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Welfare Effects of Fiscal Procyclicality: Public Insurance with Heterogeneous Agents*

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Abstract

This paper pursues a welfare analysis of fiscal policy, specifically public spending, in an economy with heterogeneous agents and incomplete markets. The main quantitative exercise consists in measuring the gains of switching from the (procyclical) spending path of the typical developing country to an acyclical or countercyclical path. The model emphasizes the role of transfer payments from the government to households in alleviating the costs of idiosyncratic shocks. Since these correlate with aggregate shocks, the way fiscal policy is conducted along the business cycle has important welfare effects. I find that the costs of procyclicality are relatively large and very heterogeneous. While wealth-rich agents don't suffer from procyclicality, poor agents, being either unemployed or unskilled, lose the most. In terms of life-time consumption equivalents these agents may lose as much as 2% from fiscal procyclicality, considering only the fraction of spending that is allocated as transfer payments.

Resumen

Este trabajo lleva a cabo un análisis de bienestar de la política fiscal, particularmente del gasto fiscal, en una economía con agentes heterogéneos y mercados incompletos. El principal ejercicio cuantitativo consiste en medir las ganancias de transitar desde la política fiscal procíclica que se puede ver en los países emergentes hacia una política acíclica y una contracíclica. El modelo enfatiza el rol que juegan los pagos de transferencias que hace el gobierno a los hogares para aliviar los costos de los shocks idiosincráticos. Debido a que estos últimos se correlacionan con los shocks agregados, la forma en que se conduce la política fiscal a través del ciclo económico tiene consecuencias relevantes para el bienestar de la población. Se encuentra que los costos de la prociclicidad fiscal son relativamente altos y bastante heterogéneos. Mientras agentes que tienen alta riqueza no sufren significativamente de la prociclicidad, los que poseen un bajo nivel de riqueza son los que más sufren. En términos de unidades de consumo permanente estos agentes pueden llegar a tener una pérdida de bienestar de hasta un 2% debido a la prociclicidad de la política fiscal, considerando solo la fracción del gasto que se asigna a transferencias.

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1 Introduction

Fiscal procyclicality in developing countries has been widely documented. Drops in output are followed by falls in public spending, including transfer payments. As more individuals experience large income losses, the parallel reduction in government transfers strongly impacts their already low consumption levels, particularly in the case of wealth-poor agents and in a context of poorly functioning social security systems. Therefore public spending doesn't play an insurance role against aggregate fluctuations as in most developed countries, where well functioning welfare programs generate an automatic countercyclical adjustment in transfer payments. In terms of policies this situation has increased the attention on structural balance fiscal rules (SBFR), i.e. those that set a target on the cyclically adjusted fiscal balance or the balance over the cycle, not only for achieving fiscal sustainability and promoting macroeconomic stabilization, but also because of their potential to provide public insurance.

In this paper I quantify the costs of fiscal procyclicality, and its distributional effects, taking explicitly into account the insurance role of public spending against aggregate fluctuations, a dimension that has been overlooked by previous literature.¹ To do this I build a model of heterogeneous agents and incomplete markets, where aggregate shocks are closely related to idiosyncratic shocks and fiscal spending, particularly transfer payments that can be potentially targeted to specific groups of the population to counteract the amplifying effect of aggregate fluctuation on individual incomes.

Behind the policy advice of implementing an acyclical or countercyclical fiscal policy is the belief that there are sizeable welfare costs from consumption fluctuations generated by aggregate shocks. The seminal work of [Lucas \(1987\)](#) considered these to be only minor costs. However research that has introduced idiosyncratic risk and incomplete markets to study quantitatively the welfare effects of business cycles finds large effects ([Krusell et al., 2009](#)). It is precisely this framework, where the correlation of idiosyncratic risk and aggregate fluctuations is key, what I use to quantify the costs of fiscal procyclicality.

Using this framework I pursue welfare comparisons between different fiscal rules. In the model these are defined as the relationship between public spending and the aggregate state of the economy. Although the model is very general and allows for a large variety of rules, the quantitative exercise focuses on three of them. The first mimics the procyclical spending pattern of the average emerging country. As I show below in the average emerging country the short-run elasticity of fiscal spending to GDP is 0.71. The second rule I consider insulates public spending from the business cycle and hence generates an acyclical pattern, which in the model is equivalent to a SBFR. The

¹Although their focus is different, the main exception is [McKay and Reis \(2016\)](#). Another paper on the insurance role of fiscal policy is [Engel et al. \(2013\)](#), but they don't consider idiosyncratic risk, the focus of this paper. [Michaud and Rothert \(2018\)](#) explore the impact of social transfers on private consumption, also in a model without idiosyncratic risk.

third rule goes beyond this to obtain a countercyclical policy, with an elasticity as large as in the procyclical rule but with the opposite sign. Based on this, the paper implements a welfare analysis to quantify the relative gains across individuals, primarily as a function of their wealth, employment status and efficiency levels, and across certain features of the economy, of switching between rules. Therefore it assesses quantitatively the welfare cost of procyclicality in a typical emerging country, or equivalently, it measures the welfare gains from following an acyclical (or a SBFR) or a countercyclical fiscal policy.

There are many features influencing the costs of procyclicality. Among these macroeconomic volatility is particularly relevant, and this tend to be specially pronounced in emerging economies (see [Loayza et al., 2007](#), and references therein). This is due to more volatile policies but also due to some structural features such as the dependance on commodity production and on swings in international financial markets. Small social security systems and underdeveloped financial markets translate this greater macroeconomic volatility into more volatile labor markets and individual's incomes. The model is built and calibrated to reproduce these features of emerging economies.

I find that spending cyclicity has significant distributional consequences, even though I just consider the effect of transfers, which according to the calibration represents about half of total fiscal spending. Poor workers gain the most from eliminating fiscal procyclicality, since they don't have an alternative instrument for insuring themselves against the risk of unemployment or low wages. While wealth-rich agents are not significantly affected, poor agents lose on average 0.12 percentage points of life-time consumption relative to an acyclical rule, and 0.23 relative to a countercyclical one. These loses may be as much as 1.2 percentage points depending on labor status and efficiency. Overall the average welfare costs are between 0.03 and 0.06 percentage points of life-time consumption depending on the alternative considered. These results are of the same order of magnitude than those found by previous papers evaluating welfare effects of other stabilization policies or experiments, in similar environments, e.g. [Krusell et al. \(2009\)](#); [Gornemann et al. \(2016\)](#).

1.1 Relation to the Literature

Studies have evaluated the macroeconomic effects of fiscal rules or procyclicality, and some of them also evaluate their welfare effects. However the focus of the literature has been on the stabilization role of rules, evaluated in a context of sizeable real effects of fiscal spending, either a representative agent or small, permanent, and exogenous levels of heterogeneity, and exogenous disturbances affecting exclusively macroeconomic variables, notably commodity price shocks (see among others [Pieschacon, 2012](#); [Kumhof and Laxton, 2013](#); [Michaud and Rothert, 2018](#)). In contrast I focus on the insurance role of spending, for which heterogeneity, financial frictions, and the interaction of aggregate and idiosyncratic shocks are key ingredients. Therefore I frame my study into incomplete markets models with heterogeneous agents ([Bewley, 1986](#); [Aiyagari, 1994](#); [Huggett, 1993, 1997](#)) and

aggregate risk (Krusell and Smith, 1998), as they seem to be the natural environment to analyze the welfare effects of fiscal spending coming from its insurance role, and its consequent distributional effects. McKay and Reis (2016) use a model with idiosyncratic and aggregate risk to evaluate the role of automatic stabilizers in the US business cycle. The insurance mechanism is present in their paper but their focus is on the role of non-discretionary fiscal policy on the dynamics of the business cycle.² Engel et al. (2013) analyze the optimality of fiscal spending, with an emphasis on insurance, but they don't consider idiosyncratic shocks and private savings.

