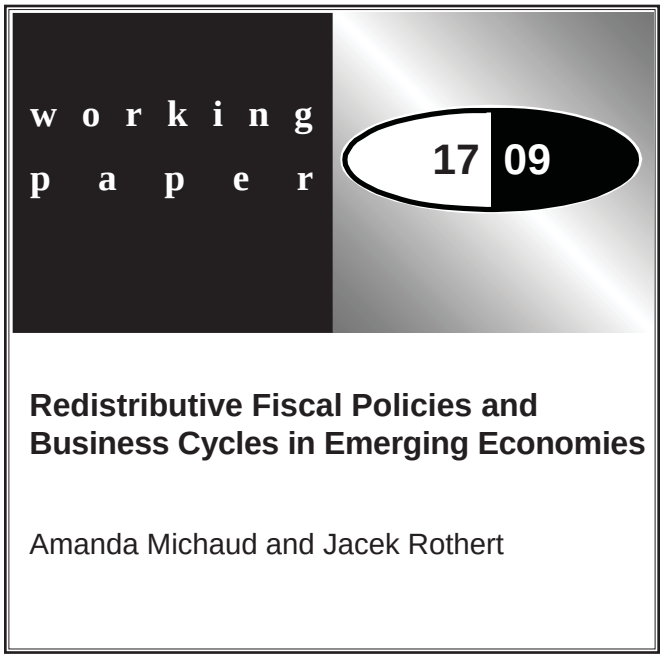

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FEDERAL RESERVE BANK OF CLEVELAND

ISSN: 2573-7953

Working Paper 17-09 May 2017

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Government expenditures are procyclical in emerging markets and countercyclical in developed economies. We show this pattern is driven by differences in social transfers. Transfers are more countercyclical and comprise a larger portion of spending in developed economies compared to emerging. In contrast, government expenditures on goods and services are quite similar across the two. In a small open economy model, we find disparate social transfer policies can account for more than a half of the excess volatility of consumption relative to output in emerging economies. We analyze how differences in tax policy and the nature of underlying inequality amplify or mitigate this result.

Keywords: Fiscal Policy, Open Economy Macroeconomics, Emerging Markets, Business Cycles.

JEL classifications: E3, F4, E6.

Suggested citation: Michaud, Amanda, and Jacek Rothert, 2017. "Redistributive Fiscal Policies and Business Cycles in Emerging Economies," Federal Reserve Bank of Cleveland, Working Paper no. 17-09. https://doi.org/10.26509/frbc-wp-201709.

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1 Introduction

It has been established that total government expenditures tend to be procyclical in emerging economies and either acyclical or countercyclical in developed economies.[1] In this paper, we document that a single component of government expenditure— social transfers— drives this contrast. We then evaluate the implication of our finding by embedding a simple theory of social transfers in a workhorse open economy business cycle model. We show disparate social transfer policies play a significant quantitative role in generating the business cycle anomalies of emerging small open economies, particularly the excess volatility of consumption.[2] The point we make as follows. There is a very large, *observable* difference in the size and cyclical behavior of social benefits between developed and emerging economies. Once we account for this difference, a typical emerging economy (with the same stochastic processes for productivity and interest rates as before) may no longer exhibit the puzzling behavior documented in previous studies[3].

The first half of our paper presents results from our exploration of the cyclical characteristics of disaggregated fiscal data in a set of small open economies.[4] Our main finding is that fiscal expenditures over the business cycle differ most significantly in one component: social transfers. They account for 34.6% of the variation in the correlation of GDP and government expenditures across our sample, whereas goods expenditures account for 4%. The difference is most stark across income groups. Social transfers are weakly procyclical in emerging economies and countercyclical in developed economies (correlation with GDP is 0.14 and -0.64, respectively). This is important because social transfers are the largest expenditure category in each country group and provide 52% of the variance in average total government spending as a share of GDP across our sample. Again, levels differ systematically across income groups: developed economies spend an average of 16.1% of GDP on

[1] An incomplete list of papers establishing this fact include: Kaminsky et al. (2005), Ilzetzki and Végh (2008), and Gavin and Perotti (1997). We replicate a comparable result in our study.

[2] Key works in this field include: Mendoza (1995), Neumeyer and Perri (2005), Uribe and Yue (2006), and Aguiar and Gopinath (2007).

[3] In Michaud and Rothert (2016) we provide estimates for a panel of countries showing how much the role of unobservable shocks is reduced once the package of observable fiscal policy is accounted for.

[4] We focus our analysis on components of government expenditure. Vegh and Vuletin (2015) provide a complete and complementary analysis of the components of government revenues.

social transfers annually (38.6% of total government spending), whereas emerging economies spend just 6.0% (26.8% of total government spending). The large differences in transfers trounce the minor differences in other categories such as Goods Expenses, Fixed Capital, and Employee Compensation. Therefore, understanding the impact of transfers is paramount for understanding the impact of fiscal policy on business cycle outcomes.

The contrasting fiscal policy of emerging markets has been an important area of study because fiscal procyclicality tends to amplify underlying forces driving business cycles. In the second half of our paper, we consider how our empirical finding on the dominance of social transfers in accounting for fiscal procyclicality of emerging markets affects our understanding of how those countries experience business cycles. We do so by modifying a prototypical open economy business cycle model to include a role for government expenditures explicitly modeled as social transfers. The base of our model is the workhorse small open economy model of Mendoza (1991) merged with an endogenous country spread on debt following the framework Neumeyer and Perri (2005). To the base model, we add heterogeneous households in order to provide a meaningful role for social transfers. Households differ in both their labor productivity and access to financial markets. The government provides social transfers to poor households according to an exogenous process replicating the level, standard deviation, and correlation with GDP of social transfers observed in the data. Social transfers are supported by taxes, the composition of which are also calibrated to the data.[5]

We find that differences in fiscal policy go a long way in accounting for one aspect of the contrasting business cycle characteristics of emerging and developed economies—excess volatility of consumption. We estimate the structural fundamentals of the model for a prototype emerging economy to replicate key targets while imposing a social transfer policy calibrated to the average across emerging economies. Among these targets is the relative volatility of consumption (standard deviation of consumption relative to the standard deviation of output) equalling 1.54. We then perform an experiment in which we change the social transfer policies to that of the average developed economy. We find this lowers the

[5]Sovereign default is obviously an important issue for emerging markets. However, the question we ask in this paper does not require the explicit modeling of default. Instead, we can consider a partial equilibrium interest rate on bonds that depends on the current debt to GDP ratio. This captures the relevant difference in constraints to tax smoothing in emerging and developed countries.

excess volatility of consumption by roughly half, to 1.26. This change is provided by the following differences in policy: 55% on account of the larger overall size of social transfers as a percent of GDP in developed countries; 22% on account of the greater counter-cyclicality of social transfers in developed countries; and 23% on account of the interaction between these two dimensions.

We consider our results as a plausible upper-bound on the impact of disparate social transfer policies on the excess volatility of consumption within a standard framework used to study emerging markets business cycles. This claim is a consequence of our choice of how to model the rich and poor households between which social transfers redistribute resources. We assume rich agents own the capital stock and poor agents are hand-to-mouth consumers with no means of saving. This imposes that all transfers to poor households are consumed within the period, while maintaining the standard inter-temporal savings problem for the rich. As a result, redistribution towards poor households mechanically drives the relative volatility of consumption to income towards one. The second dimension of inequality that we consider is wage-income inequality. We assume rich agents have higher efficiency units of labor than poor agents resulting in a higher wage per unit of time worked. This amplifies the effect of redistribution through social transfers on cyclical properties of consumption. While our definition of a poor household is designed to elicit an extreme result to our experiment, we do quantitatively discipline the share of poor agents in the economy and their share of labor income using country-level data. Our objective is to convince a reader that a disaggregated approach to modelling government expenditures, particularly redistributive policies, is a promising approach towards understanding quantitative properties of business cycles over the course of development. It is in this way we use the theoretical model to provide a ball-park figure of the implications of our empirical findings.

1.1 Literature

Ours is not the first paper to study disparate fiscal policy in the context of emerging markets business cycles. Gavin and Perotti (1997) first document the pattern of procyclical fiscal policy in Latin America. Their work is followed by broader studies on expenditures (Kaminsky et al. (2005)) and taxes (Ilzetzki and Végh (2008)) reinforcing their findings. Two

complementary theoretical literatures are related to these empirical findings: one seeking to understand the implication of fiscal policy in open economy business cycles and one seeking to understand the fundamental cause of why these fiscal policies differ. Our paper belongs to the first literature.[6] The study of fiscal policy in open economy models was included in early works. Backus et al. (1992) show that an increase in government spending causes a real exchange rate depreciation in the open economy neoclassical model. This response has been shown to be counterfactual. For example, Ravn et al. (2007) document that increases in government expenditure on goods deteriorates the trade balance and depreciates the real exchange rate. They provide a theory of deep habits where an increase in government spending leads firms to lower domestic markups relative to foreign providing a real exchange rate depreciation matching the data.

Our contribution to the quantitative theory literature is to explore how the composition of government expenditures, not just the level, may reconcile outcomes in the neoclassical open economy model with empirical observations. As such we depart from the standard modelling assumptions as government expenditures as a sunk expense, or equivalently as separable in the utility function of households. We also add agents who are heterogenous in wealth and income into the analysis. These departures relate our paper to a third, emerging literature on the calculation of government spending multipliers in models with heterogenous agents. Most related is Brinca et al. (2014). They document a positive correlation between fiscal multipliers and wealth inequality. They show a heterogenous agent neoclassical model of incomplete markets can replicate this fact when government spending is modeled as social security and appropriately calibrated. Ferriere and Navarro (2014) study the impact tax progressivity on multipliers, but model expenditures as "thrown into the ocean". Our work is also distinct in considering an open economy setting.

Our empirical analysis of the IMF's Government Finance Survey is an independent contribution apart from our quantitative theory exercises. Changes in the survey overtime and differences in reporting conventions across countries require significant cleaning of the dataset to provide consistent measures of government expenditure at the categorical level. We devise

[6]The second literature has provided theories related to limited access to international credit markets (Cuadra et al. (2010),Riascos and Vegh (2003)) and political economy motives (Talvi and Vegh (2005), Alesina et al. (2008)).

a detailed methodology to achieve this. We then merge the dataset with key variables from other Macroeconomic datasets and compute a variety of statistics useful for studying issues in growth, international macroeconomics, and political economy.

Our consideration of observed fiscal policy offers another perspective on the origins of business cycle behavior of emerging economies. In the attempt to account for excess volatility of consumption and strongly counter-cyclical trade balance, previous literature explored the role of potentially different productivity process (introduced by Aguiar and Gopinath (2007) and further evaluated by Chen and Crucini (2016), Garcia-Cicco et al. (2010), Chang and Fernández (2013), and Rothert and Rahmati (2014)), counter-cyclical interest rates (Neumeyer and Perri (2005), Uribe and Yue (2006), Fernández and Gulan (2015)), or different substitutability between domestic and foreign goods (Rothert (2016)). In this paper we show that difference in the size and cyclicality of social benefits goes a long way in accounting for both highly volatile consumption and counter-cyclical trade balance.[7]

2 Empirical Regularities in Fiscal Components

Government Finance Statistics Dataset [8] Our main dataset for fiscal variables is the Government Finance Statistics Dataset (GFS) maintained by the International Monetary Fund (IMF). The data collection began in 1972 with further guidelines established in 1986 intended to harmonize reporting of fiscal measures across countries.[9] We use annual data.[10]

Reported transactions are delineated by sub-sectors of the total Public Sector. Starting from finest to coarsest, the sector-level reporting concepts we consider are:

1. Budgetary Central Government: a single unit encompassing financial activities of the judiciary, legislature, ministries, president, and government agencies. It is funded by

[7] In this paper we link directly to the literature on counter-cyclical interest rates. In Michaud and Rothert (2016) we further explore implications for these other theories.

[8] Information for this section comes from the 2014 GFS manual.

[9] These guidelines have subsequently been updated twice: once in 2001 and again in 2014. These changes have little impact on our analysis with the exception of the expansion in the inclusion of nonmonetary transactions. Most countries switched from cash accounting to accrual in the mid-1990s' early 2000's.

[10] Higher frequency- monthly and quarterly data- are limited to a smaller group of mostly developed countries.

the main operating budget of the nation, generally approved by the legislature. Items not included in the budgetary central government statistics include extra-budgetary units and transactions;[11] and social security funds.

2. Central Government: the central government includes all transactions not operated through a public corporation (ex: central bank and other financial institutions) that are implemented at the national level (ie: not state or local governments). These statistics may or may not include social security, depending on the country reporting. Social security refers to social insurance schemes operated by a budget of assets and liabilities separate from the general fund.

3. General Government: the sum of central, state, and local financial activities plus social security. This does not include financial corporations.

The transactions we analyze fall into the categories of revenues and expenses affecting net worth. The specific breakdown is as follows.

- Revenue: transactions that increase *net* worth. These do not include transactions that simply affect the composition of assets and liabilities in the balance sheet such as the payments of loans or sale of financial assets.

