should note that Lim and McNelis focus on overall spending rather than social spending and use country-level data.

[7] Ferreira, Leite and Ravaillon focus on the determinants of poverty reduction rather than inequality.

of heteroscedasticity and autocorrelation. We mitigate the bias introduced by high instrument count by replacing instruments by their principal components.

Table 1. Fixed Effects Regressions 1995-2011

	1 Gini	2 Gini	3 Gini	4 Gini	5 Gini	6 Gini	7 Gini	8 Gini
Lagged Dependent Variable	0.455***	0.455***	0.430***	0.433***	0.425***	0.422***	0.420***	0.415***
	[0.094]	[0.094]	[0.090]	[0.090]	[0.092]	[0.088]	[0.092]	[0.092]
Δ(Cyclically Adj. Primary Surplus/GDP)$_{t-1}$	-0.181***	-0.182***	-0.179**	-0.176**	-0.162**	-0.153**	-0.153**	-0.157**
	[0.063]	[0.062]	[0.067]	[0.064]	[0.060]	[0.057]	[0.057]	[0.058]
(GDP Growth per capita)$_{t-1}$		0.025	0.021	0.037	0.035	0.049	0.050	0.044
		[0.067]	[0.069]	[0.073]	[0.071]	[0.069]	[0.069]	[0.072]
(Employment rate)$_{t-1}$			-0.284***	-0.294***	-0.251**	-0.307**	-0.301**	-0.272**
			[0.096]	[0.099]	[0.111]	[0.112]	[0.109]	[0.111]
(Inflation)$_{t-1}$				0.073**	0.076***	0.076***	0.076***	0.078***
				[0.026]	[0.026]	[0.026]	[0.026]	[0.024]
(Sub-national Social Expenditure)$_{t-1}$					0.217***	0.348***	0.345***	0.348***
					[0.072]	[0.068]	[0.069]	[0.069]
(Federal Social Transfers/GDP)$_{t-1}$						-1.073***	-1.036***	-0.915**
						[0.322]	[0.345]	[0.363]
(Years of Education)$_{t-1}$							-0.007	0.027
							[0.017]	[0.018]
(Returns to Education)$_{t-1}$								-0.094
								[0.065]
Constant	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Time Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pesaran (2004) cross-sectional dependence test	-1.87*	-1.89*	-2.05**	-2.04**	-2.19**	-2.28**	-2.28**	-2.30**
Observations	405	405	405	405	405	405	405	405
Number of groups	27	27	27	27	27	27	27	27
R-squared	0.589	0.589	0.606	0.609	0.614	0.621	0.621	0.622

Driscoll-Kraay standard errors in brackets. Null hypothesis of Pesaran (2004) test for regression residuals is cross-sectional independece. *** p<0.01, ** p<0.05, * p<0.1 . Time effects coefficients not reported to save space.

The results obtained (Table 2) confirm the association between inequality measures, the employment rate and federal social transfers, as well as the link between the cyclically adjusted-primary balances and reductions in inequality. Nevertheless, the coefficient for the inflation rate is no longer statistically significant. The estimated coefficient (semi-elasticity) for changes in the primary balance continues to be statistically significant and is larger than what we obtained for fixed-effects regressions, ranging from around –0.26 to -0.51.

Diagnostic tests reject the null of cross-sectional independence in the residuals for most specifications, despite the inclusion of time dummies, thus the results should be interpreted with caution. In addition, AR tests do not indicate the presence of serial correlation of the residuals. As far as the validity of instruments is concerned, the Hansen test suggests that overidentifying restrictions are valid, but the Sargan test rejects the validity of these restrictions. Nevertheless one should bear in mind that the Sargan test statistic is not robust to heteroskedasticity or serial correlation.

Table 2. Difference (Arellano-Bond) and System (Blundell-Bond) GMM Regressions 1995-2011