Importantly for the results, the government provides transfer payments directly to households who face idiosyncratic shocks and who differ in their assets holdings. Most of the studies measuring welfare effects of fiscal policy focus on government purchases that enter directly the agent's utility function. But the optimal path for this type of spending is very sensitive to the specific formulation of the utility function. For instance Ambler and Paquet (1996) shows that optimal public spending is smoothed out similarly to private consumption, while Bachmann and Bai (2013) show that optimal spending in goods entering the utility function of consumers is procyclical.³ Additionally transfer payments are critical to understand the fiscal procyclicality observed in many countries (Ilzetki and Végh, 2008; Ilzetki, 2011; Michaud and Rotherth, 2018).⁴ In the model transfers can be targeted in different ways to agents depending on their changing individual characteristics.⁵

2 The Model

In this section I build a model that incorporates incomplete markets, heterogeneous agents, and aggregate fluctuations. Agents face unemployment shocks that are more likely during recessions. Financial frictions prevent poor agents from smoothing consumption during unemployment spells, and hence aggregate fluctuations are particularly costly for them. On top of this structure there

²Fiscal policy has been analyzed in this type of models mostly in relation to taxes (see e.g. Aiyagari and McGrattan, 1998; Heathcote, 2005). This paper focuses in public spending (and particularly its cyclical behavior), which is assumed exogenous in this literature, while tax rates are kept fixed. This approach is suitable for developing countries, where a large source of revenue volatility comes from fluctuations in world commodity prices, and where the ability to fine-tune tax rates is limited (Mendoza and Oviedo, 2006).

³Both of these papers assume a balanced budget every period, which is not the case of the present paper.

⁴As described above there is a large literature documenting that fiscal policy is procyclical in developing countries. One source of procyclicality has a political origin and is related to the overaccumulation of public debt beyond levels consistent with public expenditure smoothing. Another source of fiscal procyclicality is market incompleteness (see e.g. Cuadra et al., 2010; Bauducco and Caprioli, 2014). In the model the correlation between expenditures and output is mostly exogenously determined. In particular I impose an exogenous distribution for expenditures conditional on the state of the economy. This allows to answer the question of who wins with a certain fiscal policy but it does not allow to conclude whether the policy is an equilibrium outcome or not.

⁵Engel et al. (2013) and Michaud and Rotherth (2018) are two papers that share my focus on transfer payments. The main difference is that they assume hand-to-mouth consumers, and hence a one-to-one response of private consumption, no idiosyncratic risk and ex-ante heterogeneity in terms of who receive transfers.

is a government that collects taxes and issues debt to finance spending in goods and services and transfer payments to private agents. Since these are an alternative source of agents' income, they influence the cost of fluctuations. Hence fiscal spending possesses an insurance role which impacts agents' welfare. Fiscal rules define the exogenous relationship between public spending and the aggregate state of the economy, specifically in the case I analyze, GDP and public debt, allowing for different degrees of fiscal volatility and cyclical, and hence of public insurance provision.

The economy is open and faces a fixed international interest rate equal to r . The aggregate production function is

$$y = zF(K, N)$$

where z is productivity, K is capital and N is aggregate effective labor supply. The sequence z evolves according to the following stochastic process,

$$\log z' = \rho_z \log z + v'$$

where v *iid* $N(0, \sigma_v^2)$. There is an additional source of income in this economy denoted by p , described by the following stochastic process,

$$\log p' = \mu_p + \rho_p \log p + \eta'$$

where η *iid* $N(0, \sigma_\eta^2)$. We can think of p as revenues coming from the exploitation of a commodity that does not require inputs. I assume these revenues are owned by the government. Aggregate income in this economy is $Y = y + p$.

2.1 Household's Problem

The economy is inhabited by a continuum of infinitely lived agents of measure 1. Each period agents consume c units of the good and accumulate assets a subject to a borrowing limit $\underline{a} \leq 0$. Households differ in labor efficiency, denoted by $h \in H$, which follows a Markov process with transition probability $\pi_h(h'/h)$. They also face idiosyncratic employment shocks $\epsilon \in E = \{e, u_{sr}, u_{lr}\}$. If $\epsilon = e$ then the agent is employed and receives the market wage w times effective hours $h\ell$, where ℓ is working hours. Otherwise the agent is unemployed and receives a fixed amount $\omega(h)$ as income, which is not provided by the government. Two unemployment states are considered in order to introduce differences between short and long-term unemployment, denoted by u_{sr} and u_{lr} , respectively. The difference between the two relates to the probability of finding a job, which is lower for the long-term unemployed. The sequence ϵ follows a Markov process with transition probability $\pi_\epsilon(\epsilon'|z', \epsilon, h, z)$.⁶ The dependence on the aggregate transition z', z captures the correlation between aggregate fluctuations and idiosyncratic risk as first introduced by [Imrohoroglu \(1989\)](#), which is key

⁶This transition is restricted so $\pi_\epsilon(u'_{sr}|z', u_{lr}, h, z) = \pi_\epsilon(u'_{lr}|z', e, h, z) = 0$, and $\pi_\epsilon(e'|z', u_{lr}, h, z) \leq \pi_\epsilon(e'|z', u_{sr}, h, z)$, for all z', h, z .

to obtain sizeable welfare effects from business cycle fluctuations (Krusell et al., 2009). The fact that h enters the transition means that average unemployment rates and their standard deviations may differ among groups.

Households face a constant tax τ on wages and rental income and receive transfer payments from the government, which in the aggregate are provided in an amount t . The government spend an amount g on goods and services. Since the focus is on transfers, I assume g doesn't provide utility to households. Each spending component is a fixed fraction of total spending $s = t + g$.

Transfers are not provided uniformly across the population or specific groups of agents with the same individual state variables. The reason is that in emerging countries there is not a clear relationship between transfers received by households and their income, as I show below. I define $\gamma \in G = \{0, 1\}$ as an indicator that takes the value 1 when the family receives transfers and 0 otherwise. This variable follows a Markov process characterized, in the benchmark case, by a transition function $\pi_\gamma(\gamma'/t')$. Therefore receiving transfers is stochastic. Conditioning by t' makes the probability of receiving transfers, and hence the fraction of the population receiving them, a function of the aggregate spending on transfers. As it is the case with the other stochastic individual state variables this scheme generates precautionary behavior. More importantly it also implies that there are no permanent ex-ante differences across agents in their access to transfers.

Individual state variables are $(a, h, \epsilon, \gamma) \in Q = \mathcal{A} \times H \times E \times G = [-\underline{a}, \infty) \times \{h_1, \dots, h_{N_h}\} \times \{e, u_{sr}, u_{lr}\} \times \{0, 1\}$. I denote by \hat{t} the transfer received by each household with $\gamma = 1$. Therefore $\hat{t} = t / \int \gamma d\Phi$. The cross-section distribution over individual state variables is $\Phi(a, h, \epsilon, \gamma) \in \mathcal{M}$. Finally, let $\Delta = \{z, p, s, B\} \in \Lambda$ denote the vector of aggregate state variables, where B is government debt.⁷ The household problem is

$$\begin{aligned} V(a, h, \epsilon, \gamma; \Delta) &= \max_{c, a' \geq \underline{a}} \left\{ u(c) + \beta E \left[V(a', h', \epsilon', \gamma'; \Delta') \right] \right\} \\ \text{s.t. } c + a' &= I_{\epsilon=e} (1 - \tau)w(\Delta)h + (1 - I_{\epsilon \neq e})\omega(h) + \left(1 + (1 - \tau)r(\Delta) \right) a/q + \gamma \hat{t}(\Delta) \\ B' &= \Omega(\Delta) \end{aligned}$$

where Ω is the perceived law of motion of public debt B and $I_{\epsilon=e}$ is an indicator function that takes the value of 1 when $\epsilon = e$. Denoting by $\pi(h', \epsilon', \gamma' | z', t', h, \epsilon, z)$ the joint conditional probability of (ϵ, h, γ) , and by $J(z', p' | z, p)$ the joint conditional distribution of aggregate shocks,

⁷I make the simplifying assumption that taxes are levied on domestic capital, instead of total assets, returns, and that the same happens in the rest of the countries. This means that the government budget balance, and hence the law of motion for public debt, don't depend on A but in K . Together with the fact that r is constant, this implies that the wealth distribution is not a state variable in the consumer's problem.

$$E\left[V(a', h', \epsilon', \gamma'; \Delta')\right] = \int \int \sum_{\substack{h' \in H, \epsilon' \in E, \\ \gamma' \in G}} \pi(h', \epsilon', \gamma' | z', t', h, \epsilon, \gamma, z) V(a', h', \epsilon', \gamma'; \Delta') dR_j(s' | \Delta) dJ(z', p' | z, p).$$

The conditional distribution of public spending, denoted by $R_j(s' | \Delta')$, is defined in the next section.