    1. Tax Revenue: compulsory, unrequited accounts receivable by the government. Does not include, fines, penalties, and most social security contributions (as these are requited). Revenue can be further disaggregated into: (a) taxes on income, profits and capital gains; (b) payroll taxes; (c) property taxes; (d) taxes on goods and services; (e) taxes on international trades and transactions.

    2. Social Contributions: revenue of social insurance schemes. May be voluntary or compulsory.

    3. Grants: transfers relievable that are not taxes, social contributions, or subsidies. May come from domestic or international organizations and units.

[11] For example, units with revenue streams outside of the central budget, external grants received, etc.

4. Other: revenues not fitting in the aforementioned categories. Include: (a) property income, (b) sales of goods and services, (c) fines, etc.

- Expense: transactions that decrease *net* worth. These do not include transactions that simply affect the composition of assets and liabilities in the balance sheet.

    1. Compensation of Employees: renumeration payable, both cash and in-kind, to employees of the government unit. Includes contractors.
    2. Use of Goods and Services: "value of goods and services used for the production of market and nonmarket goods and services". Includes consumption of fixed capital and goods purchased by the government for direct distribution. Consumption of fixed capital is also reported separately.
    3. Interest: interest fees on liabilities generated by both financial and non-financial services consumed by the government. Includes intra-government liabilities for disaggregated units.
    4. Subsidies: unrequited transfers to enterprises based on production activities. *Includes implicit subsidies of central banks.*
    5. Social Benefits: current transfers receivable by household related to social risks. These include: sickness, unemployment, retirement, housing, and education.
    6. Other: transfers not otherwise classified, non-interest property expense, premiums and fees on nonlife insurance schemes.

Constructing Consistent Measures of Revenues and Expenditures. Constructing consistent measures of revenues and expenditures at the categorical level is non-trivial. The main hurdle is that different countries implement fiscal policy through different government bodies. For example, Brazil reports almost all social benefits are provided at the central government level while subnational governments provide three-quarters of social benefits in Denmark. This is a potential problem because the data are incomplete: some countries only report spending at certain levels.[12] Our algorithm for choosing a time-series is as follows.

[12]The main issue is the exclusion of local governments for the emerging economies.

In cases where we observe general government spending in ten or more years, we use this category as is (32 out of the 45 countries). In cases where we only observe central government spending in ten or more years, we continue to use the time series if Social Benefits reported at the central level are more than 85% of Social Benefits reported at the level of total government spending in the years where general government spending is observed as well.[13] A second hurdle is that some countries switch from reporting cash to non-cash payments or switch the level at which they report payments: general, central, or budgetary general. We handle each of these issues on a case-by-case basis. In many cases the time-series remains smooth despite changes in the reported accounting scheme. If these changes occur in the two years after the GFS survey is updated (1995-6, 2001-2) we use the two series as one consistent series.

Sample. The unbalanced panel spans 1990-2015. Our sample selection algorithm is as follows. We begin with all countries in the GFS dataset. We first exclude countries with a Penn World Table v9.0 data quality grade of "C" or worse.[14] Next, we drop countries that do not have a consistent measure of social transfer data for ten consecutive years within our time-frame. From the remaining 47 countries, we exclude Norway and Bahrain due to their unique situation as heavy oil-exporting countries with high government involvement in these industries. This leaves our 45 country sample.

"High" and "Low" Consumption Volatility Grouping. We are interested in researching how components of government spending relate to excess volatility of consumption. As such, we follow convention in the literature by placing countries into two groups based on consumption volatility and present population-weighted averages for these groups as stylized facts.[15] Let $\hat{x}$ be the time series of the cyclical component of x. We define the excess

[13]For Argentina, we sum State and Central statistics as local are not available. Full listing of spending category chosen by country detailed in appendix.

[14]See Feenstra et al. (2015) for a description of Penn World Tables

[15]Many papers use groupings of "Emerging" and "Developed" countries, but these subgroups include different countries in different papers. The relations in key papers in this literature are: the 10 countries in Neumeyer and Perri (2005) are a subset of the 26 countries in Aguiar and Gopinath (2007) and fall in the same groups. Garcia-Cicco et al. (2010) consider 22 countries that only partially overlap with Aguiar and Gopinath (2007). Each presents their own criteria, usually that the country is low- or middle- income

Table 1: List of countries

High Volatility of Consumption (*Emerging*)	*Argentina, Australia, Bangladesh, Barbados, Bolivia, Brazil, Chile, Costa Rica, El Salvador, Estonia, Hungary, Iceland, Israel, Jamaica, Malaysia, Mauritius, Moldova, Netherlands, Nicaragua, Paraguay, Trinidad & Tobago, Uruguay.*
Low Volatility of Consumption (*Developed*)	*Austria, Belarus, Belgium, Canada, Czech Republic, Denmark, Finland, Germany, Greece, Ireland, Italy, Japan, Lithuania, Luxembourg, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Thailand, Tunisia.*

volatility of consumption in the standard way:

$$\text{Excess Volatility of Consumption} = \frac{sd(\hat{C})}{sd(\hat{Y})}$$

The variable C is real household consumption per capita and the variable Y is real GDP per capita.[16] We define the cyclical component using a linear-quadratic trend.[17] The same procedure is used to detrend components of government spending and revenues.

We define our groupings as: (1) "High Consumption Volatility" countries where $\frac{sd(\hat{C})}{sd(\hat{Y})} > 1.05$; and (1) "Low Consumption Volatility" countries where $\frac{sd(\hat{C})}{sd(\hat{Y})} < 0.95$. These groupings roughly encompass classifications used in the small open economy literature with "high consumption volatility" as "emerging" and "low consumption volatility" as "developed".[18] In comparing our sample results to the literature, bare in mind that our summary statistics are all weighted by population and so our inclusion of smaller countries does not change the analysis substantially. The resulting sample is presented in Table 1.

Business Cycle statistics relevant to our analysis are presented in Table 2. Country specific values are depicted in the bar chart in Figure A.

Table 3 shows the following stylized facts about average expenses and revenues across the country groups. Developed countries have higher mean total expenses and total revenues over the sample. The difference in total expenses is driven almost entirely by the difference in Social Benefits. Developed countries mean spending on social benefits is twice that of

alongside other factors including data availability, etc.

[16]Data are from the "World Development Indicators" database (http://data.worldbank.org) accessed on 12/15/2016.

[17]As in Ravn et al. (2007).

[18]Indeed, a recalculation of group means according to the classification of Aguiar and Gopinath (2007) present the same stylized facts of similar magnitudes.

Table 2: Macro Statistics- Cyclical Components

Variable	High Volatility of C	Low Volatility of C
$std(\hat{Y})$	0.031	0.030
$std(\hat{C})/std(\hat{Y})$	1.53	0.77
$corr(\hat{NX}, \hat{Y})$	-0.44	-0.07

Population-weighted average value. Country values listed in appendix. Y is Gross Domestic Product, C is household consumption, NX is net exports. All variables are the residual from a linear-quadratic trend and are in real-per capita terms.

Table 3: Composition of Government Spending

Average Share of GDP		
Variable	High Volatility of C	Low Volatility of C
Total Expenses	22.22	41.70
Social Benefits	5.96	16.10
Goods Expenses	2.53	4.80
Employees	4.83	8.80
Grants	2.40	4.00
Subsidies & Transfers	0.72	1.24
Interest	4.01	2.86
Total Revenue	21.19	40.49
Social contributions	5.82	10.78
Taxes	14.26	22.09
Grants	0.39	3.92
Gini		

Population-weighted average value of country median over the time series. Country values listed in appendix. All statistics are as a percentage of real GDP per capita.

emerging economies. Social benefits are also the largest expenditure category in each country group. Social contributions are 2.5 times higher in the developed group. Taxes are also five percentage points higher (as percent of GDP). The final line show the Gini coefficient on wealth in each country, taken as the median over the sample period. It is clear that inequality is also much higher in emerging markets.

Table 4 further defends our claim that Social Benefits are the main determinant of cross-sectional variation in overall government spending. It shows this result is not an artifact of our categorical classification of country sub-samples. Nor is it dependent on the population weights used to calculate group averages. It shows the un-weighted cross-country covari-

Table 4: Covariance matrix of mean spending

	Total	Social	Goods	Employ	Interest	Subsidy	Other
Total	1.00						
Social Ben	0.51	0.33					
Goods/Sevices	0.12	0.04	0.04				
Employees	0.17	0.06	0.03	0.06			
Interest	0.04	0.01	0.00	0.01	0.02		
Subsidies	0.01	0.00	-0.00	-0.00	-0.00	0.02	
Other	0.15	0.08	0.01	0.02	0.00	-0.01	0.05
Contribution to Variance of Total		52.1%	12.0%	17.5%	4.4%	0.6%	15.6%

Variance decomposition of each component's contribution to the overall variance of total spending across countries in the pooled sample.

ance matrix of each component of total government spending in the pooled sample of all countries.[19] In the final row, we present the variance decomposition of total spending. Let $G = \sum_{j=1} g_j$ be total government spending as a sum of its components. The variance of overall spending is:

$$var(G) = \sum_j var(g_j) + 2 \sum_j \sum_{k \neq j} cov(g_j, g_k) \tag{2.1}$$

The contribution of each component g_j to the overall variance is: $\frac{var(g_j) + \sum_{k \neq j} cov(g_j, g_k)}{var(G)}$; in percent terms.

We now examine the volatility of expenditures and revenues as well as their comovement with GDP. Table 5 shows overall expenditures are more volatile and less counter-cyclical in emerging markets. Similarly, government revenues are more procyclical and volatile as well. Social Benefits are strongly countercyclical in developed countries and acyclical in emerging markets. Compare this to goods expenditures, a category often focused on in the literature: they are counter-cyclical in both groups of economies.

Similarly to Table 4, Table 6 shows that the cyclical component of Social Benefits also drives cross-sectional variation in the cyclical component of overall government spending in the pooled sample. It shows the un-weighted cross-country covariance matrix of the cyclical-

[19] That is, we have one observation for each country: the mean spending level of each category across the sample period. We then calculate the covariance of these statistics across countries, so we are not studying within country variation.

Table 5: Cyclical Properties of Fiscal Policy

Variable	High Volatility of C	Low Volatility of C
std(G expend)	0.19	0.19
corr(G expend, gdp)	-0.01	-0.38
std(G rev)	0.13	0.16
corr(G rev, gdp)	0.14	0.04
std(Social Benefits)	0.06	0.06
corr(Social Benefits, gdp)	0.14	-0.55
std(Goods Exp)	0.06	0.02
corr(Goods Exp, gdp)	-0.30	-0.34

Population-weighted average value of country median over the time series. Country values listed in appendix. All statistics are as a percentage of real GDP per capita.

Table 6: Covariance matrix of the cyclicality of government spending

	Total	Social	Goods	Employ	Interest	Subsidy	Other
Total	1.00						
Social Ben	0.35	0.31					
Goods/Sevices	0.05	0.03	0.02				
Employees	0.11	0.03	-0.01	0.05			
Interest	0.04	-0.05	0.01	-0.01	0.08		
Subsidies	-0.03	-0.05	-0.01	0.01	0.01	0.03	
Other	0.25	0.08	-0.01	0.02	-0.03	-0.01	0.20
Contribution to Cyclical Variance of Total Expend.		34.6%	4.0%	9.3%	0.7%	-3.2%	24.8%

Variance decomposition of each component's contribution to the overall variance of the cyclicality total spending across countries in the pooled sample.

ity of each component, measured as the correlation of the residuals from each component's quadratic trend with the residual of GDP from its quadratic trend. The final row presents the variance decomposition of the cyclical component of total government spending. Define $\hat{X}$ as the residual from the quadratic trend of a series X. In this case, we use the formula:

$$var(corr(\hat{G}, \hat{Y})) = var(\frac{\sum_j cov(\hat{g}_j, \hat{Y})}{std(\hat{G}), std(\hat{Y})})$$

Then, we apply 2.1 to calculate the contribution of the variance in the cyclicality of each component g_j to the overall variance of the cyclicality of total Government expenditures, in percent terms.

3 Model

We now turn to the impact of redistributive policies on the business cycle behavior of small open economies. To do so, we incorporate inequality, social benefits, and taxes into a workhorse business cycle model of a small open economy. In particular, we require a model that can accommodate features of emerging markets business cycles. The most prominent theories in that literature introduce either: (1) trend shocks (Aguiar and Gopinath (2007)), (2) financial frictions in the form of working capital constraint (Uribe and Yue (2006)), or (3) endogenous country risk premium that rises in response to adverse productivity shock (Neumeyer and Perri (2005)).

Chang and Fernández (2013), in their Bayesian estimation of a model that encompasses all three of the aforementioned theories conclude that the model with endogenous country risk premium fits the data on aggregate quantities best. Partly based on their results, and partly motivated by our focus on government fiscal policy where interest rate movements can play a large role, we use a small open economy model with endogenous risk premium. Therefore, we build upon the classical framework of Mendoza (1991) merged with Neumeyer and Perri (2005).