	1 Gini	2 Gini	3 Gini	4 Gini	5 Gini	6 Gini	7 Gini	8 Gini
Lagged Dependent Variable	0.595***	0.670***	0.648***	0.654***	0.543***	0.624***	0.565***	0.593***
	[0.096]	[0.093]	[0.081]	[0.077]	[0.107]	[0.094]	[0.122]	[0.120]
Δ(Cyclically Adj. Primary Surplus/GDP)$_{t-1}$	-0.512***	-0.390***	-0.442***	-0.392***	-0.256**	-0.309**	-0.257**	-0.292**
	[0.098]	[0.117]	[0.100]	[0.110]	[0.103]	[0.111]	[0.119]	[0.116]
(GDP Growth per capita)$_{t-1}$		0.015	0.033	-0.086	-0.119	-0.099	-0.072	-0.065
		[0.107]	[0.118]	[0.096]	[0.081]	[0.090]	[0.095]	[0.090]
(Employment rate)$_{t-1}$			-0.329**	-0.283*	-0.206**	-0.316***	-0.294***	-0.288***
			[0.155]	[0.149]	[0.091]	[0.085]	[0.071]	[0.078]
(Inflation)$_{t-1}$				0.021	0.018	0.020	0.012	0.027
				[0.058]	[0.061]	[0.064]	[0.057]	[0.058]
(Sub-national Social Expenditure)t-1					0.286**	0.337**	0.368**	0.377***
					[0.125]	[0.136]	[0.140]	[0.135]
(Federal Social Transfers/GDP)$_{t-1}$						-0.761**	-1.108**	-1.109***
						[0.358]	[0.403]	[0.381]
(Years of education)$_{t-1}$							-0.001	-0.008
							[0.029]	[0.029]
(Returns to education)$_{t-1}$								0.016
								[0.057]
Constant	-5.302	-5.172	-5.924	12.538	25.931**	19.519	18.859	13.879
	[8.187]	[15.363]	[16.386]	[14.812]	[11.323]	[12.777]	[14.220]	[17.910]
Time Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pesaran (2004) cross-sectional dependence test	-1.99**	-1.90*	-2.00**	-1.91*	-2.08**	-2.08**	-2.16**	-2.16**
Sargan test	98.24***	153.3***	159.9***	171.8***	165.1***	181.7***	173.1***	177.0***
Hansen test	10.70	12.33	16.41	14.73	8.519	2.873	2.142	1.627
Arellano-Bond AR(2) test	0.354	0.563	0.547	0.837	0.657	0.603	0.499	0.515
Observations	405	405	405	405	405	405	405	405
Number of groups	27	27	27	27	27	27	27	27

HAC robust standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. Null hypothesis of Pesaran (2004) test for regression residuals is cross-sectional independece. Null of Arellano-Bond test is that first-differenced errors exhibit no 2nd order serial correlation. Sargan and Hansen tests of tests of the validity of overidentifying restrictions.

Disentangling the effects of changes in expenditures and changes in revenue

As we have seen in previous sections, a number of papers in the cross-country literature on fiscal consolidations at the national level tend to find different effects on inequality depending on whether the consolidation is "expenditure-based" or "revenue-based". In this section we will explore these differential channels for the Brazilian case by separately including changes in revenues and changes in primary expenditures in our regressions rather than focusing on the cyclically adjusted primary balance. We do not attempt to describe the precise mechanism driving these results, but to shed light on possible candidates for transmission channels.

The evidence at the national level for Brazil and other Latin American countries points to a greater reliance on indirect (regressive) taxes relative to income taxes, which would suggest that higher primary surpluses driven by higher tax revenues would tend to be associated with increases in inequality (Bastagli, Coady and Gupta, 2012 and Goni, Lopez and Serven, 2011). On the other hand, the evidence at the national level also indicates that a large share of social spending is captured by the better off, and thus reductions of these expenditures would not necessarily lead to increases in inequality.

Prior to presenting the regression results, it is important to note that revenues have played an influential role in those years in which the state-level primary surpluses experienced a positive change. Expenditures, on the other hand, have been relatively more influential in those years in which the state-level primary surpluses experienced negative changes. Hence, fluctuations of the overall fiscal adjustment process embed changing roles for revenue and expenditure. Also, from a descriptive perspective, the fiscal adjustment process at the state-level appears to have a relatively stronger revenue-side component on aggregate, though this pattern can vary significantly by state.

The regression results are presented in Table 3. In fixed-effects regressions (specification 1 in the Table), changes in revenues are negatively associated with inequality, whereas changes in primary expenditures present a positive association. Further disaggregation of revenues and expenditures suggests that these results are driven by changes in revenues linked to revenue transfers to states[8] and by changes in investment expenditure (specification 2), with coefficients for these variables being significant at the 1 percent level. These relations hold with the same signs for GMM regressions as well, nevertheless only changes in primary expenditures are statistically significant. Cross-sectional dependence of the residuals continues to be a problem in GMM regressions.

[8] Note that the federal revenue transfers go to state governments, whereas federal social transfers also considered in the regressions are direct cash transfers to households, thus these components have very different implications for inequality. The bulk of revenue transfers originate from the "States' Participation Fund", which comprises revenues from income taxes and the IPI tax on manufactured products (21.5% of the revenues linked to these taxes is allocated to the Fund). States with lower GDP per capita receive a relatively larger share of the transfers.

In this context, we can conclude that revenue increases in Brazilian states were not typically linked to increases in inequality over the period of analysis. Furthermore, reductions in primary expenditures also do not seem to have had deleterious impacts on inequality measures. The behavior of revenue transfers to states and investment expenditure seem to be particularly important to explain these results. Changes in revenues linked to revenue transfers are associated with reductions in "within-state" income inequality, though between-state inequality has remained broadly stable (as discussed previously). The rules that govern federal revenue transfers to states in Brazil do favor poorer states (in terms of GDP per capita), which tend to present higher inequality indicators as well.

Changes in investment expenditure also seem to have played a role in inequality dynamics, but in the direction of increasing inequality. As argued by Lim and McNelis (2014), capital spending (especially infrastructure spending) enhances the returns to capital and might contribute to increase inequality. In the case of Brazil, public investment does appear to have an infrastructure bias. Evidently, our results do not show that infrastructure investment has a permanent negative impact on inequality.