2.2 Fiscal Policy

The government budget balance is the following,

$$B' + p + \tau(rA + w(\Delta)N) = (1 + r)B + g + t \quad (1)$$

where A denotes aggregate assets holdings.

I assume public spending $s = g + t$ is exogenously determined by the aggregate state, plus a stochastic component. This is the fiscal rule we want to evaluate. In particular I assume the following stochastic formulation

$$s' = \Gamma(\Delta) + \mu \quad (2)$$

where $\mu \text{ iid } N(0, \sigma_\mu^2)$ captures exogenous shocks to fiscal spending. Therefore (2) define the conditional distribution $R_j(s' | \Delta)$, where j indexes the specific form taken by Γ .

Note that output, fiscal revenues, and public debt are fully determined by Δ , and hence the expression allows for rules that set s in terms of any of them, using any functional form.⁸ In the numerical part I evaluate a transition form a procyclical rule, where y enters Γ positively, to rules that either don't depend on y or depend on it negatively.

2.3 Equilibrium Definition

Definition 1. For a given fiscal rule R_j , a recursive competitive equilibrium is a value function V , policy functions a' and c , a pricing function w , and law of motions Ω , M , and Ψ , such that,

1. V satisfies the household's Bellman equation and a' and c are the associated policy functions, given $w(\Delta)$.
2. K, N satisfy, given $w(\Delta)$,

$$\begin{aligned} r &= zF_K(K, N) - \delta \\ w(\Delta) &= zF_L(K, N) \end{aligned}$$

⁸The stochastic nature of the rule and of public revenues doesn't ensure a stationary debt to GDP ratio and hence the stock of debt needs to be introduced in Γ to achieve stationarity.

3. For all $\Delta \in \Lambda$,

$$\begin{aligned} \int a'(a, h, \epsilon, \gamma; \Delta) d\Phi &= A' = K' + F' + B' \\ \int hI_{\epsilon=e} d\Phi &= N \\ \int c(a, h, \epsilon, \gamma; \Delta) d\Phi + K' + F' + g &= y + p + (1 - \delta)K + (1 + r)F + \int (1 - I_{\epsilon \neq e})\omega(h) d\Phi \end{aligned}$$

where F is the stock of foreign assets

4. The aggregate law of motion Ω is generated by the government budget constraint (1), and Ψ is generated by the exogenous conditional distributions $J(z', p'/z, p)$, $R_j(s'/\Delta)$, and π , and the policy function a' .

3 Calibration

The aim of the calibration is that the equilibrium outcomes under the benchmark procyclical rule R_p match those of the average emerging economy, in terms of macroeconomic aggregates as well as relevant moments at the micro level. Once I calibrate the model under R_1 the only parameters I modify to solve the model for the alternative acyclical (R_a) and countercyclical (R_c) rules are those associated to the function Γ .

A period is set to be a quarter. The interest rate r is set at 1% per quarter. and the value of β is such that foreign assets are zero on average. For preferences I assume first a CRRA formulation with a coefficient of risk aversion σ of 2. For technological parameters I pick standard values, i.e. $\alpha = 0.36$ and $\delta = 0.025$.

To define the labor efficiency groups I use data from the WDI for the sample of emerging countries. I first define three groups; low, middle and high income individuals. Hence $H = \{h_l, h_m, h_h\}$. Based on data availability I classify these groups according to the level of education: individuals with primary, secondary, and tertiary education. Table 1 shows the main statistics. In the sample of emerging countries each group represents on average 31%, 46% and 23% of total population, respectively. To obtain this as the distribution of skills in the model I constrain the transition matrix $\pi_h(h'|h)$ accordingly. The other target to parameterize the transition matrix is the expected duration in each of the states. Since there is no data on this for emerging economies I set the expected value of being in the groups of low and high education to be 40 years, i.e. roughly the length of a working lifetime. For income I set the values in H , which determine earnings differences between groups, to match the fraction of income in the data going to the richest 20% and to the poorest 40%, which roughly coincide with the population with tertiary and primary education, respectively. Normalizing $h_l = 1$, this implies $h_m = 2.3$ and $h_h = 6.6$, according to WDI data in the group of emerging economies.

Efficiency Units	% Pop	Income	Unemp.	Vol. Unemp.
<i>Primary Education, h_l</i>	30.9	1.0	1.00	0.24
<i>Secondary Education, h_m</i>	46.1	2.3	0.63	0.27
<i>Tertiary Education, h_h</i>	23.0	6.6	0.30	0.30

Notes: first two columns are based on annual data from the WDI for 22-24 emerging countries. Income matches the % of total income going to richest 20% and 60%, and it's relative to the group with primary education. Unemp. and Vol. Unemp. are based on quarterly data from ILO for 12 emerging countries. Vol. Unemp. is the ratio between the standard deviation and average unemployment.

Table 1: Calibration, Labor Efficiency

Following a usual practice in the literature to better approximate the observed wealth distribution (see e.g. [Gornemann et al., 2016](#)), I add a fourth group h_s . This group represents 1% of the population and its income process is parameterized such that the first two deciles accumulate 70% and 20% of total wealth in the economy. These numbers correspond to the means across the 15 countries for which [Davies et al. \(2010\)](#) report wealth by quintile. For the rest of the calibration I assume the group h_s has the same properties than the high-education, high-income group h_h .

I assume a different unemployment process for each labor efficiency group. I use quarterly data from ILO to compute the average and volatility of the unemployment rate for different educational groups. As shown in [Table 1](#), where I show the differences with respect to the group of primary education, the unemployment rate is lower the higher the level of education. Agents with secondary and tertiary education have on average unemployment rates that are about 60 and 30% of the one shown by the group least educated. For volatility I compute the ratio of the standard deviation to the average unemployment rate for each group. This statistic is increasing in education since the standard deviation doesn't increase as much as the average as education raises. For non-market income I set $\omega(h) = 1\%$ of average labor income, hw .

In the case of the allocation of transfer payments, π_γ , I use a value of 0.5 in the baseline computations whenever t is equal to its average, i.e. $\pi_\gamma(\gamma'|t' = \bar{t}) = 0.5$. Then I fix the amount of individual transfers to the size that is consistent with this (50% of the population receiving a total amount \bar{t} of transfers) for any other level of t . Hence any change in t translates into a change in the number of families receiving transfers, i.e. a change in π_γ . Individual states don't affect the probability of receiving transfers. This choice is made based on data from the WDI on subsidies for emerging economies, which suggest that transfers are uniformly provided across the population, and that only a fraction of it receives some transfer from the government.⁹

The parameters governing aggregate shocks are chosen to match macroeconomic moments observed in emerging countries. For the productivity parameter z I use three states, z_l , z_m , and z_h ,

⁹For instance, according to the WDI, in the group of emerging countries the percentage of benefits going to the poorest quintile are 18%, 27%, and 7%, for labor market, social assistance, and social insurance programs, respectively. And the percentages of the population receiving benefits are 5%, 43%, and 30%, respectively.

no immediate transitions between the extreme values z_h and z_l , and a symmetric transition matrix to obtain an autocorrelation parameter of 0.78, and a standard deviation of 3.2%, for quarterly GDP. These numbers correspond to the average persistence and standard deviation of quarterly GDP for a group of 23 emerging countries according to the IFS. It is worth to notice that the standard deviation in this group of countries is much higher than the 1.8% shown by the group of 32 developed countries included in the database.