3.1 Households

We introduce redistribution by considering two types of households: (R)ich and (P)oor. A fraction N^R of households are rich, and the remainder $N^P = 1 - N^R$ of households are poor. The difference between a rich and a poor household is twofold. First, rich households have higher efficiency of labor. For each unit of time worked, a rich household provides one unit of labor input, whereas a poor household provides $\gamma < 1$ units of labor input. Second, rich households can own physical capital and have access to financial markets, while the poor households live hand-to-mouth: they can only consume their current income and cannot save or borrow.

The Rich A typical rich household solves the following utility maximization problem:

$$\max_{(c_t^R,\ell_t^R,k_t,a_t,x_t)} E_0 \sum_{t=0}^{\infty} \beta^t \frac{\left[c_t^R - \frac{\chi}{1+\nu}\ell_t^{R\,1+\nu}\right]^{1-\sigma}}{1-\sigma}$$

subject to:

$$c_t^R(1+\tau_{c,t}) + x_t \leq w_t^R(1-\tau_{\ell,t}^R)\ell_t^R + r_t(1-\tau_{k,t})k_{t-1} - \tau_t^{LS} + R_{t-1}a_{t-1} - a_t - \frac{\kappa}{2}(a_t - \bar{a})^2$$

$$k_t = (1-\delta)k_{t-1} + x_t - \frac{\phi}{2}\left(\frac{k_t}{k_{t-1}} - 1\right)^2 k_{t-1}.$$

The last term on the right-hand side of the budget constraint is a portfolio adjustment cost introduced to ensure the law of motion for assets in the linearized economy is stationary.[20] The other terms are as follows: $\tau_{c,t}$ denotes consumption tax; $\tau_{\ell,t}^R$ denotes labor income tax; $\tau_{k,t}$ denotes capital income tax; τ_t^{LS} denotes a lump-sum tax that is introduced to ensure the government budget is balanced.[21]

The Poor A typical poor household solves the following utility maximization problem:

$$\max_{(c_t^P,\ell_t^P)} E_0 \sum_{t=0}^{\infty} \beta^t \frac{\left[c_t^P - \frac{\chi}{1+\nu}\ell_t^{P\,1+\nu}\right]^{1-\sigma}}{1-\sigma}$$

subject to:

$$c_t^P(1+\tau_{c,t}) \leq w_t^P \ell_t^P(1-\tau_{\ell,t}^P) + sb_t.$$

The last term on the right-hand side, sb_t, is the net social transfer from the government. Similarly to the rich household, the poor household pays consumption tax $\tau_{c,t}$ and labor income tax $\tau_{\ell,t}^P$ (possibly at a different rate). Contrary to the rich household, the only source

[20] See Schmitt-Grohe and Uribe (2003) for different ways of ensuring stationarity in small open economy models.

[21] Our choice of GHH preference is largely driven by empirical analysis of competing theories of emerging markets. Specifically, Chang and Fernández (2013) consider preferences that nest GHH and Cobb-Douglas as special cases (following Jaimovich and Rebelo (2009)) and their estimates suggest the model with GHH utility function fits the data on aggregate quantities best.

of income for the poor household is the labor income.

Notice that in the limit, as $N^R \to 1$, our model collapses to a standard representative agent small open economy model. Thus, we expect the behavior of the rich household to resemble closely the behavior of a stand-in household in the traditional small open economy business cycle model.

3.2 Production

The aggregate production function is Cobb-Douglas:

$$Y_t = e^{z_t} K_t^{\alpha} L_t^{1-\alpha},$$

where z_t is the log of total factor productivity (TFP). The inputs, K_t and L_t, are aggregate capital stock and aggregate labor respectively. The log of productivity follows an AR(1) process:

$$z_t = \rho_z z_{t-1} + \epsilon_t^z$$

The aggregate capital stock is the sum of all the physical capital owned by rich households. Aggregate labor input is the sum of effective labor inputs of the rich and the poor households:

$$\begin{aligned} K_t &= N^R \cdot k_t \\ L_t &= N^R \cdot \ell_t^R + N^P \cdot \gamma \ell_t^P \end{aligned}$$

where k_t is capital stock per rich household, ℓ^R and ℓ^P are labor supply of rich and poor household, respectively.

3.3 Interest Rate

The interest rate at which the rich household can borrow and lend is a product of the world interest rate and the country spread:

$$R_t = R_t^* \cdot CS_t$$

The world interest rate follows an AR(1) process:

$$\log(R_t^*) = (1-\rho^R)r^* + \rho^R \cdot \log(R_{t-1}^*) + \epsilon_t^R, \qquad \epsilon_t^R \sim N(0, \sigma^R)$$

The country spread responds to country's productivity shocks. We model it in a similar fashion as Neumeyer and Perri (2005):

$$\log(CS_t) = \eta^{CS} \cdot z_t + \epsilon_t^{CS}, \qquad \epsilon_t^{CS} \sim N(0, \sigma^{CS})$$

The parameter η^{CS} captures the response of country spread to productivity shock. It is a reduced form way of capturing the impact of economic conditions on the country's perceived probability of default, which affects the country risk premium.

3.4 Government

The government's only expenditure is social benefits distributed to poor households. The aggregate social benefits are

$$SB_t \equiv N^P \cdot sb_t.$$

The expenditures are financed with labor income, capital income, and consumption taxes imposed on all households, and with lump-sum taxes imposed on the rich households. The government budget is balanced every period.[22] The budget constraint for the government can be written as follows:

$$N^R \cdot \left(\tau_{c,t} c_t^R + \tau_{\ell,t}^R w_t^R \ell_t^R + \tau_{k,t} \cdot r_t k_t + \tau_t^{LS}\right) + N^P \cdot \left(\tau_{c,t} c_t^P + \tau_{\ell,t}^P w_t^P \ell_t^P\right) = SB_t \equiv N^P \cdot sb_t$$

3.4.1 Cyclicality of benefits

The aggregate social benefits follow the following stochastic process:

$$\log(SB_t) = \log(\overline{SB}) + \eta^{SB} \cdot z_t + \epsilon_t^{SB}, \qquad \epsilon_t^{SB} \sim N(0, \sigma^{SB})$$

[22] An alternative specification would be for the government to issue debt instead of impose lump-sum tax on a rich household, but it would yield identical results because of Ricardian Equivalence (rich household has perfect access to credit markets).

The deviation of social benefits from their steady-state value has two sources: the systematic cyclical component $\eta_{SB} \cdot z_t$ and the random component ϵ_t^{SB}. The random component is introduced to match the volatility of social benefits, and to ensure the correlation of social benefits with output could take any value between 0 and 1. Our focus, however, is on the cyclical component $\eta^{SB} \cdot z_t$, and the size $\overline{SB}$.[23]

3.4.2 Cyclicality of taxes

The tax rates follow the following processes:

$$\begin{aligned}
\tau_{c,t} &= \bar{\tau}_c + \eta^{TAX} \cdot z_t + \epsilon_t^{TAX} \\
\tau_{\ell,t}^i &= \bar{\tau_\ell^i} + \eta^{TAX} \cdot z_t + \epsilon_t^{TAX}, \qquad i \in \{R, P\} \\
\tau_{k,t} &= \bar{\tau}_k + \eta^{TAX} \cdot z_t + \epsilon_t^{TAX}, \qquad \epsilon_t^{TAX} \sim N(0, \sigma^{TAX})
\end{aligned}$$

In words, the deviations of the distortionary tax rates from their steady state levels are identical for each type of tax. We make this assumption, because we do not have sufficient data for all countries in our panel that would allow us to estimate separate processes for each type of tax.

3.5 Solution method

We solve the model with local methods by linearizing the equilibrium conditions around the non-stochastic steady-state. We use Dynare for this step. Equilibrium conditions are described in the appendix.

[23] While the behavior of social benefits in our model is not the outcome of a formally specified decision problem of a policy-maker, the value of η^{SB} will be estimated using simulated method of moments. Our objective is not to understand the reasons behind differences in cyclicality of social benefits. Instead, our goal is to get a sense of the potential effects of the cyclicality of social transfers on the behavior of macroeconomic aggregates.

4 Quantitative Analysis

4.1 Model parameters

We impose the values of some standard parameters to be identical across both "emerging" and "developed" country groups. The remaining parameters are either calibrated or estimated by targeting population-weighted average statistics, separately for each country group.

Imposed parameter values

The discount factor is set to $\beta = 0.96$; the depreciation rate is set to $\delta = 0.04$; the capital share in the production function is set to $\alpha = 0.33$; the curvature parameter on labor on the utility function is set to $\nu = 0.6$ (same as in Neumeyer and Perri (2005)), implying the elasticity of labor supply of 1.66. Finally, the weight on labor disutility is set to $\psi = 1.45$, same as in Neumeyer and Perri (2005). With this value of ψ, the average household in a typical emerging economy spends 33% of its time working (i.e. $N^R\bar{\ell}^R + N^P\bar{\ell}^P = 0.33$).

Steady-state calibration

We calibrate steady-state values of tax rates — $\bar{\tau}_c$, $\bar{\tau}_k$, $\bar{\tau}_\ell^P$, and $\bar{\tau}_\ell^R$ — to match the revenue share of Value Added Tax (VAT), Corporate Income Tax (CIT), and Personal Income Tax (PIT) in each group, as well as the ratio of highest and lowest marginal tax rate.[24] We assume VAT is the empirical equivalent of the consumption tax in our model, CIT is the empirical equivalent of the capital income tax, and PIT is the empirical equivalent of the labor income tax. The share of rich households N^R equals the fraction of households with access to a formal savings account reported in Demirguc-Kunt (2012). The steady-state level of social benefits $\overline{SB}$ is calibrated to match the share of social transfers in GDP, which in the model equals $\overline{SB}/Y$. Finally, the relative labor efficiency of the poor household—γ—is calibrated to match the income share of GDP earned by the fraction N^R of the richest households, calculated using country-specific income distribution reported in Pinkovskiy and

[24] These values are calculated using population-weighted averages of countries reported in Ilzetzki and Végh (2008).

Sala-i-Martin (2009).With exception of N^R, all these parameters have to be calibrated jointly. Table 7 reports the calibrated parameters together with data targets for the two groups of countries.

Table 7: Calibrated Parameters

Parameter	Data target	**Emerging**		**Developed**	
		Parameter value	Data target	Parameter value	Data target
$\overline{SB}$	sb / gdp	0.03	0.060	0.21	0.161
τ_c	VAT %	0.02	0.190	0.03	0.135
τ_ℓ^P	PIT %	-0.09	0.146	0.04	0.225
τ_k	CIT %	0.04	0.161	0.08	0.066
τ_ℓ^R	Marg / Avg Tax	0.05	1.917	0.04	1.238
N^R	% Rich	0.28	0.280	0.54	0.540
γ	Inc share of rich	0.33	0.900	0.89	0.731

Method of moments estimation

We set the world interest to be the US annual real interest rate and estimate parameters driving its shock process - persistence ρ^R and standard deviation σ^R. Our point estimates on annual US data are: $\rho^R = 0.81$ and $\sigma^R = 0.0229$. We then jointly estimate 9 parameters with simulated method of moments. The 9 parameters are: standard deviation and persistence of the productivity shock—σ^z and ρ_z; standard deviations and cyclicality parameters of social benefits and taxes—σ^{SB}, σ^{TAX}, η^{SB}, and η^{TAX}; investment adjustment cost ϕ; standard deviation and cyclicality parameter for the country spread—σ^{CS} and η^{CS}. We use 10 moments: standard deviation of real GDP and real interest rate; relative (to that of GDP) standard deviation of consumption, investment, social benefits, and tax revenues; correlation of social benefits, tax revenues, and trade balance with GDP; correlation of first differences of real interest rate with GDP growth; and the autocorrelation of real GDP series. We compute the model moments in the same way in which we computed the data moments (e.g., we de-trend the same series using the same method as in the data). We use identity weighing matrix.

The results of the estimation for each group of countries are presented in Table 8. These estimates are largely consistent with previous literature and with empirical regularities doc-

umented in Section 2. The counter-cyclical response of the country spread, η^{CS}, is much stronger in the average emerging economy (point estimate of -1.754 comparing to -0.788 in the average developed economy)[25]. The volatility of the country spread shock is also larger in the average emerging economy (0.077 comparing to 0.042), though the difference is not as stark (in the estimation we are trying to match the standard deviation of the interest rate; larger (absolute) value of η^{CS} also translates into more volatile interest rate).

For the purpose of our analysis, the most important is the difference in the point estimate of the cyclical response of social benefits. The point estimate of the parameter η^{SB} is 0.234 for the average emerging economy and it is -1.658 for the average developed economy, which accounts for the very large difference in the cyclicality of social transfers between the two groups of countries. Table 9 presents model and data moments that were targeted in the estimation. Interestingly, the estimated standard deviation and persistence of productivity shocks are very similar in the two groups of countries. This result is akin to our finding in Michaud and Rothert (2016) where we emphasize that accounting for *observable* disparate fiscal policy rules dampens the estimated differences between productivity processes in the two groups of countries.