Finally, it is important to note that the scope for efficiency gains in revenue mobilization at the state-level a decade ago were substantial, so it would have been plausible for states to raise revenues without necessarily exacerbating existing inefficiencies. In addition, current public spending could also have been captured by the better off, and thus controlling the growth of these expenditures would not necessarily lead to increases in inequality. Overall, our results are consistent with the view that the observed fiscal adjustment process has contributed to a better economic environment and to a more judicious and efficient use of public resources.

One important caveat regarding the disaggregated results is that the quality of the fiscal information deteriorates as one considers the breakdown of revenues and expenditures at the state level. This is due to potential misclassification and lack of harmonized classification practices across states. The primary surplus measure is significantly less affected by such issues. The primary balance is also calculated by the Central Bank using financing information and by the Treasury using information above the line.

Table 3. Effects of Changes in expenditures and Changes in revenue 1995-2011

	1	2	3	4
	Fixed Effects	Fixed Effects	System GMM	System GMM
	Gini	Gini	Gini	Gini
Lagged Dependent Variable	0.422***	0.423***	0.670***	0.774***
	[0.086]	[0.087]	[0.110]	[0.097]
Δ(Primary Revenues)$_{t-1}$	-0.159**		-0.164	
	[0.058]		[0.213]	
Δ(Primary Expenditure)$_{t-1}$	0.151**		0.382***	
	[0.065]		[0.132]	
Δ(Tax Revenue)$_{t-1}$		-0.037		-0.262
		[0.225]		[0.268]
Δ(Revenue Transfers)$_{t-1}$		-0.293***		-0.314
		[0.096]		[0.223]
Δ(Other Revenue)$_{t-1}$		0.049		0.101
		[0.106]		[0.258]
Δ(Current Expenditure)$_{t-1}$		0.078		0.407*
		[0.107]		[0.232]
Δ(Investment Expenditure)$_{t-1}$		0.215***		0.263**
		[0.053]		[0.117]
Δ(Other Expenditure)$_{t-1}$		0.197		0.194
		[0.147]		[0.365]
(GDP Growth per capita)$_{t-1}$	0.054	0.049	-0.001	-0.039
	[0.066]	[0.070]	[0.093]	[0.095]
(Employment rate)$_{t-1}$	-0.307**	-0.311***	-0.169*	-0.103
	[0.112]	[0.104]	[0.088]	[0.086]
(Inflation)$_{t-1}$	0.075***	0.064**	0.032	0.065
	[0.024]	[0.029]	[0.063]	[0.066]
(Sub-national Social Expenditure)$_{t-1}$	0.348***	0.346***	0.247	0.133
	[0.073]	[0.076]	[0.164]	[0.136]
(Federal Social Transfers/GDP)$_{t-1}$	-1.078***	-1.091***	-0.483	-0.104
	[0.332]	[0.330]	[0.330]	[0.273]
Constant	0.000	0.000	7.569	7.317
	[0.000]	[0.000]	[17.012]	[16.464]
Time Trend	Yes	Yes	Yes	Yes
Time Dummies	Yes	Yes	Yes	Yes
Pesaran (2004) cross-sectional dependence test	-2.28***	-2.26***	-2.07***	-1.84*
Sargan test			206.6***	293.0***
Hansen test			2.769	8.002
Arellano-Bond AR(2) test			0.783	0.792
Observations	405	405	405	405
Number of groups	27	27	27	27
R-squared	0.621	0.626		

HAC robust (GMM regressions) or Driscoll-Kraay (F.E. regressions) standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. Null hypothesis of Pesaran (2004) test for regression residuals is cross-sectional independece. Null of Arellano-Bond test is that first-differenced errors exhibit no 2nd order serial correlation. Sargan and Hansen tests of tests of the validity of overidentifying restrictions.

Fiscal Adjustment and "Shared Prosperity"

The World Bank has recently advocated the notion of "shared prosperity" as a major policy goal in order to address the shortcomings of standard measures of economic development (Word Bank, 2013). The World Bank's shared prosperity indicator is defined as the growth rate of the income of the bottom 40 percent of the income distribution. Contrary to indicators of economic development from national accounts (such as GDP growth), improvements in share prosperity require growth to be inclusive of the less well-off segments of the population (Basu, 2013).

We examine the links between fiscal policy at the state-level and shared prosperity in Brazil[9]. The results obtained when regressing the first difference of the log income of the bottom 40 percent on our baseline control variables are presented in Table 4. Since the dependent variable is now a growth rate, we modify Equation 2 and include the lagged level of the log of the income of the bottom 40 percent as a control variable to capture convergence effects (see equation 3). Time dummies were also included, but not a time trend.

$$SP_{i,t} = \kappa Incb40_{i,t-1} + \psi \Delta pb_{i,t-1} + \sum_{m=1}^{M} \beta_m X_{m,i,t-1} + u_{i,t} \qquad (3)$$
$$u_{i,t} = \alpha_i + \lambda_t + \varepsilon_{i,t}$$

The results are mixed for the main variable of interest. The coefficients for changes in the cyclically-adjusted primary balance are positive, but not statistically significant in fixed-effects regressions. Nevertheless, the coefficients are highly significant for all GMM specifications (with semi-elasticities ranging from 1.4 to 1.6). Diagnostic tests do not indicate that cross-sectional dependence is a problem for these models. Overall, except for the convergence term, the other control variables included do not seem to present a robust statistically significant association with our shared prosperity measure, which indicates that exploring the correlates of shared prosperity at the sub-national level remains an interesting avenue for further research.