Since I follow [Krusell and Smith \(1998\)](#) in modeling the relationship between aggregate and idiosyncratic shocks, there is a one-to-one mapping from the parameter z to the unemployment rate of each of the efficiency groups.¹⁰ Hence the first moments I use to calibrate the transition matrices are the average unemployment rate and its volatility for each group as reported in [Table 1](#), and the average aggregate unemployment rate. This last variable is set to 8.8%, which is the average for 20 emerging countries according to the IFS.¹¹

Additionally I match average unemployment duration. I use data from ILO, which reports the fraction of unemployed people that has been in such a state less than 2 quarters, between 2 and 4 quarters, and more than 4 quarters. In a group of 20 emerging countries this fractions are on average 54%, 15%, and 31% respectively. To obtain these statistics in the model I calibrate the implied exit and finding rates, and I assume these are the corresponding rates in normal times, i.e. whenever $z = z_m$. I obtain an expected unemployment duration of 2.3 quarters, which raises to 5.6 quarters when the unemployed has been in such condition for a quarter already, i.e. $\epsilon = u_{lr}$. For the other realizations of the productivity shock I take the average of all the observations that are lower than the 10th percentile, and of those that are higher than the 90th percentile, across all emerging markets. Then I assume that in a recession the fraction of unemployed people with less than 2 quarters corresponds to the average of the observations below the 10th percentile, and that of people with more than 4 quarters corresponds to the average of the observations above the 90th percentile. For an expansion I do the opposite assumption.¹² These fractions are reported in [Table 2](#), together with the implied unemployment durations for each of the aggregate productivity realizations.¹³

It is left to show how the parameters related to fiscal policy are set. For the size of the

¹⁰In the data the persistence of the unemployment rate is higher than the one for output. The calibration strategy however impose the persistence of z to the unemployment process. This means that shocks will be larger but less persistent than what the data shows.

¹¹This implies average unemployment rates of 13.1%, 8.3%, and 4% for the groups of primary, secondary, and tertiary education, and corresponding standard deviations of 3.2%, 2.3%, and 1.2%.

¹²Note that what is needed is expected duration assuming that the economy stays forever with the corresponding realization of the aggregate productivity shock.

¹³For the rest of the parameters needed to calibrate the transition of idiosyncratic unemployment shocks π_ϵ , I follow closely [Krusell and Smith \(1998\)](#), extended to three possible realizations of the aggregate shock. In particular I assume $\pi_\epsilon(u_{lr}/u_{lr}, z'_h, z_m) = 0.75\pi_\epsilon(u_{lr}/u_{lr}, z'_h, z_h)$, $\pi_\epsilon(u_{lr}/u_{lr}, z'_m, z_l) = 0.75\pi_\epsilon(u_{lr}/u_{lr}, z'_m, z_m)$, $\pi_\epsilon(u_{lr}/u_{lr}, z'_m, z_h) = 1.25\pi_\epsilon(u_{lr}/u_{lr}, z'_m, z_m)$, and $\pi_\epsilon(u_{lr}/u_{lr}, z'_l, z_m) = 1.25\pi_\epsilon(u_{lr}/u_{lr}, z'_l, z_l)$. But since the last probability is close to one I set $\pi_\epsilon(0/0, z'_l, z_m) \simeq 1$.

	% of unemployed		Expected duration	
	< 2q	> 4q	Uncond.	Long-term
<i>Recession, z_l</i>	22.3	62.6	6.9	9.8
<i>Normal times, z_m</i>	53.7	31.1	2.3	5.6
<i>Expansion, z_h</i>	93.6	2.4	1.4	1.4 [†]

Notes: % of unemployed is the fraction of the unemployed people that has been in that situation for less than 2 quarters (< 2q) and for more than four quarters (> 4q). Averages for 20 emerging countries from ILO. See the text for details on the classification with respect to z . Expected duration is expressed in quarters and it is derived from % of unemployed assuming fixed exit and finding rates. Uncond. is the expected duration of unemployment for an agent transiting from employment to unemployment. Long-term is expected duration of remaining unemployment for an agent that has been already unemployed for a quarter. †: the implied value is 1.2 but I restrict finding rates for u_{lr} to be higher or equal to those for u_{sr} .

Table 2: Calibration, Unemployment Duration

government I use data from the WDI on total expenses, which are 27.8% of GDP on average in the sample of emerging countries. Tax revenues represent 85% of total revenues in the same group of countries. I calibrate the tax rate and the average value of p to obtain these numbers. To calibrate the standard deviation and persistence of the p process I match the annual standard deviation and persistence of total revenues to the one observed in the data, which according to the WDI are 2% of GDP and 0.23, respectively. I assume no correlation between p and z in the baseline model. Unfortunately good data on transfer payments is scarce. I assume half of total expenditure goes to spending in goods and services, or g in the model, and half to transfer payments, or t .¹⁴

Finally I calibrate the function $\Gamma(\Delta)$. The strategy is that under R_p public spending behaves as in the average emerging country. To measure the degree of procyclicality in the data I estimate the following equation for each country

$$\log(E_t) = \beta + \beta_y \log(GDP_t) + \beta_s \log(E_{t-1}) + \mu_t \quad (3)$$

where E is fiscal spending and GDP is output, both detrended using the HP filter. I estimate these regressions with annual data from 1980 to 2014 from the WDI for 24 emerging countries. For spending I use general government final consumption expenditure. Although it doesn't include transfer payments it is the only spending variable with enough coverage to run the regressions for emerging countries. Since transfer payments seems to be one of the most procyclical spending categories in emerging countries (see e.g. [Ilzetzi and Végh, 2008](#); [Ilzetzi, 2011](#)), the coefficient probably will underestimate the welfare effects when focusing on transfer payments only. The average value of the coefficients in the group of emerging countries are $\beta_y = 0.71$ and $\beta_g = 0.47$. This means a high degree of procyclicality. The same averages for the group of developed countries are $\beta_y = 0.32$ and $\beta_g = 0.64$.¹⁵ The average developed country is very close to the less procyclical

¹⁴ Assuming public investment is zero in the data as it is in the model.

¹⁵ And for the larger sample of 134 developing but non-emerging economies the same coefficients are $\beta_y = 0.66$ and $\beta_g = 0.39$, very close to the average of emerging countries.

emerging country, which has a β_y coefficient of 0.24. To match this behavior in the model I assume a log-linear specification for $\Gamma(\Delta)$, similar than the one estimated but for the model periodicity, which is quarterly, and including in addition the debt to GDP ratio to ensure its stationarity (otherwise the stochastic components of spending and revenues would make it non-stationary).¹⁶ I calibrate this function to obtain the values of the estimated coefficients when estimating the same regression but with data from model simulations. To calibrate the coefficient on debt I match the standard deviation of the public debt to GDP ratio, adjusted by a linear trend, which for a group of 24 emerging countries is 11% of GDP according to the database constructed by [Abbas et al. \(2010\)](#). Finally I set σ_μ to obtain the average standard deviation of total spending in the group of emerging economies, which is 1.9% of GDP based on WDI data.