4.2 Transfers, taxes, and inequality - impact on business cycles

We now investigate the impact of different cyclical behavior and/or size of social benefits, taxes, and inequality on business cycle statistics. Our analysis proceeds as follows. We start with a benchmark emerging economy whose business cycle behavior is driven by parameters reported in Tables 7 and 8. We then compute business cycle statistics from counter-factual simulations, in which we change certain characteristics of the average emerging economy to resemble those of the average developed economy. These counterfactuals will inform how much of the factual statistics are driven by social benefits and inequality. We first describe our counter-factual experiments, and then present the results.

[25] Neumeyer and Perri (2005) estimate $\eta^{CS} = -1.04$. There are three reasons behind the difference in our estimates. First, we have a different model with additional shocks that can affect movements in the country's interest rate. Second, they use Argentine data in their estimation, while we use cross-country averages. Finally, their model is quarterly, while ours is annual.

Table 8: Estimated Parameters

Parameter	Emerging		Developed	
	Estimate	**(s.e.)**	**Estimate**	**(s.e.)**
η^{CS}	-1.754	(1.563)	-0.788	(0.332)
ϕ	40.585	(2.620)	27.234	(10.071)
η^{SB}	0.234	(0.191)	-1.658	(0.178)
η^{TAX}	0.051	(0.201)	0.246	(0.038)
ρ_z	0.804	(0.081)	0.886	(0.045)
σ^z	0.011	(0.002)	0.013	(0.009)
σ^{CS}	0.077	(0.006)	0.042	(0.005)
σ^{SB}	0.059	(0.004)	0.077	(0.007)
σ^{TAX}	0.004	(0.000)	0.013	(0.001)

Notes: estimates based on 2000 replications of the model; each replication consisted of 500 periods; model moments were computed on the last 50 periods.

4.2.1 Description of experiments

Social benefits and taxes The first round of our counter-factual experiments investigates the impact of fiscal policy on the business cycle experience in the average emerging economy. First we explore how this experience would change, if the size and/or cyclicality of its social transfers had resembled those in the average developed economy. Then, we look at the effect of different size, composition, and cyclicality of taxes. Finally, we combine the two sides of the fiscal policy. The first five experiments are then as follows:

1. Experiment 1 (size of benefits): the share of social transfers in GDP is that of a developed economy. In this economy we re-calibrate $\overline{SB}$ to provide a steady state level of transfers equal to that of a developed economy: $\frac{\text{Benefits}}{GDP} = 0.161$.

2. Experiment 2 (cyclicality of benefits): the cyclical response of social transfers is that of a developed economy: $\eta^{SB} = \hat{\eta}^{SB}(\text{developed}) = -1.66$

3. Experiment 3 (size and cyclicality of benefits): Experiments 1 and 2 combined.

4. Experiment 4 (taxes): We set $\eta^{TAX} = \hat{\eta}^{TAX}(\text{developed}) = 0.25$, and we calibrate steady-state values of consumption, labor, and capital income tax rates $(\tau_c, \tau_\ell^R, \tau_\ell^P, \tau_k)$

Table 9: Simulated Method of Moments Estimation - Model vs. Data

	Emerging		**Developed**	
Moments	**Data**	**Model**	**Data**	**Model**
$\sigma(y)$	3.00	3.06	3.10	3.93
		(0.48)		(0.87)
$\sigma(c)/\sigma(y)$	1.54	1.55	0.77	1.00
		(0.16)		(0.11)
$\sigma(inv)/\sigma(y)$	3.15	3.15	3.08	3.10
		(0.41)		(0.42)
$\sigma(sb)/\sigma(y)$	2.11	2.11	2.66	2.65
		(0.34)		(0.29)
$\sigma(tax)/\sigma(y)$	5.08	5.08	7.35	7.35
		(0.91)		(1.27)
$\sigma(R)$	0.06	0.10	0.02	0.06
		(0.01)		(0.00)
$\rho(sb, y)$	0.14	0.14	-0.55	-0.60
		(0.09)		(0.08)
$\rho(tax, y)$	0.14	0.14	0.04	0.03
		(0.11)		(0.16)
$\rho(nx, y)$	-0.46	-0.44	-0.21	-0.08
		(0.13)		(0.17)
$\rho(\Delta R, \Delta y)$	-0.05	-0.09	0.06	-0.04
		(0.10)		(0.10)
$\rho(y_t, y_{t-1})$	0.67	0.74	0.52	0.65
		(0.07)		(0.11)

Notes: moments based on 2000 replications of the model; each replication consisted of 500 periods; business cycle statistics were computed on the last 50 periods.

to ensure that share of VAT, CIT, and PIT in revenues, as well as the ratio of top marginal to average income tax are the same as in the average developed economy

5. Experiment 5 (benefits and taxes): Experiments 3 and 4 combined

Inequality The second round of counter-factual experiments investigates the impact of inequality on business cycle statistics. The three experiments are described below.

6. Experiment 6 (wealth inequality): we set the share of rich households equal to $N^R = 0.538$ (the value for a developed economy)

7. Experiment 7 (income inequality): we set poor's efficiency of labor to $\gamma = 0.89$ (the value for a developed economy)

8. Experiment 8 (wealth and income): Experiments 6 and 7 combined

Social benefits, taxes, and inequality Finally, we investigate the joint impact of inequality and fiscal policy on the business cycle experience, by considering the average emerging economy with developed country's inequality and fiscal policy.

9. Experiment 9 (transfers, taxes, and inequality): Experiments 5 and 8 combined

4.2.2 Results and Discussion

We will analyze the results step by step. First, we look at the impact of fiscal policy on business cycle statistics. Then we look at inequality. Finally, we combine the two. Table 14 in the Appendix provides complete set of results.

Social benefits and taxes. (Experiments 1-5 shown in Table 10)

The results of experiments 1-3 show that both size and cyclicality matter for the volatility of consumption and for the negative correlation of trade balance with GDP. Relative volatility of consumption drops from 1.55 to 1.38 when only the size of social benefits increases from 6% to 16% of GDP, and it drops from 1.55 to 1.48 when only the cyclical response is set to the value estimated for the average developed economy. When both the size and cyclicality are

changed, the relative volatility of consumption drops further to 1.24. The size and cyclical response of social benefits have similar impact on the negative correlation of trade balance with GDP, reducing it from -0.44 to -0.39. When the two interact, the negative correlation of trade balance to GDP reduces to -0.25, essentially on par with the data for developed countries.

In order to see how the size and cyclical response of social transfers reinforce each other's impact, consider the log-linearized budget constraint of the poor household (for simplicity, without the consumption and labor income taxes):

$$\hat{c}_t^P \approx \frac{\bar{w}\bar{\ell}^P}{\bar{c}^P}\left(\hat{w}_t^P + \hat{\ell}_t^P\right) + \frac{\bar{sb}}{\bar{c}^P}\hat{sb}_t = \frac{\bar{w}\bar{\ell}^P}{\bar{c}^P}\left(\hat{w}_t^P + \hat{\ell}_t^P\right) + \frac{\bar{sb}}{\bar{c}^P}\cdot\underbrace{\left(\eta^{SB}z_t + \epsilon_t^{SB}\right)}_{=\hat{sb}_t}. \tag{4.1}$$

During productivity-driven recessions ($\hat{z}_t < 0$) both wages and employment of the poor households falls, which drives down the consumption of the poor (see the first term on the right-hand side in the equation (4.1) above). When social benefits are counter-cyclical ($\eta^{SB} < 0$), the the fall of c^P during recessions is dampened. The dampening impact of counter-cyclical social benefits will be larger when the size of these benefits relative to the steady-state level of the poor's consumption is larger. The interaction effect can be read directly from the last term on the right hand-side of (4.1).

Equation (4.1), however, is only part of the story. In the model, the excess volatility of consumption is driven primarily by the behavior of the rich households, because they are the ones with access to financial markets. In the benchmark model, the country spread is counter-cyclical which results in a counter-cyclical interest rate. As a result, during expansions credit is cheaper and households with access to credit (the rich) have a strong incentive to borrow and increase their consumption more than their income increases. In terms of log-deviations during expansions, we will always have $\hat{c}_t^R > \hat{c}_t^P$. The log-deviation of the aggregate consumption will be given by:

$$\hat{c}_t = N^R \cdot \frac{\bar{c}^R}{\bar{c}}\hat{c}_t^R + N^P \cdot \frac{\bar{c}^P}{\bar{c}}\hat{c}_t^P \tag{4.2}$$

In the equation above $\bar{c}$ is the steady-state level of aggregate consumption, $\bar{c}^R$ and $\bar{c}^P$ are

steady state levels of consumption of the rich and poor, respectively. When the size of the social benefits increases, $\bar{c}^P/\bar{c}$ will rise, while $\bar{c}^R/\bar{c}$ will fall. This in turn will increase the role of poor households' consumption as a driver of the movements in the aggregate consumption, thereby reducing its volatility. It may be convenient to think of two extreme cases. One is an economy where all households are hand-to-mouth. In that economy, aggregate consumption moves one-to-one with income. The other case is an economy where all households are rich. In that economy, aggregate consumption moves one-to-one with the consumption of the rich, which is more volatile than output due to counter-cyclical interest rates. Equation (4.2) simply states that the aggregate movements in consumption is the weighted average of the movements in c^P and in c^R. Higher steady-state level of social benefits means we put higher weight on the movements of c^P, which are the smaller ones.

Next, we look at taxes. Counterfactual (4) in the table shows simulated moments from the model of the average emerging economy with the size, composition, and cyclical response of taxes that are the same as in a typical developed economy. Changing the tax policy mildly reduces countercyclicality of the trade balance but it raises the excess volatility of consumption. The relative volatility of taxes is drastically increased, because taxes are now a much larger portion of GDP.

It is worth noting that changing the size and cyclicality of taxes has a substantial impact on the volatility of output in our model. Developed economies have tax rates that are larger and more pro-cyclical, which makes them run surpluses in expansions and deficits in recessions. The size and pro-cyclicality of taxes makes them very effective stabilizers in our economy, in which (due to GHH preferences) labor supply depends on the after-tax wage only. In such a setting, the change in tax policy to the one estimated for the developed economy would reduce the emerging economy's volatility of output by 0.40 percentage points. We think our result is interesting in light of the growing interest in the effects of fiscal policy on aggregate variables in environments with heterogenous households (Brinca et al. (2014), McKay and Reis (2016)).

Finally, we combine the two sides of fiscal policy. Counterfactual (5) in the table shows simulated moments from the model of the average emerging economy with social benefits and tax policies that are the same in the benchmark developed economy (in terms of size,

Table 10: Counter-factual experiments: social benefits and taxes

Moments	Emerging benchmark		Counter-factual experiments					Developed benchmark	
			Fiscal Policy						
			Benefits			Taxes	Both		
	data	**model**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**model**	**data**
$\sigma(y)$	3.00	3.06	3.06	3.06	3.06	2.61	2.61	3.93	3.10
		(0.48)	(0.48)	(0.48)	(0.48)	(0.51)	(0.50)	(0.87)	
$\sigma(c)/\sigma(y)$	1.54	1.55	1.38	1.48	1.24	1.61	1.26	1.00	0.77
		(0.16)	(0.14)	(0.17)	(0.14)	(0.19)	(0.17)	(0.11)	
$\sigma(sb)/\sigma(y)$	2.11	2.11	2.11	2.63	2.63	2.47	2.92	2.65	2.66
		(0.34)	(0.34)	(0.29)	(0.29)	(0.41)	(0.36)	(0.29)	
$\sigma(tax)/\sigma(y)$	5.08	5.08	2.65	5.09	2.65	9.85	5.17	7.35	7.35
		(0.91)	(0.43)	(0.91)	(0.43)	(1.42)	(0.70)	(1.27)	
$\rho(sb, y)$	0.14	0.14	0.14	-0.61	-0.61	0.12	-0.54	-0.60	-0.55
		(0.09)	(0.09)	(0.08)	(0.08)	(0.09)	(0.08)	(0.08)	
$\rho(tax, y)$	0.14	0.14	0.32	0.13	0.30	0.54	0.60	0.03	0.04
		(0.11)	(0.11)	(0.11)	(0.11)	(0.10)	(0.10)	(0.16)	
$\rho(nx, y)$	-0.46	-0.44	-0.39	-0.39	-0.25	-0.40	-0.19	-0.08	-0.21
		(0.13)	(0.13)	(0.14)	(0.15)	(0.14)	(0.15)	(0.17)	
Aletered Parameters									
η^{SB}		0.23		-1.66	-1.66		-1.66	-1.66	
η^{TAX}		0.05				0.25	0.25	0.25	
Altered steady-state targets									
Benefits / GDP	0.06		0.16	0.06	0.16		0.16		0.16
VAT/Taxes	0.19					0.13	0.13		0.13
PIT/Taxes	0.15					0.23	0.23		0.23
CIT/Taxes	0.16					0.07	0.07		0.07
Marg / Avg Tax	1.92					1.24	1.24		1.24

Counter-factual experiments - benchmark model emerging economy with the following changes:
(1) - Experiment 1—size of social benefits as in developed economy: $\frac{\text{Benefits}}{GDP} = 0.16$
(2) - Experiment 2—cyclical response of social benefits as in developed economy: $\eta^{SB} = -1.66$
(3) - Experiment 3—Experiments 1 and 2 combined
(4) - Experiment 4—size, composition, and cyclical response of taxes as in developed economy
(5) - Experiment 5—Experiments 3 and 4 combined

composition, and cyclical response). The most striking result is that the effect of changing social benefits is much stronger than the effect of changing the size and cyclical behavior of taxes. The change in the size and behavior of social benefits drives the volatility of consumption and completely outweighs the impact of changing the size and behavior of taxes.