Summing up, in all specifications presented in this section, a tighter fiscal stance at the sub-national level is negatively associated with inequality and positively associated with our measure of shared prosperity. Nevertheless, in what concerns the shared prosperity regressions, the coefficient of the change in the cyclically-adjusted primary balance is not statistically significant in fixed-effect specifications. In none of the specifications the tighter fiscal stance is linked to a deterioration in inequality.

[9] As one of the twin goals of the World Bank, shared prosperity is measured by the growth of the income per capita of the bottom 40. In this paper we present this measure at the state level (bottom 40% of the state) to provide a finer lens on the reading of shared prosperity in a large federal country such as Brazil. The World Bank benchmark for shared prosperity in Brazil remains at the national level.

These conclusions contrast with the literature based on cross-country data that examines the link between fiscal consolidation and inequality at the national level. These differences could be explained by the fact that several of these studies employ measures of fiscal adjustment that are different from the ones used here. The difference could also be linked to the definition of income used to measure inequality. Some studies use measures based on disposable income, while in Brazil we use income after transfers and before taxes.

Table 4. Shared Prosperity Regressions

	1	2	3	4	5	6	7	8
	F.E.	F.E.	F.E.	F.E.	System GMM	System GMM	System GMM	System GMM
	S. Prosperity	S. Prosperity	S. Prosperity	S. Prosperity	S. Prosperity	S. Prosperity	S. Prosperity	S. Prosperity
Lagged Level ("convergence")	-0.424***	-0.430***	-0.492***	-0.566***	-0.053	-0.138**	-0.143*	-0.166**
	[0.063]	[0.066]	[0.081]	[0.081]	[0.038]	[0.062]	[0.070]	[0.068]
Δ(Cyclically Adj. Primary Surplus/GDP)$_{t-1}$	0.464	0.438	0.443	0.470	1.641***	1.468***	1.425***	1.462***
	[0.325]	[0.328]	[0.313]	[0.309]	[0.457]	[0.391]	[0.388]	[0.414]
(GDP Growth per capita)$_{t-1}$	-0.272	-0.286	-0.284	-0.212	-0.324	-0.245	-0.293	-0.356
	[0.197]	[0.198]	[0.191]	[0.204]	[0.287]	[0.272]	[0.256]	[0.285]
(Employment rate)$_{t-1}$	0.026	0.061	0.060	-0.056	0.095	0.364	0.402	0.165
	[0.210]	[0.243]	[0.227]	[0.242]	[0.677]	[0.591]	[0.588]	[0.542]
(Inflation)$_{t-1}$	0.017	0.014	0.038	0.027	-0.083	-0.186	-0.156	-0.078
	[0.056]	[0.055]	[0.051]	[0.051]	[0.231]	[0.168]	[0.147]	[0.190]
(Sub-national Social Expenditure)$_{t-1}$		-0.396	-0.310	-0.315		-0.879*	-0.945*	-0.926*
		[0.304]	[0.284]	[0.271]		[0.448]	[0.490]	[0.456]
(Federal Social Transfers/GDP)$_{t-1}$		1.379	0.824	-0.081		0.362	0.746	0.608
		[0.834]	[0.638]	[0.984]		[2.052]	[1.866]	[1.691]
(Years of Education)$_{t-1}$			0.185*	-0.102			0.011	-0.083
			[0.108]	[0.068]			[0.059]	[0.060]
(Returns to Education)$_{t-1}$				0.881***				0.231
				[0.222]				[0.213]
Constant	0.000	0.000	0.000	0.000	0.294	0.691**	0.664**	0.967**
	[0.000]	[0.000]	[0.000]	[0.000]	[0.431]	[0.314]	[0.300]	[0.425]
Time Trend	No	No	No	No	No	No	No	No
Time Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pesaran (2004) cross-sectional dependence test	-0.15	-0.26	-0.45	-0.65	-0.33	-0.44	-0.45	-0.60
Sargan test					127.8***	142.2**	149.1**	161.4***
Hansen test					3.728	1.977	1.639	1.167
Arellano-Bond AR(2) test					0.223	0.0408	-0.0356	-0.152
Observations	405	405	405	405	405	405	405	405
Number of groups	27	27	27	27	27	27	27	27
R-squared	0.441	0.444	0.459	0.482				

HAC robust (GMM regressions) or Driscoll-Kraay (F.E. regressions) standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. Null hypothesis of Pesaran (2004) test for regression residuals is cross-sectional independece. Null of Arellano-Bond test is that first-differenced errors exhibit no 2nd order serial correlation. Sargan and Hansen tests of tests of the validity of overidentifying restrictions.