When switching from R_p to the others rules I only change the elasticity of Γ to y such that in the regressions with the simulated data the coefficient on y is 0 in the case of R_a and -0.71 in the case of R_c . The first is close to the minimum coefficient estimated for the group of developed countries. The second coefficient is not observed in the data but could give a better idea about the optimal conduct of fiscal policy.

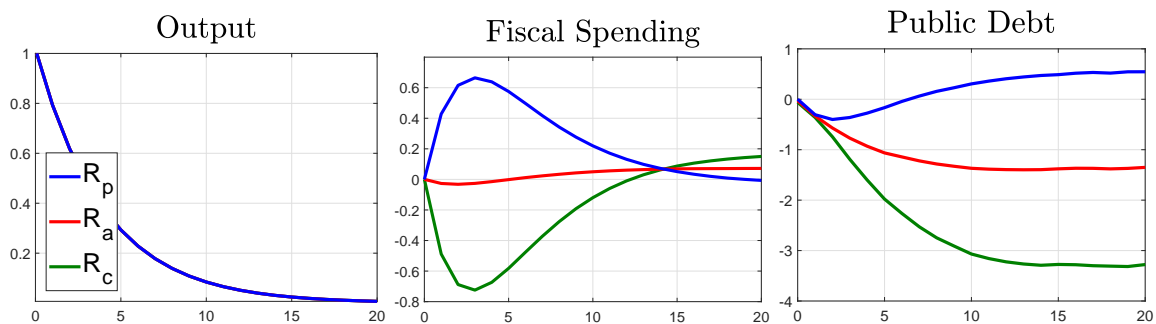
4 Results

Before computing welfare effects I briefly describe the equilibrium outcomes under each rule to better understand how the model works and the mechanisms behind the results. Since this is a small-open economy, capital, labor and prices are exogenously given, and hence fiscal rules only affect public accounts, consumption and savings.

First I show how fiscal rules work quantitatively in the model. [Figure 1](#) depicts impulse-response functions to a productivity shock under each rule. The shock is normalized such that the impact effect on output is 1% (left graph). The blue line in the middle graph, corresponding to R_p , illustrates the observed procyclical behavior of fiscal spending in emerging economies, as captured by the estimation described in the last section. Fiscal spending rises about 0.65% three quarters after the shock, and converges slowly to its average level. In the acyclical case R_a , which corresponds to the red lines in [Figure 1](#), spending doesn't react significantly to the shock, while in the countercyclical rule R_c the response is the opposite than in the procyclical case. These responses generate different patterns for public debt as shown in the right panel. Debt falls significantly under R_c and remains at low levels for more than 15 quarters. Under R_p debt falls as well but only transitorily, since it rises once the increase in fiscal spending counteracts the effect of higher revenues. After 20 quarters public debt is around 0.5% of GDP under R_p , -1.5% under R_a and around -3.5% of GDP under R_c .¹⁷

¹⁶When including debt in the regression the coefficients of interest are practically unchanged, but the coefficient on debt is too small to ensure stationarity.

¹⁷The response of private consumption to the productivity shock, not shown to save space, is positive and larger for



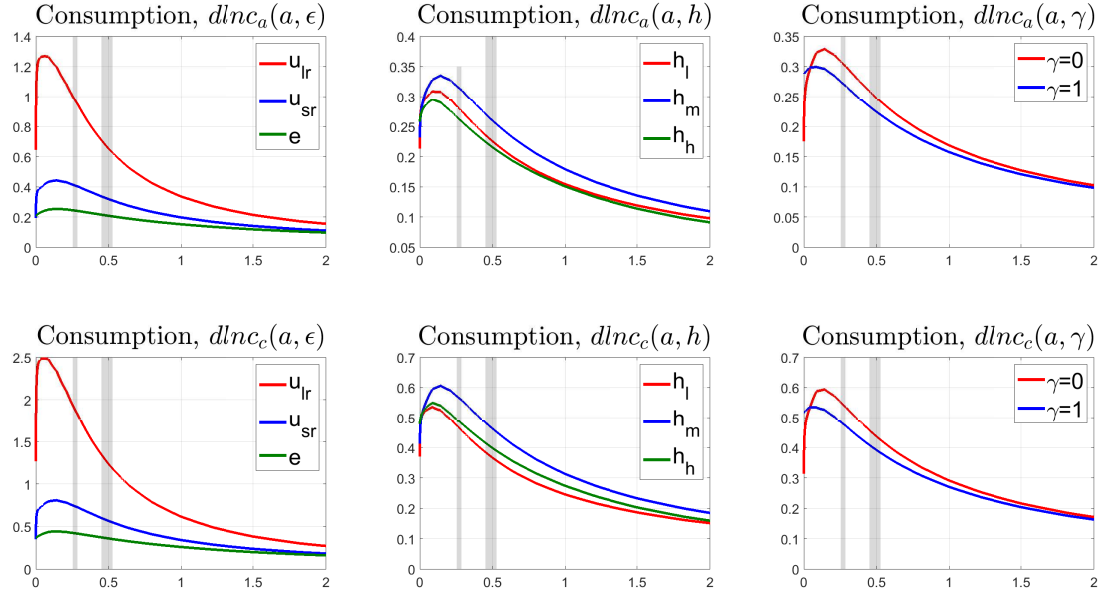
Note: Impulse responses to a shock in z , with its size normalized such that the impact effect on output is 1%. Output, fiscal spending, consumption and assets are in logs; public debt is expressed as a % of GDP.

Figure 1: Impulse-Response Functions to a Productivity Shock

The different fiscal responses to productivity shocks, which also affect wages and labor finding and exit probabilities, influence the behavior of individual agents. In particular the more procyclical is the rule the larger is the accumulation of assets by individuals due to precautionary motives. To see this Figure 2 compares policy functions for consumption under the different fiscal rules. It shows percentage differences between R_a and R_p (upper panel), and between R_c and R_p (lower panel), as a function of individual assets in the x-axis (as a fraction of annual GDP per capita) and employment status (left), efficiency units (center), and whether agents receive or not transfers (right). Shaded bars show the range of assets hold by agents belonging to the middle quintile of each of the labor efficiency groups. As expected the main feature that can be observed is that, particularly poor agents, increase their consumption, and therefore reduce their savings, when moving from R_p to a less procyclical fiscal rule. The effect is stronger for long-term unemployed workers, with increases in consumption close to 2.5% and 1.3% when moving to R_c and R_a respectively. As agents become wealthier precautionary motives loss importance because agents can self-insure themselves against labor risk.

The change in consumption and saving decisions translates into dynamic aggregate effects when the economy switches rules. Figure 3 shows the dynamics of assets and consumption when an economy switches from R_p (blue line) to R_a (red line) or R_c (green line). In the upper-left graph the path for assets is depicted. Assets fall slowly but steadily after the transition, achieving levels that are 0.15% and 0.3% slower than what would be observed without the switch. Consumption increases around 0.1% (R_a) and 0.2% (R_c) in the first quarter after the transition, and then slowly converges to a level that is slightly lower to the one without the switch. Since the effect on consumption is heterogeneous, with poor agents experiencing a larger increase, there is a temporary fall in consumption dispersion, as shown in the upper-right panel. In the lower panel I distinguish

wealth-poor agents due to incomplete financial markets (Krueger et al., 2016). In terms of fiscal rules, the short-run consumption response is stronger the more procyclical is fiscal spending because more transfers allow agents that are financially constrained to increase their level of consumption.



Note: Percentage difference between consumption policies under R_a (upper panel) and R_c (lower panel) relative to R_p . Policies are evaluated at $B = 0$, weighting the rest of the state variables according to their stationary distributions. On the horizontal axis is the amount of individual assets as a fraction of annual income per capita. Shaded bars show the range of assets for agents belonging to the middle quintile of the two lowest efficiency groups according to the average wealth distributions under R_p .