Inequality (Experiments 6-8 shown in Table 11) In this section we explore how our main results regarding the effect of disparate fiscal policies on business cycle properties depend on our calibration of inequality. We first look at the effect of wealth inequality (counterfactual (6) in the table). In our model, reducing wealth inequality means that larger fraction of households owns capital and has access to international financial markets. Reduction in wealth inequality increases the excess volatility of consumption. The mechanics of this effect are quite simple. Consider the expression for log-deviation of the aggregate consumption from its steady-state value described earlier in (4.2). Since the rich have access to financial markets, and since the country spread is strongly counter-cyclical, we will have $\hat{c}_t^R > \hat{c}_t^P$ during expansions. Increasing N^R from 0.28 to 0.54 will put a higher weight on $\hat{c}_t^R$ when calculating the deviation of aggregate consumption from its steady-state.

Next, we turn to income inequality. We change income inequality to be the same as in the average developed country (counterfactual (7) in Table 11), by setting $\gamma = 0.89$. Increasing γ reduces excess volatility of consumption. The intuition can again be read from Equation (4.2). The log-deviation of the aggregate consumption is the weighted average of $\hat{c}_t^R$ and $\hat{c}_t^P$ with weights proportional to steady-state levels of the poor's and rich's consumptions. When income inequality declines, the difference between steady-state values of these consumptions shrinks. As a result the weight $\bar{c}^R/\bar{c}$ drops while the weight $\bar{c}^P/\bar{c}$ increases.[26]

The previous two experiments showed that in our model the two types of inequality had opposing effects on the volatility of aggregate consumption. In experiment (8) we combine the previous two. It turns out that the impact of changing income inequality outweighs the impact of changing wealth inequality - relative volatility of consumption drops from 1.55 to

[26] One can also notice a huge increase in the volatility of tax revenues. The reason is that we keep the original, "emerging" economy structure of taxes, in particular we have $\tau_\ell^P = -0.09$, which is now applied to a much higher wage of a poor household.

Table 11: Counter-factual experiments: inequality

Moments	Emerging benchmark		Inequality			Developed benchmark	
			Wealth	Income	Both		
	data	**model**	**(6)**	**(7)**	**(8)**	**model**	**data**
$\sigma(y)$	3.00	3.06	3.06	3.06	3.06	3.93	3.10
		(0.48)	(0.48)	(0.80)	(0.80)	(0.87)	
$\sigma(c)/\sigma(y)$	1.54	1.55	1.68	1.26	1.43	1.00	0.77
		(0.16)	(0.19)	(0.10)	(0.14)	(0.11)	
$\sigma(sb)/\sigma(y)$	2.11	2.11	2.11	2.11	2.11	2.65	2.66
		(0.34)	(0.34)	(0.34)	(0.34)	(0.29)	
$\sigma(tax)/\sigma(y)$	5.08	5.08	4.39	502.24	10.74	7.35	7.35
		(0.91)	(0.77)	(95.10)	(2.00)	(1.27)	
$\rho(sb, y)$	0.14	0.14	0.14	0.14	0.14	-0.60	-0.55
		(0.09)	(0.09)	(0.09)	(0.09)	(0.08)	
$\rho(tax, y)$	0.14	0.14	0.18	0.07	0.03	0.03	0.04
		(0.11)	(0.11)	(0.10)	(0.11)	(0.16)	
$\rho(nx, y)$	-0.46	-0.44	-0.44	-0.45	-0.45	-0.08	-0.21
		(0.13)	(0.13)	(0.13)	(0.13)	(0.17)	
Altered parameters / steady-state targets							
% of the Rich	0.28		0.54		0.54		0.54
γ		0.33		0.89	0.89	0.89	

Counter-factual experiments - benchmark model emerging economy with the following changes:
(6) - Experiment 6—% of households that own capital the same as in developed countrys $N^R = 0.54$
(7) - Experiment 7—labor efficiency of the poor households set to $\gamma = 0.89$
(8) - Experiment 8—Experiments 6 and 7 combined

1.43, with the behavior of other macroeconomic aggregates remaining essentially unaffected.

Social benefits, taxes, and inequality. (Experiments 5, 8, and 9 shown in Table 12)

Our main result is that if the average emerging economy introduced fiscal policy of a developed country, with its structure and cyclicality of both benefits and taxes, the excess volatility of consumption could be reduced by about a half (it drops from 1.55 to 1.26 with the standard error of 0.17). Experiment 9 shows that when we interact these effects with reduction in income and wealth inequality, the reduction in the volatility of aggregate consumption is even greater. The mechanics of these results can be explained by looking at equations (4.1) and (4.2) jointly:

$$\hat{c}_t \approx N^R \cdot \frac{\bar{c}^R}{\bar{c}} \hat{c}_t^R + N^P \cdot \frac{\bar{c}^P}{\bar{c}} \hat{c}_t^P$$
$$\hat{c}_t^P \approx \frac{\bar{w}\bar{\ell}^P}{\bar{c}^P} \left(\hat{w}_t^P + \hat{\ell}_t^P \right) + \frac{\bar{sb}}{\bar{c}^P} \cdot \left(\eta^{SB} z_t + \epsilon_t^{SB} \right).$$

Consider a positive productivity shock: $z_t > 0$. Larger size ($\bar{sb}/\bar{c}^P$) and cyclical response (η^{SB}) of social benefits dampens the positive impact of the productivity shock on the consumption of the poor, making $\hat{c}_t^P$ smaller. In addition to that, we are now considering an economy with smaller income inequality, which means that $\bar{c}^P/\bar{c}$ is higher. In addition to that, social benefits are larger, which results in an even greater increase in $\frac{\bar{c}^P}{\bar{c}}$, thus putting an extra larger weight on $\hat{c}_t^P$ when calculating the log-deviation of the aggregate consumption $\hat{c}_t$. This way, the size of social benefits interacts with the decrease in income inequality, which makes the movements of the the poor households' consumption play a larger role in the movements of the aggregate consumption.

The impact of different social benefits and income inequality on aggregate consumption of course translates to the the impact on the cyclicality of the trade balance. The natural consequence of less volatile aggregate consumption is the smaller counter-cyclicality of the trade balance, also reported in Table 12. Overall, our results indicate that the differences in the conduct of redistrubutite policies can go a long way in accounting for the differences in the behavior of aggregate consumption and trade balance between developed and emerging economies.

Table 12: Counter-factual experiment: inequality and fiscal policy

Moments	**Emerging benchmark**		**Counterfactual experiments** Fiscal	Inequality	Both	**Developed benchmark**	
	data	**model**	**(5)**	**(8)**	**(9)**	**model**	**data**
$\sigma(y)$	3.00	3.06	2.61	3.06	2.60	3.93	3.10
		(0.48)	(0.50)	(0.80)	(0.82)	(0.87)	
$\sigma(c)/\sigma(y)$	1.54	1.55	1.26	1.43	1.09	1.00	0.77
		(0.16)	(0.17)	(0.14)	(0.14)	(0.11)	
$\sigma(inv)/\sigma(y)$	3.15	3.15	3.69	3.14	3.69	3.10	3.08
		(0.41)	(0.49)	(0.40)	(0.48)	(0.42)	
$\sigma(sb)/\sigma(y)$	2.11	2.11	2.92	2.11	2.92	2.65	2.66
		(0.34)	(0.36)	(0.34)	(0.36)	(0.29)	
$\sigma(tax)/\sigma(y)$	5.08	5.08	5.11	10.74	5.77	7.35	7.35
		(0.91)	(0.69)	(2.00)	(0.79)	(1.27)	
$\sigma(R)$	0.06	0.10	0.10	0.10	0.10	0.06	0.02
		(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	
$\rho(sb, y)$	0.14	0.14	-0.54	0.14	-0.54	-0.60	-0.55
		(0.09)	(0.08)	(0.09)	(0.08)	(0.08)	
$\rho(tax, y)$	0.14	0.14	0.60	0.03	0.58	0.03	0.04
		(0.11)	(0.10)	(0.11)	(0.10)	(0.16)	
$\rho(nx, y)$	-0.46	-0.44	-0.19	-0.45	-0.13	-0.08	-0.21
		(0.13)	(0.15)	(0.13)	(0.15)	(0.17)	
$\rho(\Delta R, \Delta y)$	-0.05	-0.09	-0.08	-0.09	-0.08	-0.04	0.06
		(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	
$\rho(y_t, y_{t-1})$	0.67	0.74	0.74	0.74	0.74	0.65	0.52
		(0.07)	(0.08)	(0.07)	(0.08)	(0.11)	
$\rho(c, y)$	0.69	0.86	0.75	0.89	0.77	0.85	0.55
		(0.06)	(0.08)	(0.05)	(0.07)	(0.05)	
Altered parameters / steady-state targets							
η^{SB}		0.21	-1.54		-1.54	-1.54	
η^{TAX}		0.40	0.06		0.06	0.06	
γ		0.33		0.89	0.89	0.89	
Benefits / GDP	0.06		0.16		0.16		0.16
VAT/Taxes	0.19		0.13		0.13		0.13
PIT/Taxes	0.15		0.23		0.23		0.23
CIT/Taxes	0.16		0.07		0.07		0.07
Marg / Avg Tax	1.92		1.24		1.24		1.24
% Rich	0.28			0.54	0.54		0.54

Counter-factual experiments: benchmark model emerging economy with the following changes:
(5) - Experiment 5—fiscal policy of a developed economy
(8) - Experiment 8—inequality of a developed economy
(9) - Experiment 9—Experiments 5 and 8 combined

Table 13: Life-time consumption equivalent of policy change

	Benefits			Taxes	Both
	size	cycle	both		
Poor	48.9%	0.0%	48.9%	-3.1%	47.1%
Rich	-14.7%	0.0%	-14.7%	0.7%	-14.1%
Total	22.3%	0.0%	22.3%	-1.9%	21.6%

4.3 Welfare

Finally, we turn our analysis to the welfare effects of changing the size, composition, and cyclicality of fiscal policy in our model emerging economy. For each experiment, we simulate the economy for 2,000 periods, drop first 500 observations and then calculate the realized life-time utility of both rich and poor households, as well as the population-weighted average over the remaining 1,500 periods. We do so 10,000 times and average over each replication to obtain a measure of the expected utility.

Table 13 reports the results. Each column corresponds to a different fiscal policy experiment (1 through 5, as described earlier). For each experiment we compute the percentage change in life-time consumption in the benchmark emerging economy that would yield identical change in welfare to the one resulting from a given experiment. We compute that statistic for the poor and for the rich. We also compute the utilitarian welfare change as the population-weighted average of the welfare change experienced by the rich and the poor.

The results are striking. Changing the size of social benefits from 6% to 16% of GDP would have large welfare effects for both the poor (positive) and the rich (negative). Given the large proportion of the poor in the emerging economies' population, such a change would result in a large increase in utilitarian welfare. However, given that the rich would experience a welfare decline equivalent to a 15% decrease in their life-time consumption, it is not surprising emerging economies do not implement such policies if we believe the rich have a major say in designing fiscal policies.

Notice also, that changing the cyclicality of the social transfers, as well as changing the tax rate policy, has a relatively minor impact on welfare. This is consistent with Lucas' point about the welfare costs of business cycles (Lucas (1985)): welfare effects of changing

long-run growth rate are of the order of magnitude larger than welfare effects of reducing business cycle fluctuations. In our model, in terms of welfare effects, the impact of changes to the steady-state of the model trumps the impact of changes to the nature of business cycle fluctuations.

5 Conclusions

In this paper we investigated the cyclical behavior of government expenditures in a sample of emerging and developed economies. We found that social transfers are the major element of fiscal expenditures whose behavior is different in emerging and in developed countries. They are weakly procyclical in emerging markets and strongly counter-cyclical in developed economies. They are also much larger in developed economies, constituting 16.1% of GDP, comparing to only 6.0% of GDP in emerging economies. Comparing to differences in the size and cyclicality of social transfers, other categories of fiscal expenses look quite similar between the two groups of countries.

We then explored how our documented differences in social transfer policies affect emerging markets business cycles. Our main result is that if the average emerging economy introduced fiscal policy of a developed country and the excess volatility of consumption would fall from 1.54 to 1.16. If differences in income and wealth inequality were also eliminated excess volatility of consumption would virtually disappear, falling further to 1.09.

Overall, our results indicate that the disaggregated approach to modelling government expenditures, particularly redistributive policies, is a promising approach towards understanding quantitative properties of business cycles over the course of development. We believe it can offer new perspective on problems such as graduation from pro-cyclical fiscal policy (Frankel et al. (2013)), populist macroeconomic policies (Dornbusch and Edwards (1990); Dovis et al. (2016)), or the fear of free falling (Vegh and Vuletin (2012)). Understanding the role of social benefits in these problems is a fruitful area for further research.