Nevertheless, we believe that the bulk of the differences in results are explained by differences in structural characteristics (fiscal, social, and economic). Finally, it is worth noting that all measures of inequality used in this paper came from the same survey, which is conducted using the exact same questionnaire, with the same field work protocols, and using the same period of reference. As Beegle and others (2012) rigorously demonstrate survey design and implementation effects can have significant impacts on the final indicators, which can confound any cross country analysis in this field.

VI. ROBUSTNESS CHECKS

In this section, we discuss a number of alternative specifications. We start by estimating regressions including additional control variables (Table 5), namely the share of prime-age workers in the informal sector, the share of employment in agriculture, the share of employment in manufacturing, as well as some demographic variables (the dependency ratio and the average household size). Specifications 1 to 7 of the Table present results for fixed effects regressions and the columns 8 to 14 present results for system GMM specifications.

None of the additional control variables present statistically significant coefficients, but otherwise the results are broadly similar to the ones obtained previously. The coefficients for the employment rate, federal direct transfers and the primary balance being negative and statistically significant in most specifications (except for one in the case of the latter variable). In addition, we estimated models that include the share of employment in all sectors (excluding manufacturing) and our benchmark results did not change (results are available upon request).

Moreover, we also considered specifications that include the log of the average labor income of low-skilled workers (defined as workers with 8 years of education or less) and the log of average labor income of high-skilled workers as well as the total labor income of low and high-skilled workers as control variables. Specifications 6 and 13 include these additional control variables in levels using fixed effects and the GMM estimators respectively, whereas specifications 7 and 14 consider the first differences.

As expected, the coefficient for average earnings of high-skilled workers is positive and significant and the earnings for low-skilled workers present a negative coefficient. More importantly for our purposes, the coefficient for the primary balance continues to be negative and significant in all specifications, although its statistical significance is reduced to the 10% level in fixed-effects regressions (but not in GMM ones).

In Table 6 we consider alternative estimation methods. The first two columns present estimates from random effects models. Overall, these models do not perform well (in the sense that most variables are not statistically significant), but the link between changes in the cyclically-adjusted primary balance and inequality remains negative and statistically significant. We also consider models that allow both the intercept and slope coefficients to vary across panel members, following the random coefficient model proposed by Swamy (1970). We use bootstrapping to obtain robust standard errors in this case and present

specifications with and without a deterministic trend. For these models, the coefficient for the primary balance continues to be negative, but is no longer statistically significant.

We also experimented with specifications that model deterministic components (i.e. time trends and time effects) in a different way. We estimated regressions including national, regional and state-level polynomial time trends and results are qualitatively similar to those already presented (see specifications 5 to 7 in the Table). Even if the statistical significance of the results for the primary balance is reduced (as we lose degrees of freedom), the coefficient for these variables remains negative in all specifications.

Overall, the robustness checks confirm that there is no evidence that fiscal adjustment at the sub-national level is positively linked to inequality in Brazil. On the contrary, for several specifications, changes in the primary balance are negatively associated with inequality measures with statistically significant coefficients.