Figure 2: Percentage Differences between Policy Functions, R_c vs. R_p

the consumption response of the different labor efficiency groups. The change ranges from 0.2% and 0.4% in the case of the low-skilled group, to less than 0.1% in the case of the high-skilled group.

It is worth to notice that the calibration exercise doesn't aim to match the wealth distribution across the poorest quintiles. Indeed the model generates a less unequal wealth distribution than what is commonly reported at least for developed economies. The first and second quintiles accumulate around 1.6% and 2.9% of total wealth, respectively, while in the data these fractions are near 0% (Krueger et al., 2016; Kuhn and Ríos-Rull, 2016; ?). Under these the consumption response to the switch in rules depicted in Figure would be larger.

As can be seen in Figure 3 the change in consumption is only transitory. Since assets are permanently reduced consumption falls in the long-run. I obtain long-run effects comparing the average of different variables after simulating economies with different rules for a large number of periods. Assets fall around 0.6% of GDP when comparing R_a with respect to R_p , and by 2% of GDP when considering R_c , while consumption falls only slightly, in 0.01% and 0.02% of GDP, respectively. The switch in rules increases inequality in the long-run as the lower quintiles accumulate a lower fraction of total assets with acyclical or countercyclical fiscal policies. I also compute volatilities for each variable. The main effects come from public accounts. The annual standard deviations of public spending and debt go from the calibration targets 1.9 and 11% of GDP under R_p , to 1.7 and 12% of GDP under R_a , and 2.05 and 15% of GDP under R_c , respectively. Since wealth-poor agents

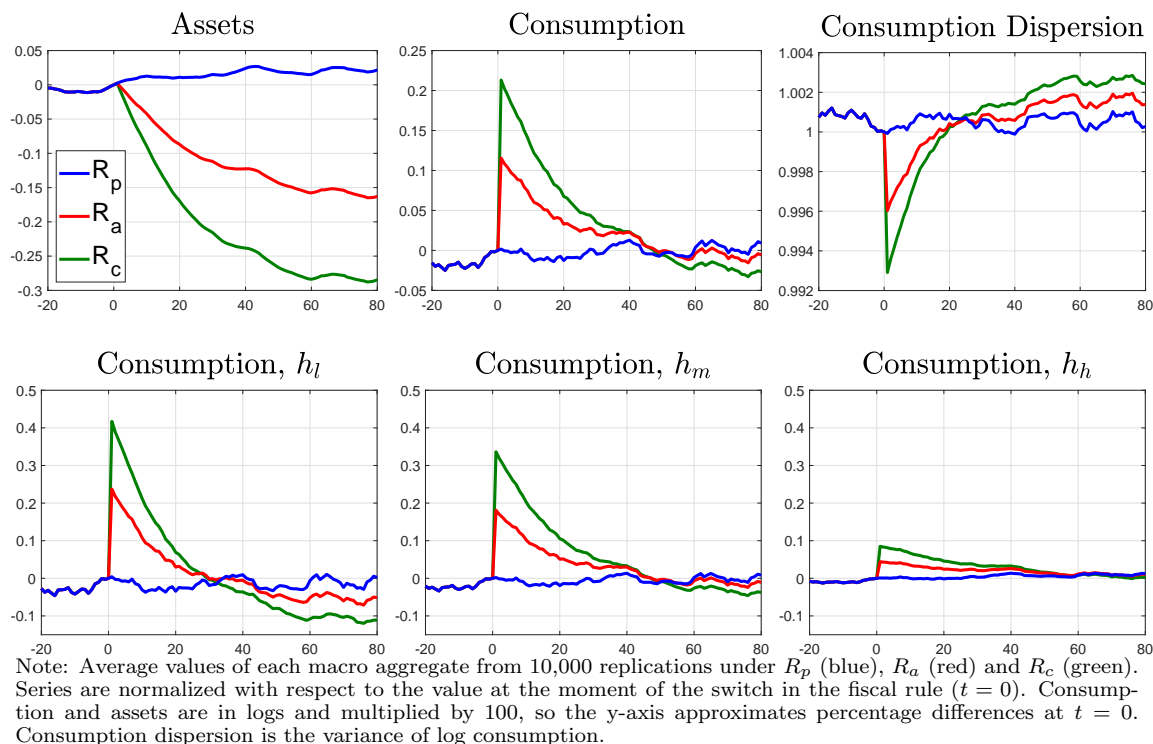


Figure 3: Transition from a Procyclical to Acyclical and Countercyclical Fiscal Rules

become even poorer consumption becomes more volatile although the effect is quantitatively small.

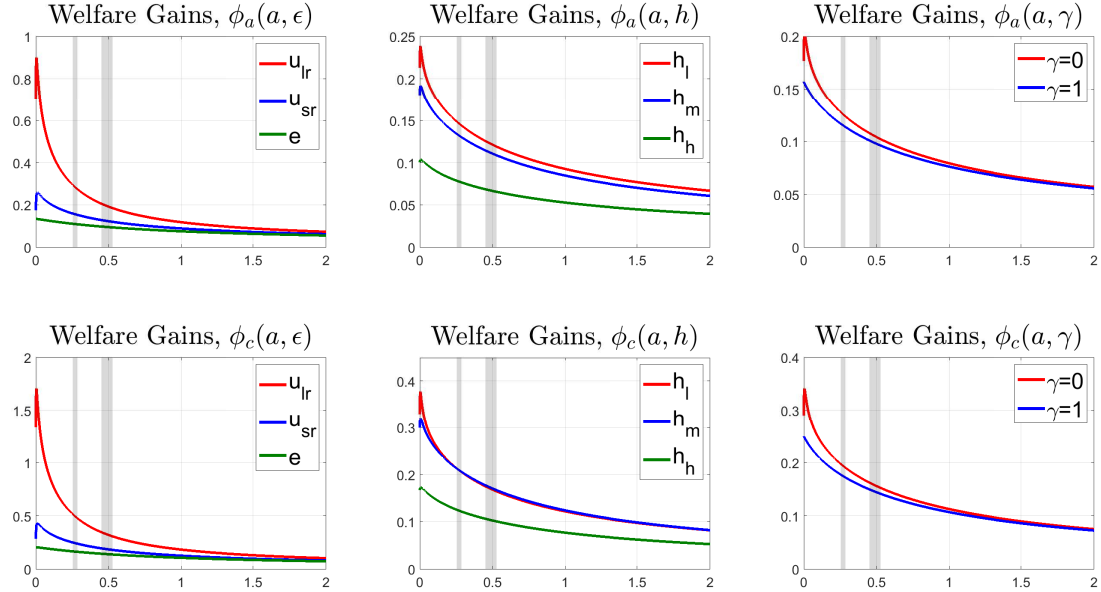
5 Welfare Analysis: Baseline Results

In this section I measure consumption gains of switching from the procyclical fiscal rule (R_p) to an acyclical (R_a) and countercyclical (R_c) rules, using the baseline model and calibration. I compute the equivalent-variation welfare gain for households of type (a, h, ϵ, γ) from an unexpected switch from R_p to R_a or R_c occurred at $t = 0$, after the value of Δ is realized and before decisions are made. This is the value of ϕ that solves,

$$E \left[\sum_{t=0}^{\infty} \beta^t u(c_t^p (1 + \phi_j)) / a_0, \epsilon_0, h_0, \gamma_0; \Delta_0 \right] = E \left[\sum_{t=0}^{\infty} \beta^t u(c_t^j) / a_0, \epsilon_0, h_0, \gamma_0; \Delta_0 \right]$$

where $\{c_t^j\}_{t=0}^{\infty}$ are equilibrium allocations for households facing the rule R_j , with $j = a, c$. Unless noted differently I present gains that are conditional on individual state variables, evaluating them in the mean values of K and B under R_p , and the stationary distribution over the rest of aggregate state variables, also under R_p . I also compute expected gains conditional on a sub-set of individual state variables using the stationary distributions for the rest of these.