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Appendices

A Figures and Tables

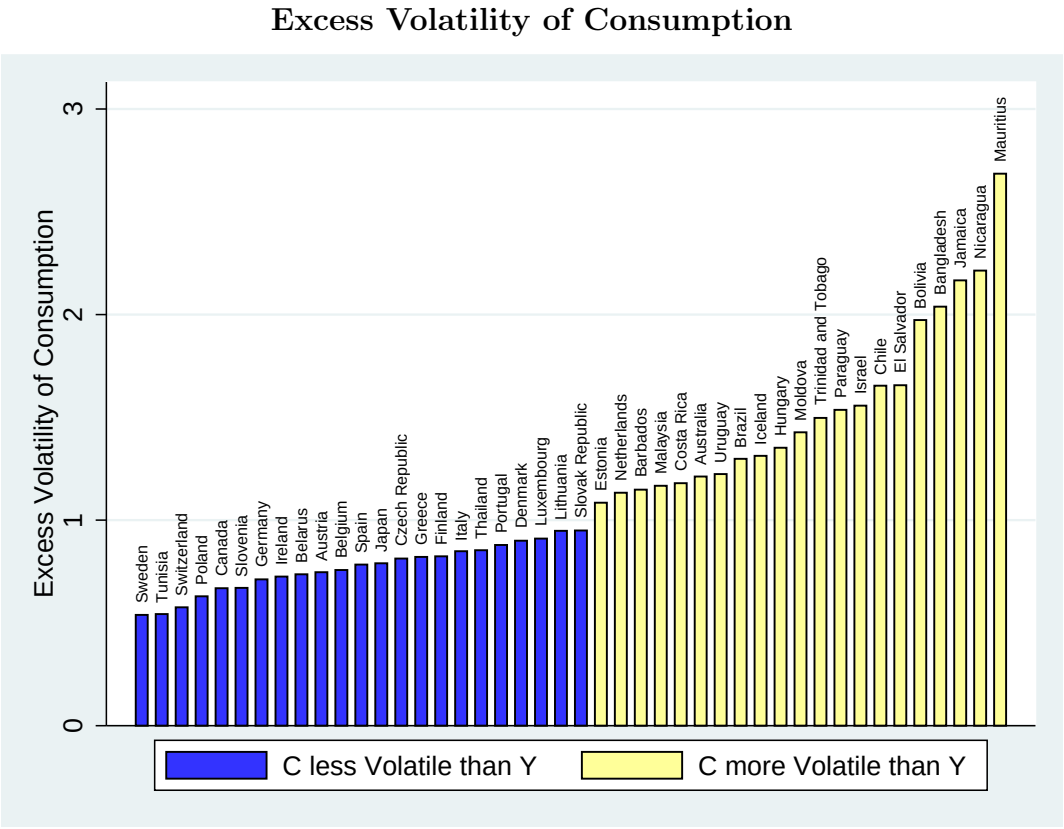

Figure 1: Excess Volatility of Consumption equals $\frac{sd(\hat{C})}{sd(\hat{Y})}$. High Volatility of C if $\frac{sd(\hat{C})}{sd(\hat{Y})} > 1.05$, low if $\frac{sd(\hat{C})}{sd(\hat{Y})} > 0.95$

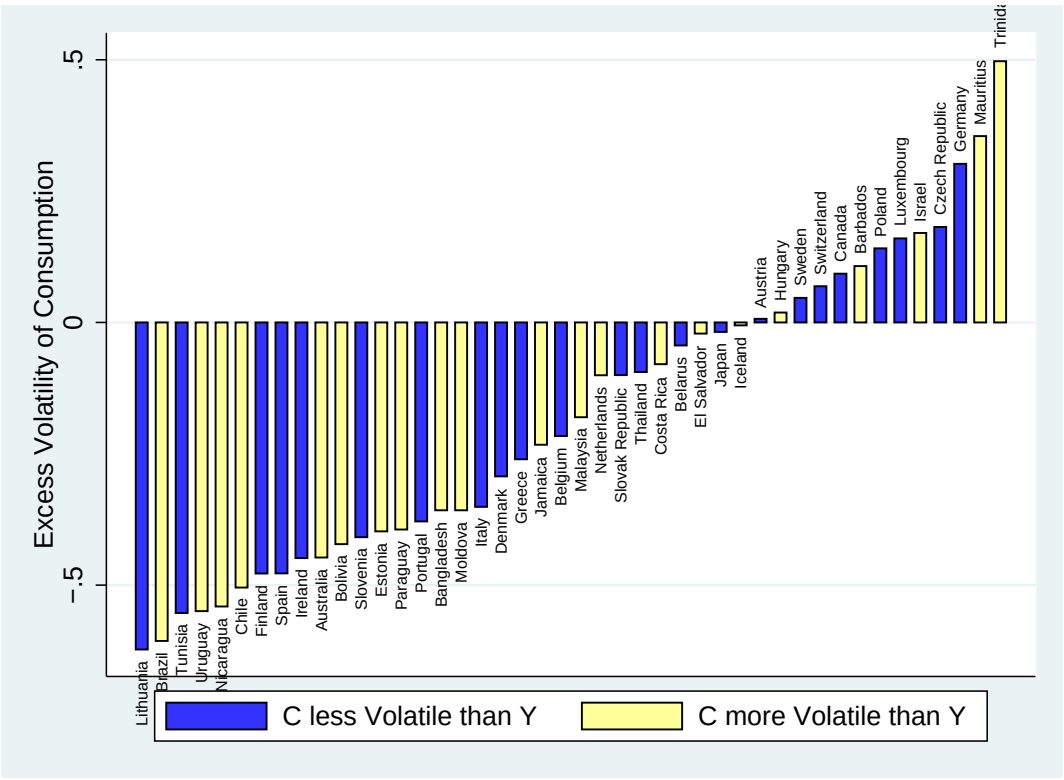

Figure 2: High Volatility of C if $\frac{sd(\hat{C})}{sd(\hat{Y})} > 1.05$, low if $\frac{sd(\hat{C})}{sd(\hat{Y})} > 0.95$

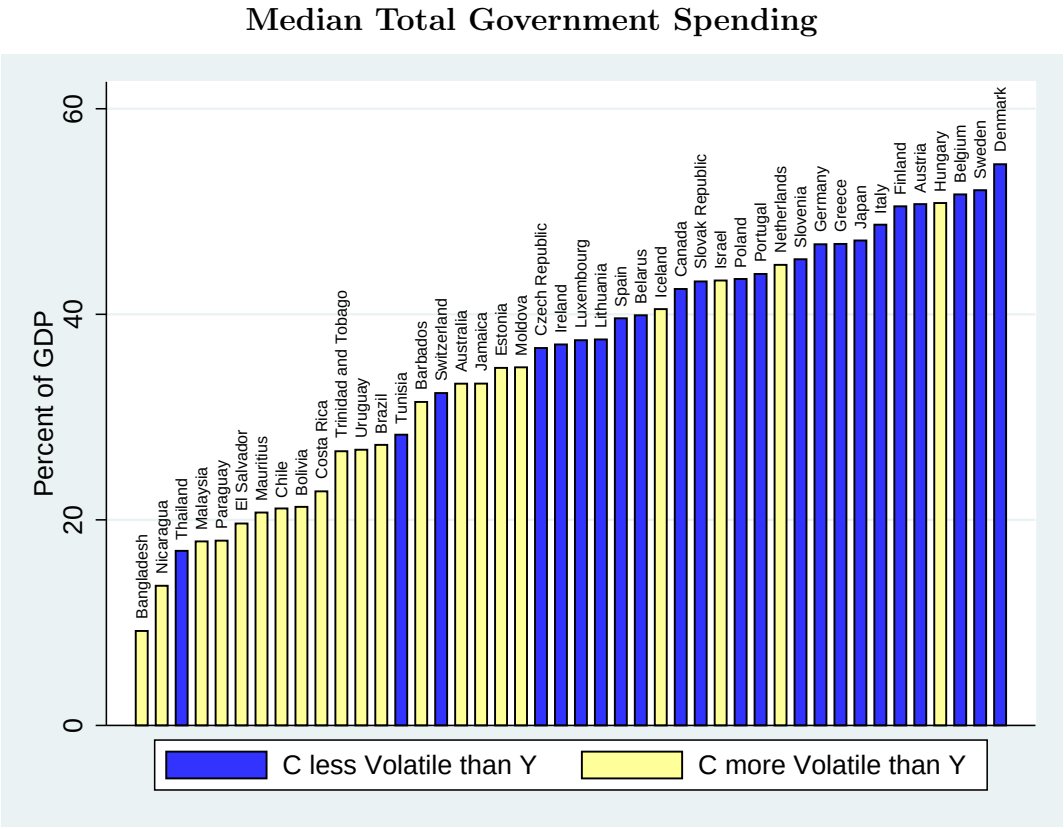

Figure 3: Median over the time series. As a percent of real GDP per capita. High Volatility of C if $\frac{sd(\hat{C})}{sd(\hat{Y})} > 1.05$, low if $\frac{sd(\hat{C})}{sd(\hat{Y})} > 0.95$

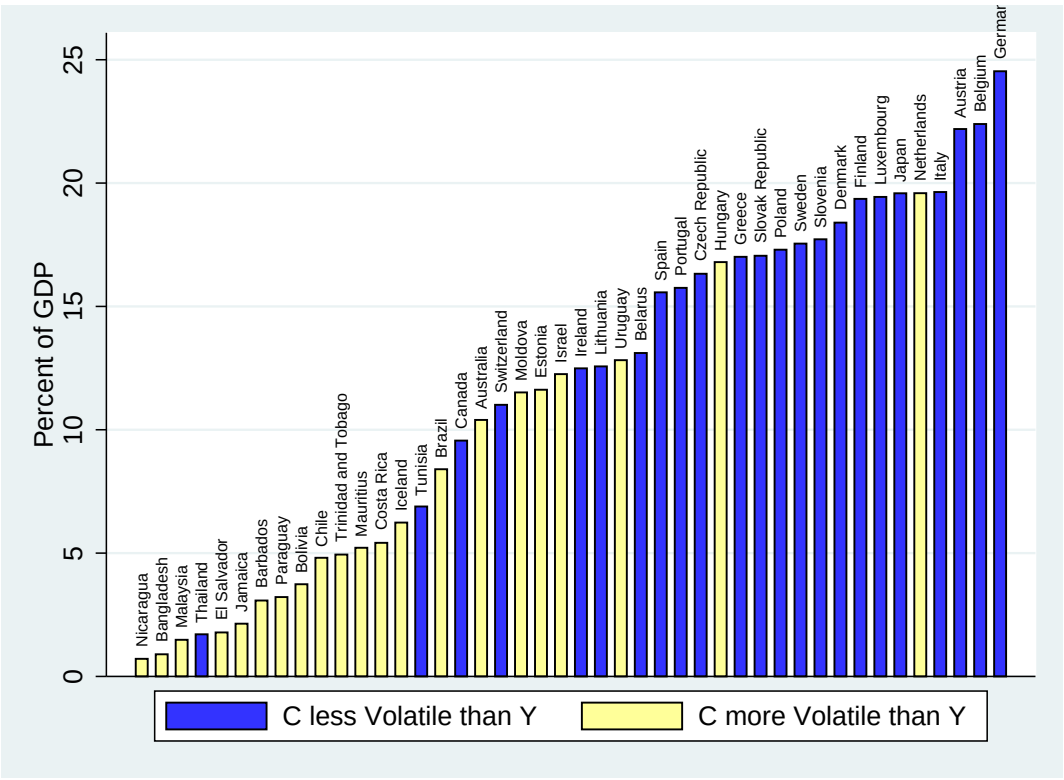

Figure 4: Median over the time series. As a percent of real GDP per capita. High Volatility of C if $\frac{sd(\hat{C})}{sd(\hat{Y})} > 1.05$, low if $\frac{sd(\hat{C})}{sd(\hat{Y})} > 0.95$