Table 5. Robustness Checks: Additional Control Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	F.E.	F.E.	F.E.	F.E.	F.E.	F.E.	F.E.	System GMM	System GMM	System GMM	System GMM	System GMM	System GMM	System GMM
	Gini	Gini	Gini	Gini	Gini	Gini	Gini	Gini	Gini	Gini	Gini	Gini	Gini	Gini
Lagged Dependent Variable	0.430***	0.413***	0.413***	0.417***	0.406***	0.290***	0.636***	0.596***	0.610***	0.593***	0.582***	0.634***	0.324***	0.893***
	[0.084]	[0.090]	[0.094]	[0.088]	[0.089]	[0.047]	[0.054]	[0.091]	[0.117]	[0.085]	[0.109]	[0.092]	[0.050]	[0.071]
Δ(Cyclically Adj. Primary Surplus/GDP)$_{t-1}$	-0.152**	-0.147**	-0.148**	-0.148**	-0.147**	-0.117*	-0.181*	-0.256**	-0.352***	-0.102	-0.334**	-0.308***	-0.391***	-0.410***
	[0.057]	[0.054]	[0.058]	[0.055]	[0.054]	[0.066]	[0.089]	[0.117]	[0.120]	[0.141]	[0.131]	[0.096]	[0.104]	[0.126]
(GDP Growth per capita)$_{t-1}$	0.046	0.047	0.050	0.047	0.052	0.052	0.011	-0.089	-0.099	-0.109	-0.094	-0.062	-0.010	-0.082
	[0.073]	[0.070]	[0.070]	[0.070]	[0.070]	[0.075]	[0.059]	[0.088]	[0.088]	[0.088]	[0.082]	[0.093]	[0.083]	[0.059]
(Employment rate)$_{t-1}$	-0.305**	-0.276**	-0.297**	-0.282**	-0.292**	-0.374***	-0.201***	-0.308***	-0.397***	-0.319***	-0.376***	-0.299***	-0.426***	-0.092
	[0.114]	[0.125]	[0.110]	[0.114]	[0.114]	[0.085]	[0.068]	[0.069]	[0.090]	[0.089]	[0.091]	[0.080]	[0.066]	[0.087]
(Inflation)$_{t-1}$	0.075***	0.074***	0.080***	0.074***	0.073***	0.043*	0.060**	0.038	0.034	0.060	-0.019	0.046	0.030	0.050
	[0.026]	[0.025]	[0.028]	[0.026]	[0.025]	[0.025]	[0.023]	[0.067]	[0.055]	[0.068]	[0.058]	[0.071]	[0.052]	[0.047]
(Sub-national Social Expenditure)t-1	0.348***	0.337***	0.353***	0.348***	0.357***	0.386***	0.266***	0.428***	0.365**	0.456***	0.387**	0.384**	0.384***	0.155*
	[0.068]	[0.069]	[0.068]	[0.068]	[0.070]	[0.045]	[0.053]	[0.135]	[0.151]	[0.151]	[0.152]	[0.159]	[0.124]	[0.085]
(Federal Social Transfers/GDP)$_{t-1}$	-1.127***	-1.024***	-0.963**	-1.011***	-1.044***	-1.213***	-0.674**	-0.918**	-1.133***	-0.732	-1.226***	-0.818***	-1.017***	-0.279
	[0.298]	[0.351]	[0.373]	[0.337]	[0.348]	[0.300]	[0.296]	[0.371]	[0.362]	[0.534]	[0.363]	[0.282]	[0.244]	[0.312]
(Dependency ratio)$_{t-1}$	-0.033							-0.031						
	[0.080]							[0.069]						
(Informal share)$_{t-1}$		0.056							-0.018					
		[0.052]							[0.058]					
(Average household size)$_{t-1}$			0.012							-0.008				
			[0.019]							[0.012]				
(Share in agriculture)$_{t-1}$				0.033							0.005			
				[0.030]							[0.052]			
(Share in manufacturing)$_{t-1}$					-0.180							0.091		
					[0.117]							[0.154]		
Average earnings low-skilled						-0.079**							-0.158***	
						[0.033]							[0.025]	
Total earnings low-skilled						0.001							-0.006	
						[0.014]							[0.015]	
Average earnings high-skilled						0.271***							0.228***	
						[0.039]							[0.041]	
Total earnings high-skilled						-0.008							0.002	
						[0.018]							[0.015]	
Δ(Average earnings low-skilled)							0.030							0.054
							[0.038]							[0.043]
Δ(Total earnings low-skilled)							-0.022							-0.056**
							[0.021]							[0.024]
Δ(Average earnings high-skilled)							0.249***							0.350***
							[0.052]							[0.048]
Δ(Total earnings high-skilled)							-0.036							-0.068*
							[0.027]							[0.036]
Constant	0.000	0.000	0.000	0.000	0.000	0.000	0.000	21.947*	19.390	30.990**	18.941	13.275	-2.138	8.793
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[12.338]	[11.601]	[12.169]	[11.190]	[14.348]	[14.470]	[8.436]
Time Trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pesaran (2004) cross-sectional dependence test	-2.28**	-2.27**	-2.30**	-2.27**	-2.26**	-1.99**	-2.31**	-2.16**	-2.13**	-2.08**	-2.15**	-2.15**	-2.29**	-2.23**
Sargan test								199.2***	180.5***	192.0***	185.5***	190.3***	175.9***	206.8
Hansen test								2.221	3.394	3.804	5.133	3.103	3.210	2.901
Arellano-Bond AR(2) test								0.552	0.480	0.734	0.420	0.607	-0.511	0.566
Observations	405	405	405	405	405	404	403	405	405	405	405	405	404	403
Number of groups	27	27	27	27	27	27	27	27	27	27	27	27	27	27
R-squared	0.621	0.622	0.621	0.621	0.623	0.775	0.742							

HAC robust (GMM regressions) or Driscoll-Kraay (F.E. regressions) standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1. Null hypothesis of Pesaran (2004) test for regression residuals is cross-sectional independece. Null of Arellano-Bond test is that first-differenced errors exhibit no 2nd order serial correlation. Sargan and Hansen tests of tests of the validity of overidentifying restrictions.