Figure 4 shows the value of ϕ for different combinations of individual state variables in the



Note: ϕ^a and ϕ^c are consumption gains, in percentage points, of moving from R_p to R_a and R_c , respectively. It only considers the effects of transfers since spending is not an argument in the utility function. Gains are evaluated at the average value of B and the stationary distribution of the rest of the state variables under R_p . Each graph presents the results as a function of assets and either ϵ (left), h (center), or γ (right). In each case they are averaged with respect to the rest of the individual state variables according to their stationary distribution. On the horizontal axis is the amount of assets as a fraction of annual income per capita. Shaded bars show the range of assets for agents belonging to the middle quintile of the two lowest efficiency groups according to the average wealth distributions under R_p .

Figure 4: Welfare Costs of Procyclicality, by Individual Characteristics

baseline case. The upper panel shows ϕ_a , the gains of switching from R_p to R_a , and the lower panel shows ϕ_c , the gains of switching from R_p to R_c . The left-hand graph shows gains as a function of employment status, the middle graph as a function of labor efficiency, and the right-hand graph as a function of whether the household receives or not transfers from the government. In the horizontal axis are assets as a fraction of annual GDP per capita. Again shaded bars show the middle percentile of the wealth distribution of each labor efficiency group. The first important feature is that ϕ is positive in all cases. This is due to the insurance role of the rule, which is isolated from other potential effects of the fiscal switch in the baseline case. Since the old rule gave negative insurance agents are better off, and able to reduce their level of precautionary assets and to temporarily increase their consumption, as already shown in Figure 2.

The second clear feature observed in Figure 4 is that in general gains decrease monotonically with the level of assets.¹⁸ Wealth-poor agents are benefited the most from the switch in the rule, as self-insurance is much costly for them. Also, fixing the level of individual assets, agents more favored by the reform are those with lower expected value of income and those who face higher idiosyncratic risks. Hence gains are higher for unemployed workers, particularly long-term unemployed facing

¹⁸This is not true very close to $a = 0$ since this agents don't have a margin to increase consumption besides their labor income.

low finding rates (left-hand graph), low-efficiency workers (middle graph), and households that are currently not receiving transfers, although in this last case effects are small since there is not persistence in γ .¹⁹

A final pattern that is clear from Figure 4 is that gains increase roughly linearly with the degree of fiscal countercyclicality since in every case ϕ_c is about twice as large than ϕ_a .

Overall the effects are quantitatively important, but very heterogeneous. In the case of a switch to the countercyclical rule, they go for more than 2% of permanent consumption for wealth-poor, low-skilled, long-run unemployed agents receiving transfers, to virtually zero for wealth-rich agents, independently from their other individual characteristics. In the case of employed workers the gains are close to 0.25 for wealth-poor and low-efficiency agents. These are agents facing relatively high unemployment risk in the future and lacking the resources to self-insurance against them.

Due to the heterogeneous nature of the results when aggregating welfare gains results are obviously smaller, although still comparable with previous literature. It is worth to notice as well that averages are extremely sensitive to the wealth distribution used for aggregation. Indeed since the model underestimates inequality the results tend to underestimate average welfare costs.²⁰

Tables 3 and 4 report average gains after aggregating welfare gains according to the average wealth distribution generated by the model under R_p , for the case of a switch from P_p to R_a and R_c , respectively. In addition to average gains for the entire population I also present results for each quintile of the wealth distribution and for those with zero assets, as well as the same averages but for each groups of agents with the same individual characteristics. In the first column I report the fraction of total assets that each group accumulates.

Considering the switch to the countercyclical fiscal rule the average gain for the first and second quartiles, without differentiating among other individual characteristics, are 0.22 and 0.18 percentage points, respectively. These represent roughly 30 and 25% of the gains of agents with zero wealth, illustrating the great incidence of underestimating inequality as already mentioned since in the model these quartiles accumulate around 4.5% of total wealth, a number that in the data is close to 0 (Krueger et al., 2016; Kuhn and Ríos-Rull, 2016).

Figure 5 presents a summary of the results. There are large differences between wealth quintiles, labor status and labor efficiency. Labor status shocks are relatively shorter but the loss in income is larger. Transfer payments don't make a large difference since in the baseline case they are not persistent.

¹⁹In this case the direction of the effect depends on labor status. For wealth-poor unemployed workers gains are larger when receiving transfers since they are able to increase consumption in a larger amount. But for employed workers gains are larger when not receiving transfers since they are poorer.

²⁰In the baseline scenario this shouldn't have a large effect on welfare costs fixing the level of assets, i.e. results depicted in Figure 4, because aggregate effects are minimal in a small-open economy without real effects of fiscal policy.

		Labor Efficiency					Employment Status			Transfers	
	Wealth	All	h_l	h_m	h_h	h_s	u_{LR}	u_{SR}	e	$\gamma = 0$	$\gamma = 1$
$a = 0$	0	0.32	0.33	0.32	0.29	0.01	0.65	0.13	0.14	0.37	0.28
Q1	1.6	0.12	0.13	0.11	0.03	0.01	0.35	0.14	0.11	0.13	0.11
Q2	2.9	0.10	0.12	0.09	0.02	0.01	0.24	0.12	0.09	0.10	0.09
Q3	5.8	0.07	0.11	0.08	0.01	0.01	0.19	0.11	0.07	0.08	0.07
Q4	20	0.03	0.10	0.06	0.01	0.00	0.11	0.07	0.03	0.03	0.03
Q5	70	0.01	0.07	0.02	0.00	0.00	0.02	0.02	0.01	0.01	0.01
All	100	0.07	0.11	0.07	0.01	0.01	0.18	0.09	0.06	0.07	0.06

Note: The table shows ϕ_a , which is consumption gains, in percentage points, of moving from R_p to R_a , for each of the groups of the wealth distribution defined in the first column. In the second column I report the fraction of total wealth accumulated by each group according to the average wealth distribution under R_p . It only considers the effects of transfers since spending is not an argument in the utility function. Gains are evaluated at the average value of B and the stationary distribution of the rest of the state variables under R_p . The third column present the result for all agents, while the rest of the columns do so for specific groups. In each case gains are averaged with respect to the rest of the individual state variables according to their stationary distribution.

Table 3: Welfare Effects of Switching from R_p to R_a

6 Conclusions

In this paper I asses quantitatively the costs of fiscal cyclicity for a typical emerging economy. To do this I build a model of heterogeneous agents and incomplete markets that allows to pursue a welfare analysis of different fiscal rules, which in the model are defined as a particular relationship between total fiscal spending and the aggregate state of the economy. A fraction of fiscal spending is given directly to ceratin families in the economy and then makes disposable income correlated to aggregate spending. In the quantitative analysis I focus on three of such rules. The first one mimics the procyclical conduct of fiscal policy typically observed in emerging countries, with a short-run elasticity of spending to GDP of 0.71%. The second rule generates an acyclical pattern for fiscal spending, while the third one corresponds to a countercyclical rule with a short-run elasticity of -0.71. I find substantial and very heterogeneous gains from procyclicality. They go from close to zero for wealth-rich agents to more than 2% and 0.25% for wealth-poor unemployed and employed agents, respectively, in permanent consumption equivalents. Fiscal cyclicity has been largely studied by previous literature. However this is the first paper that assess quantitatively its welfare effects due to its insurance nature and its associated distributional effects.