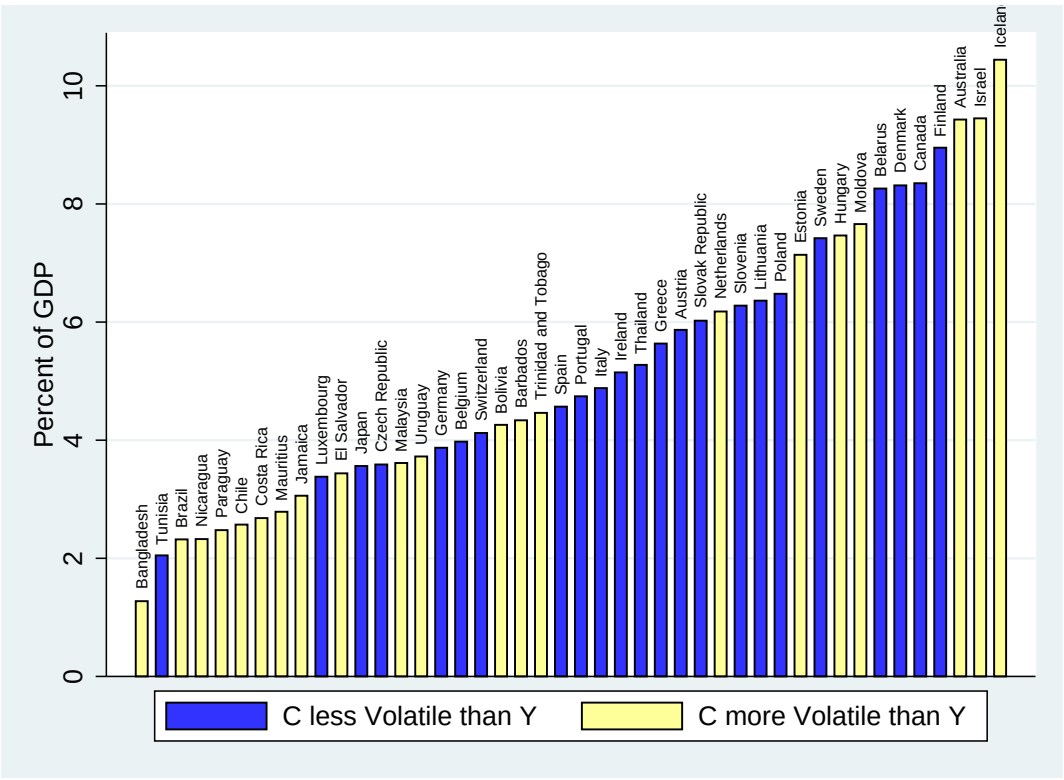

Figure 5: Median over the time series. As a percent of real GDP per capita. High Volatility of C if $\frac{sd(\hat{C})}{sd(\hat{Y})} > 1.05$, low if $\frac{sd(\hat{C})}{sd(\hat{Y})} > 0.95$

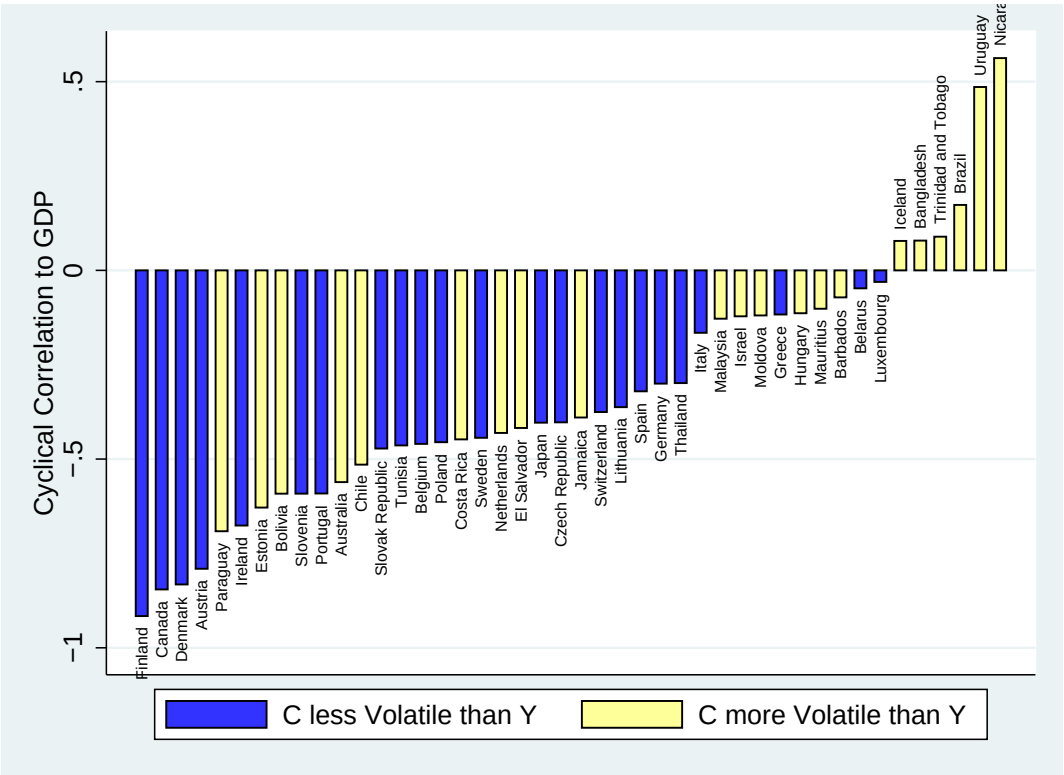

Figure 6: Residuals from linear-quadratic trends. High Volatility of C if $\frac{sd(\hat{C})}{sd(\hat{Y})} > 1.05$, low if $\frac{sd(\hat{C})}{sd(\hat{Y})} > 0.95$

Cyclical Correlation of Government Spending on Social Transfers with GDP

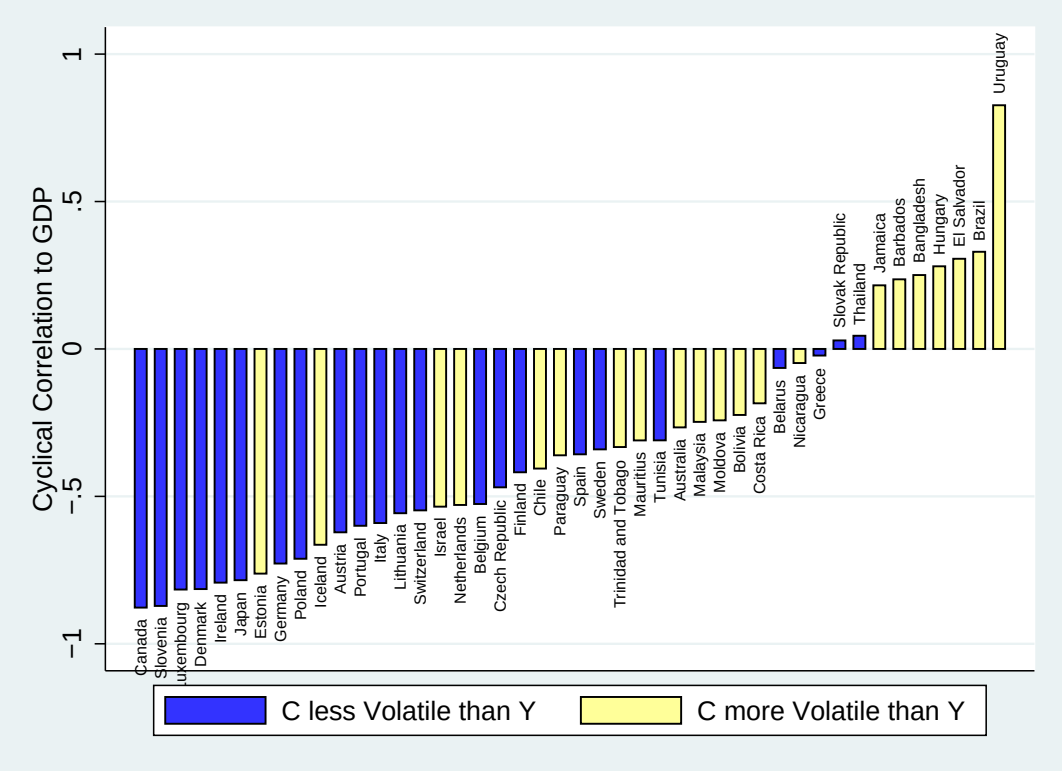

Figure 7: Residuals from linear-quadratic trends. High Volatility of C if $\frac{sd(\hat{C})}{sd(\hat{Y})} > 1.05$, low if $\frac{sd(\hat{C})}{sd(\hat{Y})} > 0.95$

Cyclical Correlation of Government Spending on Goods & Services with GDP

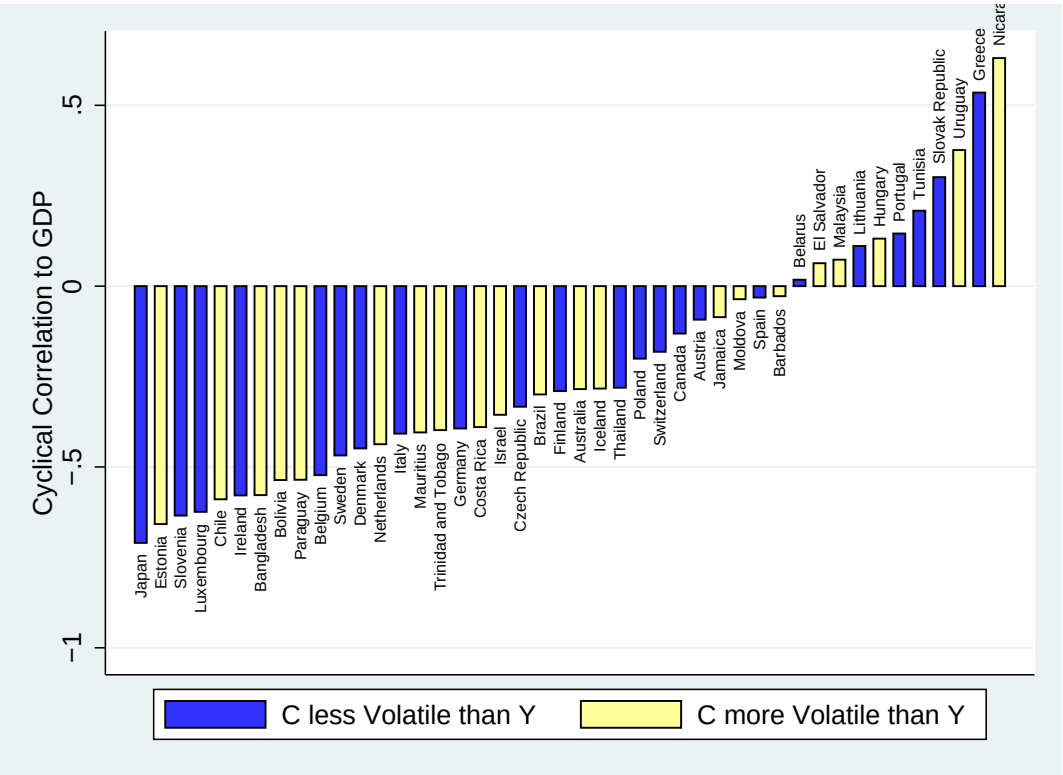

Figure 8: Residuals from linear-quadratic trends. High Volatility of C if $\frac{sd(\hat{C})}{sd(\hat{Y})} > 1.05$, low if $\frac{sd(\hat{C})}{sd(\hat{Y})} > 0.95$

Table 14: Counter-factual experiments - complete results

Moments	Emerging benchmark		Counter-factual experiments									Developed benchmark	
			Fiscal Policy					Inequality			All		
			Benefits			Taxes	Both	Wealth	Income	Both			
	data	**model**	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**model**	**data**
$\sigma(y)$	3.00	3.06	3.06	3.06	3.06	2.61	2.61	3.06	3.06	3.06	2.60	3.93	3.10
		(0.48)	(0.48)	(0.48)	(0.48)	(0.51)	(0.50)	(0.48)	(0.80)	(0.80)	(0.82)	(0.87)	
$\sigma(c)/\sigma(y)$	1.54	1.55	1.37	1.48	1.24	1.62	1.26	1.68	1.26	1.43	1.09	1.00	0.77
		(0.16)	(0.14)	(0.17)	(0.14)	(0.20)	(0.17)	(0.19)	(0.10)	(0.14)	(0.14)	(0.11)	
$\sigma(inv)/\sigma(y)$	3.15	3.15	3.16	3.15	3.16	3.67	3.69	3.15	3.12	3.14	3.69	3.10	3.08
		(0.41)	(0.41)	(0.41)	(0.41)	(0.48)	(0.49)	(0.41)	(0.40)	(0.40)	(0.48)	(0.42)	
$\sigma(sb)/\sigma(y)$	2.11	2.11	2.11	2.63	2.63	2.47	2.92	2.11	2.11	2.11	2.92	2.65	2.66
		(0.34)	(0.34)	(0.29)	(0.29)	(0.41)	(0.36)	(0.34)	(0.34)	(0.34)	(0.36)	(0.29)	
$\sigma(tax)/\sigma(y)$	5.08	5.08	2.60	5.09	2.59	9.93	5.11	4.39	502.24	10.74	5.77	7.35	7.35
		(0.91)	(0.42)	(0.91)	(0.42)	(1.43)	(0.69)	(0.77)	(95.10)	(2.00)	(0.79)	(1.27)	
$\sigma(R)$	0.06	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.06	0.02
		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	
$\rho(sb, y)$	0.14	0.14	0.14	-0.61	-0.61	0.12	-0.54	0.14	0.14	0.14	-0.54	-0.60	-0.55
		(0.09)	(0.09)	(0.08)	(0.08)	(0.09)	(0.08)	(0.09)	(0.09)	(0.09)	(0.08)	(0.08)	
$\rho(tax, y)$	0.14	0.14	0.33	0.13	0.31	0.54	0.60	0.18	0.07	0.03	0.58	0.03	0.04
		(0.11)	(0.11)	(0.11)	(0.11)	(0.10)	(0.10)	(0.11)	(0.10)	(0.11)	(0.10)	(0.16)	
$\rho(nx, y)$	-0.46	-0.44	-0.39	-0.39	-0.25	-0.40	-0.19	-0.44	-0.45	-0.45	-0.13	-0.08	-0.21
		(0.13)	(0.13)	(0.14)	(0.15)	(0.14)	(0.15)	(0.13)	(0.13)	(0.13)	(0.15)	(0.17)	
$\rho(\Delta R, \Delta y)$	-0.05	-0.09	-0.09	-0.09	-0.09	-0.08	-0.08	-0.09	-0.09	-0.09	-0.08	-0.04	0.06
		(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	(0.10)	
$\rho(y_t, y_{t-1})$	0.67	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.65	0.52
		(0.07)	(0.07)	(0.07)	(0.07)	(0.08)	(0.08)	(0.07)	(0.07)	(0.07)	(0.08)	(0.11)	
Altered Parameters													
eta^{SB}		0.23		-1.66	-1.66		-1.66				-1.66	-1.66	
η^{TAX}		0.05				0.25	0.25				0.25	0.25	
γ		0.33							0.89	0.89	0.89	0.89	
Aletered steady-state targets													
Benefits / GDP	0.06		0.16	0.06	0.16		0.16				0.16		0.16
VAT/Taxes	0.19					0.13	0.13				0.13		0.13
PIT/Taxes	0.15					0.23	0.23				0.23		0.23
CIT/Taxes	0.16					0.07	0.07				0.07		0.07
Marg / Avg Tax	1.92					1.24	1.24				1.24		1.24
% Rich	0.28							0.54		0.54	0.54		0.54