Table 6. Robustness Checks: Alternative Estimation Methods

	1	2	3	4	5	6	7
	Random Effects	Random Effects	Random Coefficients	Random Coefficients	F.E.	F.E.	F.E.
	Gini	GE0	Gini	GE0	Gini	Gini	Gini
Lagged Dependent Variable	0.797***	0.821***	0.344***	0.330***	0.407***	0.387***	0.042
	[0.112]	[0.117]	[0.065]	[0.067]	[0.090]	[0.086]	[0.070]
Δ(Cyclically Adj. Primary Surplus/GDP)$_{t-1}$	-0.188***	-0.214***	-0.127	-0.135	-0.116*	-0.112*	-0.075
	[0.072]	[0.083]	[0.084]	[0.113]	[0.057]	[0.058]	[0.058]
(GDP Growth per capita)$_{t-1}$	0.030	0.040	0.076	0.084	0.044	0.058	0.064*
	[0.081]	[0.090]	[0.054]	[0.054]	[0.060]	[0.054]	[0.032]
(Employment rate)$_{t-1}$	-0.144	-0.141	-0.535***	-0.589***	-0.289**	-0.293**	-0.123
	[0.100]	[0.118]	[0.150]	[0.173]	[0.111]	[0.129]	[0.119]
(Inflation)$_{t-1}$	0.055	0.055	-0.027	-0.037	0.055*	0.050	0.044
	[0.058]	[0.072]	[0.040]	[0.055]	[0.029]	[0.033]	[0.037]
(Sub-national Social Expenditure)t-1	0.160	0.175	0.102	0.189	0.309***	0.314***	0.505***
	[0.140]	[0.194]	[0.114]	[0.137]	[0.075]	[0.070]	[0.104]
(Federal Social Transfers/GDP)$_{t-1}$	-0.390	-0.499	-3.862***	-4.844***	-0.861**	-1.108*	-0.637
	[0.332]	[0.413]	[1.144]	[1.050]	[0.341]	[0.559]	[0.500]
Constant	-1.113	-5.553	3.000***	0.774***	2.548***	2.634***	3.890***
	[12.551]	[14.062]	[0.323]	[0.132]	[0.383]	[0.372]	[0.301]
Time Trend	Yes	Yes	No	No	No	No	No
Time Dummies	Yes	Yes	No	No	No	No	No
Polynomial trend (national)	No	No	No	No	Yes	No	No
Polynomial trend (regional)	No	No	No	No	No	Yes	No
Polynomial trend (state)	No	No	No	No	No	No	Yes
Observations	405	405	405	405	405	405	405
Number of groups	27	27	27	27	27	27	27
R-squared	0.570	0.522			0.605	0.617	0.750

Boostrapped standard errors in brackets (500 replications), except for F.E. regressions which have Driscoll-Kraay standard errors in brackets. *** p<0.01, ** p<0.05, * p<0.1.

VII. CONCLUSIONS

In this paper, we find that a tighter fiscal stance in Brazilian states, measured by changes in the cyclically-adjusted primary balance, does not seem to increase inequality over the period 1995-2011. This conclusion contrasts to the results of several papers that analyze the impact of fiscal consolidations on inequality at the national level for OECD countries (Ball and others, 2013). All measures of inequality considered in this paper came from the same survey and therefore are not subject to "spurious" design and implementation effects that can confound a cross-country analysis of heterogeneous surveys.

Our results also suggest that revenue increases in Brazilian states were not associated with increases in inequality. In addition, reductions in primary expenditures do not seem to have had deleterious impacts on inequality measures. Some further disaggregation indicates that revenue increases due to revenue transfers to states are linked to decreases in inequality, whereas changes in investment expenditure are positively linked to inequality measures. Several robustness checks performed confirm that there is no evidence that fiscal adjustment at the sub-national level is positively linked to inequality.

The different conclusions obtained relative to the rest of the literature could be explained by differences in the institutional setting and in the structural characteristics of Brazilian states relative to OECD economies, such as the importance of transfers of revenues. The paper does not attempt to establish the precise mechanism at play, but possible differences driving the result include: higher initial levels of inequality; lesser reliance on progressive taxation; the absence of extensive social safety nets and other automatic stabilizers; scope to significantly improve the efficiency of public spending and the quality of public services; and the regressive nature of some forms of public expenditure at the state level.

Furthermore, fiscal adjustment at the state-level might also have been achieved through efficiency gains both on the expenditure-side, but also in terms of revenue collection with no discernible impact in terms of increasing inequality. In addition, greater fiscal discipline could also have improved the investment climate within states, which facilitated job creation and investment.

Future research could focus on drilling down on the mechanism linking the fiscal stance and inequality dynamics. This would be important to ascertain where the relationship is likely to be maintained over time as the country macroeconomic and social conditions evolve, thus informing policy making more precisely. A central message, however, is that the results linking fiscal adjustment to an increase in inequality in advanced economies cannot be easily generalized to developing countries, given the Brazilian experience.