B Data Appendix (for on-line publication only)

B.1 Government Finance Statistics Dataset

Our main dataset for fiscal variables is the Government Finance Statistics Dataset (GFS) maintained by the International Monetary Fund (IMF)[27]. The data collection began in 1972 with further guidelines established in 1986 intended to harmonize reporting of fiscal measures across countries. These guidelines have subsequently been updated twice: once in 2001 and again in 2014. These changes have little impact on our analysis with the exception of the expansion in the inclusion of nonmonetary transactions. Most countries switched from cash accounting to accrual in the mid-1990s' early 2000's.

We use annual data. Higher frequency- monthly and quarterly data- are limited to a smaller group of mostly developed countries.

Reported transactions are delineated by sub-sectors of the total Public Sector. Starting from finest to coarsest, the sector-level reporting concepts we consider are:

1. Budgetary Central Government: a single unit encompassing financial activities of the judiciary, legislature, ministries, president, and government agencies. It is funded by the main operating budget of the nation, generally approved by the legislature. Items not included in the budgetary central government statistics include extra-budgetary units and transactions;[28] and social security funds.

2. Central Government: the central government includes all transactions not operated through a public corporation (ex: central bank and other financial institutions) that are implemented at the national level (ie: not state or local governments). These statistics may or may not include social security, depending on the country reporting. Social security refers to social insurance schemes operated by a budget of assets and liabilities separate from the general fund.

3. General Government: the sum of central, state, and local financial activities plus social security. This does not include financial corporations.

[27] Information for this section comes from the 2014 GFS manual.

[28] For example, units with revenue streams outside of the central budget, external grants received, etc.

Table 15: Sector Definitions

Country	Sector	Time Span	Country	Sector	Time Span
Argentina	Central + State	1990-2004	Italy	General	1995-2014
Australia	General	1999-2015	Jamaica	General	2003-2014
Austria	Central	1995-2015	Japan	General	2001-2014
Bangladesh	Central	2001-2013	Lithuania	General	1995-2014
Barbados	Central	2003-2013	Luxembourg	General	1999-2014
Belarus	General	2003-2015	Malaysia	Central	1990-2001
Belgium	General	1995-2014	Mauritius	General	2002-2014
Bolivia	Central	1990-2007	Moldova	General	2002-2014
Brazil	Central	1990-2014	Netherlands	General	1995-2015
Canada	General	1990-2015	Nicaragua	Central	1990-2015
Chile	General	2000-2015	Paraguay	General	2005-2015
Costa Rica	Central	1998-2014	Poland	General	1995-2015
Czech Republic	General	2000-2015	Portugal	General	1995-2014
Denmark	General	1995-2015	Slovak Republic	General	1995-2015
El Salvador	General	2002-2014	Slovenia	General	1995-2015
Estonia	General	1995-2015	Spain	General	1995-2014
Finland	General	1995-2015	Sweden	General	1995-2015
Germany	General	1991-2014	Switzerland	General	2002-2014
Greece	General	1995-2014	Thailand	General	2000-2015
Hungary	General	1995-2015	Trinidad & Tobago	Central	1993-2010
Iceland	General	1998-2014	Tunisia	Central	1990-1999
Ireland	General	1995-2015	Uruguay	Central	1990-2015
Israel	General	2000-2015			

Striation in the reporting of statistics by government level varies across countries and time. We create consistent time series by case-by-case inspection. We choose the sector with the largest value of social transfers for the longest time period. Where possible, we sum sub-national and federal expenditures to equal national expenditures. If consistent measures are not available for the sector with the largest value for 10 years or more, we use the second largest sector so long as it is not much different than the largest (within 5% of GDP). Otherwise, we drop the country. This leaves us with the following sample.

The transactions we analyze fall into the categories of revenues and expenses affecting net worth. The specific breakdown is as follows.

- Revenue: transactions that increase *net* worth. These do not include transactions that simply affect the composition of assets and liabilities in the balance sheet such as the payments of loans or sale of financial assets.

1. Tax Revenue: compulsory, unrequited accounts receivable by the government. Does not include, fines, penalties, and most social security contributions (as these are requited). Taxe revenue can be further disaggregated into: (a) taxes on income, profits and capital gains; (b) payroll taxes; (c) property taxes; (d) taxes on goods and services; (e) taxes on international trades and transactions.
2. Social Contributions: revenue of social insurance schemes. May be voluntary or compulsory.
3. Grants: transfers relievable that are not taxes, social contributions, or subsidies. May come from domestic or international organizations and units.
4. Other: revenues not fitting in the aforementioned categories. Include: (a) property income, (b) sales of goods and services, (c) fines, etc.

- Expense: transactions that decrease *net* worth. These do not include transactions that simply affect the composition of assets and liabilities in the balance sheet.

1. Compensation of Employees: renumeration payable, both cash and in-kind, to employees of the government unit. Includes contractors.
2. Use of Goods and Services: "value of goods and services used for the production of market and nonmarket goods and services". Includes consumption of fixed capital and goods purchased by the government for direct distribution. Consumption of fixed capital is also reported separately.
3. Interest: interest fees on liabilities generated by both financial and non-financial services consumed by the government. Includes intra-government liabilities for disaggregated units.
4. Subsidies: unrequited transfers to enterprises based on production activities. *Includes implicit subsidies of central banks.*
5. Social Benefits: current transfers receivable by household related to social risks. These include: sickness, unemployment, retirement, housing, and education.
6. Other: transfers not otherwise classified, non-interest property expense, premiums and fees on nonlife insurance schemes.

B.2 Inequality Data

B.2.1 Global Financial Inclusion Database (Global Findex)

We use data from the Global Findex to calibrate the share of "rich" and "poor" in our model economies. Our model definition of rich is a household that can own shares of the capital stock. Effectively, it leaves the poor households in our model as "hand-to-mouth" households- they cannot save. By this logic, our measure of this concept of rich households in the data is the share of households who saved any money in a financial institution in the given year (2011).[29]

B.2.2 Pinkovskiy & Sala-i-Martin (2009)

We use data provided by the authors of the paper "Parametric Estimates of the World Distribution of Income" to construct measures of income inequality. Pinkovskiy & Sala-i-Martin estimate log-normal distributions of income for the countries we study. Using these parametric distributions, we calculate the share of income earned by the rich, where the share of rich and poor households satisfy the model-consistent definition using the Global Findex.

[29] Statistics for Norway and Switzerland are from 2014, due to no availability in 2011.

C Model equilibrium conditions (for on-line publication only)

The variable in the dynamic model are expressed in logs if we know their steady-state value must be positive. These equations are provided as input into Dynare to find model's decision rules using first-order approximation around the steady-state.

Production function:

$$y_t = z_t + \alpha \log K_{t-1} + (1-\alpha) \log L_t \tag{C.1}$$

where

$$L_t = N^R \exp(\ell_t^R) + N^P \gamma \exp(\ell_t^P)$$

and

$$K_{t-1} = N^R \exp(k_{t-1})$$

Law of motion for capital stock:

$$\exp(k_t) = (1-\delta)\exp(k_{t-1}) + \exp(x_t) - \frac{\phi}{2}\left(\exp(k_t - k_{t-1}) - 1\right)^2 \exp(k_{t-1}) \tag{C.2}$$

Interest rate = world interest + country spread:

$$r_t = r_t^{USA} + cs_t \tag{C.3}$$

Intra-temporal Euler equations:

$$\chi \exp(\ell_t^R)^\nu = w_t^R \exp(-\tau_{\ell,t}^R)\exp(-\tau_{c,t}) \tag{C.4}$$

$$\chi \exp(\ell_t^P)^\nu = w_t^P \exp(-\tau_{\ell,t}^P)\exp(-\tau_{c,t}) \tag{C.5}$$

where the wages are given by:

$$w_t^R = (1-\alpha)\cdot \exp(y_t)/L_t, \qquad \text{and} \qquad w_t^P = \gamma w_t^R$$

Aggregate consumption:

$$\exp(c_t) = N^R \cdot \exp(c_t^R) + N^P \cdot \exp(c_t^P) \tag{C.6}$$

NIPA identity:

$$\exp(y_t) = \exp(c_t + \tau_{c,t}) + N^R \exp(x_t) + NX_t \tag{C.7}$$

where

$$NX_t = (a_t - \exp(r_{t-1}) * a_{t-1}) * NR$$

Trade balance over GDP ratio:

$$nxy_t = NX_t / \exp(y_t) \tag{C.8}$$

Inter-temporal Euler equation for capital stock:

$$U_{c,t} \cdot (1 + \phi \cdot (\exp(k_t - k_{t-1}) - 1)) = E_t \beta U_{c,t+1} \left\{ (1 - \delta) + r_{t+1}(1 - \tau_{k,t+1}) + \frac{\phi}{2} \left(\exp(k_{t+1} - k_t)^2 - 1 \right) \right\} \tag{C.9}$$

Inter-temporal Euler equation for international borrowing and lending:

$$U_{c,t} = E_t \beta U_{c,t+1} \exp(r_t) \frac{1}{1 - \frac{\kappa}{2}(\bar{a} - a_t)} \tag{C.10}$$

Poor households' budget constraint:

$$\exp(c_t^P + \tau_{c,t}) = w_t^P \exp(-\tau_{\ell_t}^P) \exp(\ell_t^P) + \frac{\exp(sb_t)}{N^P} \tag{C.11}$$

Stochastic processes:

$$r_t^{USA} = (1-\rho^R)r^* + \rho^R r_{t-1}^{USA} + \epsilon_t^R \tag{C.12}$$

$$z_t = \rho^z z_{t-1} + \epsilon_t^z \tag{C.13}$$

$$cs_t = \eta^C S z_t + \epsilon_t^{CS} \tag{C.14}$$

$$sb_t = \log \overline{SB} + \eta^{SB} z_t + \epsilon_t^{SB} \tag{C.15}$$

$$\hat{\tau}_t = \eta^{TAX} z_t + \epsilon_t^{TAX} \tag{C.16}$$

where $r^* = -\log(\beta)$.

C.1 Steady-state

The variables in this part are expressed in levels. The equations characterizing the steady-state of the economy are as follows:

$$\begin{aligned}
Y &= (N^R \cdot k)^\alpha (N^R \ell^R + N^P \gamma \ell^P)^{1-\alpha} \\
Y &= (N^R \cdot c^R + N^P \cdot c^P)\exp(\tau_c) + N^R \cdot \delta k + N^R \bar{a}(1-\exp(r^*)) \\
c^P \exp(\tau_c) &= \gamma MPL \exp(-\tau_\ell^P)\ell^P + \overline{SB}/N^P \\
\chi(\ell^R)^\nu &= MPL \exp(-\tau_\ell^R)\exp(-\tau_c) \\
\chi(\ell^P)^\nu &= \gamma MPL \exp(-\tau_\ell^P)\exp(-\tau_c) \\
1 &= \beta\left(1-\delta+(1-\tau_k)\alpha\frac{Y}{N^R \cdot k}\right)
\end{aligned}$$

where $MPL = (1-\alpha)Y/(N^R\ell^R + N^P\gamma\ell^P)$.

In the system of six equations above there are six unknowns: Y, k, ℓ^R, ℓ^P, c^R, c^P. The steady-state values of all other endogenous variables can be then recovered from the remaining model equations. The values of $\bar{a}$, $\overline{SB}$, τ_c, τ_k, τ_ℓ^R, τ_ℓ^P, and γ are jointly calibrated to make sure that the model steady-state targets are identical to data averages (see Section 4.1).