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ANNEX A: VARIABLES DEFINITIONS AND SOURCES

Variable	Description/Notes	Source
Income Inequality	Comprises several measures of inequality in household income per capita (after transfers, but before taxes) including: Log of the Gini coefficient, GEM1, GE(0), GE(1), GE(2).	Authors' calculations based on PNAD data.
Shared Prosperity	Log annual difference of the per capita income of the bottom 40 of the distribution.	Authors' calculations based on PNAD data.
Employment Rate	Share of employed population at prime working age (25-65 years) by state.	Authors' calculations based on PNAD data.
State GDP Growth per Capita	Log of change in real GDP per capita at the state level.	Authors' calculations based on IBGE data
Inflation	Change in GDP Deflator at the state level. Log of (1+(state inflation)/100).	Authors' calculations based on IBGE data
Cyclically Adjusted Primary Balance	See main text for details of variable construction. State level primary balance (revenues minus expenditures net of interest payments) as a share of state GDP.	Authors' calculations based on Treasury Department's database.
Sub-national Social Expenditures	Sum of state and municipal expenditures on education and culture; health and sanitation; and social security and social assistance as a share of state GDP.	Authors' calculations based on Treasury Department's database.
Federal Social Transfers	This comprises information at the state level on three main federal social programs: Bolsa Familia, Beneficio de Prestacao Continuada, and Renda Mensal Vitalicia. Values in the dataset are for December of each year and have been multiplied by 12 to obtain annual figures.	IPEADATA (www. IPEADATA.org)
Years of Education	Log of Average years of education of prime working-age individuals (25-65 years) by state.	Authors' calculations based on PNAD data.
Returns to Education	Return to education at prime working age.	Authors' calculations based on PNAD data.
Dependency Ratio	Number of children and elderly divided by total working age population by state.	Authors' calculations based on PNAD data.
Informal sector employment	Share of prime age workers in the informal sector.	Authors' calculations based on PNAD data.
Labor income	Log of average and total labor income for low-skilled (less than 8 years of education) and high-skilled workers in 2005 PPP terms.	Authors' calculations based on PNAD data.

ANNEX B: DESCRIPTIVE STATISTICS FOR SELECTED VARIABLES

Variable		Mean	Std. Dev.	Min	Max	Observations	
Gini	overall	4.006	0.072	3.762	4.182	N =	459
	between		0.055	3.867	4.105	n =	27
	within		0.048	3.835	4.109	T =	17
GE(0)	overall	0.555	0.088	0.326	0.807	N =	459
	between		0.070	0.403	0.712	n =	27
	within		0.054	0.397	0.710	T =	17
Shared Prosperity	overall	0.097	0.101	-0.433	0.526	N =	432
	between		0.017	0.047	0.123	n =	27
	within		0.099	-0.384	0.554	T =	16
GDP Per Capita Growth	overall	0.013	0.040	-0.144	0.144	N =	405
	between		0.007	0.000	0.033	n =	27
	within		0.039	-0.149	0.140	T =	15
Employment Rate	overall	0.657	0.042	0.519	0.765	N =	459
	between		0.035	0.569	0.710	n =	27
	within		0.024	0.522	0.731	T =	17
Inflation	overall	0.083	0.046	-0.078	0.269	N =	405
	between		0.009	0.063	0.099	n =	27
	within		0.045	-0.061	0.254	T =	15
(Sub-national Social Expenditure)/GDP	overall	0.123	0.047	0.035	0.258	N =	459
	between		0.040	0.052	0.204	n =	27
	within		0.026	0.033	0.188	T =	17
Cyclically Adjusted Primary Balance	overall	0.002	0.020	-0.125	0.079	N =	432
	between		0.006	-0.008	0.017	n =	27
	within		0.019	-0.118	0.066	T =	16
Federal Social Transfers/GDP	overall	0.011	0.011	0.000	0.054	N =	459
	between		0.008	0.002	0.026	n =	27
	within		0.008	-0.007	0.039	T =	17
Years of Education	overall	1.840	0.213	1.280	2.911	N =	459
	between		0.163	1.553	2.193	n =	27
	within		0.140	1.435	2.941	T =	17
Returns to Education	overall	0.733	0.133	0.434	1.143	N =	459
	between		0.123	0.541	1.052	n =	27
	within		0.057	0.527	0.969	T =	17

ANNEX C: PANEL UNIT ROOT AND CROSS-SECTIONAL DEPENDENCE TESTS FOR SELECTED VARIABLES

	Gini	GE(0)	GDP Growth	Employment	Inflation	Sub-National Social Expenditures	Primary Balance	Federal Social Transfers
Pesaran (2007) test								
without trend								
One lag								
Zt-bar statistic	-2.67***	-2.98***	-5.85***	-3.58***	-6.01***	-3.18***	-4.67***	-4.68***
with trend								
No lags								
Zt-bar statistic	-2.92***	-3.02***	-5.53***	-3.66***	-8.67***	-0.96	-8.50***	-2.06**
One lag								
Zt-bar statistic	-1.42*	-1.76**	-1.24	-2.93***	-4.77***	0.28	-1.88**	-2.89***
Ho: series is I(1) for all panel members; H1: series is stationary for some panel members					**Number of panels=27**	**Number of obs.= 405**		
Pesaran (2004) Cross-Sectional Dependence test	32.42***	31.98***	42.17***	15.76***	31.17***	49.50***	26.55***	75.66***

Pesaran (2007) test allows for cross-sectional heterogeneity and assumes cross-sectional dependence in the form of one unobserved common factor. Ho for Pesaran (2004) test is Cross-Sectional Independence. *** p<0.01, ** p<0.05, * p<0.1