References

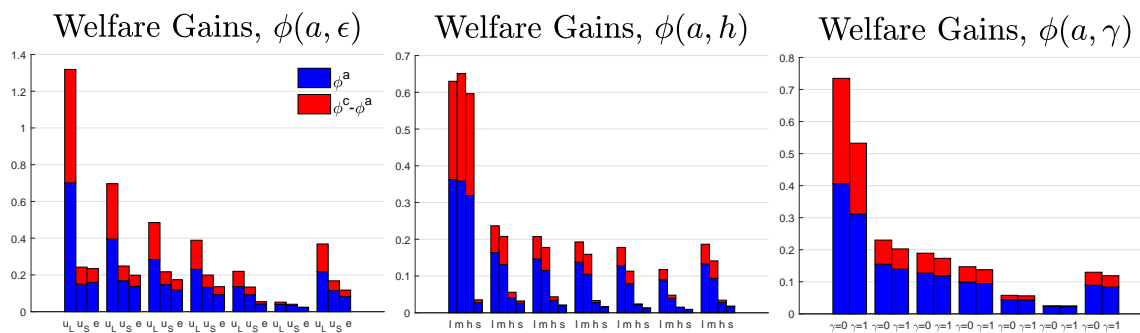
- ABBAS, S., N. BELHOCINE, A. A. ELGANAINY, AND M. HORTON (2010): “A historical public debt database,” .
- AIYAGARI, S. R. (1994): “Uninsured idiosyncratic risk and aggregate saving,” *The Quarterly Journal of Economics*, 109(3), 659–684.

		Labor Efficiency					Employment Status			Transfers	
	Wealth	All	h_l	h_m	h_h	h_s	u_{LR}	u_{SR}	e	$\gamma = 0$	$\gamma = 1$
$a = 0$	0	0.62	0.62	0.63	0.58	0.03	1.27	0.25	0.24	0.71	0.53
Q1	1.6	0.22	0.24	0.20	0.05	0.03	0.67	0.25	0.20	0.22	0.21
Q2	2.9	0.18	0.21	0.17	0.04	0.02	0.46	0.22	0.17	0.18	0.17
Q3	5.8	0.14	0.19	0.15	0.03	0.02	0.37	0.20	0.13	0.14	0.14
Q4	20	0.05	0.18	0.11	0.02	0.02	0.21	0.13	0.05	0.06	0.05
Q5	70	0.03	0.12	0.05	0.02	0.02	0.05	0.04	0.02	0.03	0.02
All	100	0.12	0.19	0.14	0.03	0.02	0.35	0.17	0.12	0.13	0.12

Note: The table shows ϕ_c , which is consumption gains, in percentage points, of moving from R_p to R_c , for each of the groups of the wealth distribution defined in the first column. In the second column I report the fraction of total wealth accumulated by each group according to the average wealth distribution under R_p . It only considers the effects of transfers since spending is not an argument in the utility function. Gains are evaluated at the average value of B and the stationary distribution of the rest of the state variables under R_p . The third column present the result for all agents, while the rest of the columns do so for specific groups. In each case gains are averaged with respect to the rest of the individual state variables according to their stationary distribution.

Table 4: Welfare Effects of Switching from R_p to R_c

- AIYAGARI, S. R., AND E. R. MCGRATTAN (1998): “The optimum quantity of debt,” *Journal of Monetary Economics*, 42(3), 447–469.
- AMBLER, S., AND A. PAQUET (1996): “Fiscal spending shocks, endogenous government spending, and real business cycles,” *Journal of Economic Dynamics and Control*, 20(1), 237–256.
- BACHMANN, R., AND J. H. BAI (2013): “Politico-economic inequality and the comovement of government purchases,” *Review of Economic Dynamics*, 16(4), 565–580.
- BAUDUCCO, S., AND F. CAPRIOLI (2014): “Optimal fiscal policy in a small open economy with limited commitment,” *Journal of International Economics*, 93(2), 302–315.
- BEWLEY, T. (1986): “Stationary monetary equilibrium with a continuum of independently fluctuating consumers,” *Contributions to mathematical economics in honor of Gérard Debreu*, 79.
- CUADRA, G., J. M. SANCHEZ, AND H. SAPRIZA (2010): “Fiscal policy and default risk in emerging markets,” *Review of Economic Dynamics*, 13(2), 452–469.
- DAVIES, J. B., S. SANDSTRÖM, A. SHORROCKS, AND E. N. WOLFF (2010): “The level and distribution of global household wealth,” *The Economic Journal*, 121(551), 223–254.
- ENGEL, E., C. NEILSON, AND R. VALDÉS (2013): “Chiles Fiscal Rule as Social Insurance,” *Central Banking, Analysis, and Economic Policies Book Series*, 17, 393–425.
- GORNEMANN, N., K. KUESTER, AND M. NAKAJIMA (2016): “Doves for the rich, hawks for the poor? distributional consequences of monetary policy,” .
- HEATHCOTE, J. (2005): “Fiscal policy with heterogeneous agents and incomplete markets,” *The Review of Economic Studies*, 72(1), 161–188.
- HUGGETT, M. (1993): “The risk-free rate in heterogeneous-agent incomplete-insurance economies,” *Journal of economic Dynamics and Control*, 17(5), 953–969.



Note: ϕ_a and ϕ_c are consumption gains, in percentage points, of moving from R_p to R_a and R_c , respectively. In red it is shown $\phi_c - \phi_a$ and in blue ϕ_a so the size of each bar corresponds to ϕ_c . It only considers the effects of transfers since spending is not an argument in the utility function. Gains are evaluated at the average value of B and the stationary distribution of the rest of the state variables under R_p . Each graph presents the results as a function of either ϵ (left), h (center), or γ (right) for agents with zero assets (left in each graph), in each quintile of the wealth distribution (center) and for all agents (right). In each case they are averaged with respect to the rest of the individual state variables according to their stationary distribution and with respect to individual assets according to the average wealth distribution under R_p .

Figure 5: Welfare Cost of Procyclicality, by Individual Characteristics and Wealth Quintiles

- (1997): “The one-sector growth model with idiosyncratic shocks: Steady states and dynamics,” *Journal of monetary economics*, 39(3), 385–403.
- ILZETZKI, E. (2011): “Rent-seeking distortions and fiscal procyclicality,” *Journal of Development Economics*, 96(1), 30–46.
- ILZETZKI, E., AND C. A. VÉGH (2008): “Procyclical fiscal policy in developing countries: Truth or fiction?,” Discussion paper, National Bureau of Economic Research.
- IMROHOROĞLU, A. (1989): “Cost of business cycles with indivisibilities and liquidity constraints,” *Journal of Political economy*, 97(6), 1364–1383.
- KRUEGER, D., K. MITMAN, AND F. PERRI (2016): “Macroeconomics and Household Heterogeneity,” in *Handbook of Macroeconomics*, ed. by J. Taylor, and H. Uhlig, vol. 2, chap. 11, pp. 843–921. Elsevier.
- KRUSELL, P., T. MUKOYAMA, A. ŞAHİN, AND A. A. SMITH (2009): “Revisiting the welfare effects of eliminating business cycles,” *Review of Economic Dynamics*, 12(3), 393–404.
- KRUSELL, P., AND A. A. SMITH, JR (1998): “Income and wealth heterogeneity in the macroeconomy,” *Journal of political Economy*, 106(5), 867–896.
- KUHN, M., AND J. RÍOS-RULL (2016): “2013 Update on the US earnings, income, and wealth distributional facts: A View from Macroeconomics,” *Quarterly Review, Federal Reserve Bank of Minneapolis, April*, pp. 1–75.
- KUMHOF, M., AND D. LAXTON (2013): “Simple fiscal policy rules for small open economies,” *Journal of International Economics*, 91(1), 113–127.
- LOAYZA, N. V., R. RANCIERE, L. SERVÉN, AND J. VENTURA (2007): “Macroeconomic volatility and welfare in developing countries: An introduction,” *The World Bank Economic Review*, 21(3), 343–357.

- LUCAS, R. E. (1987): *Models of business cycles*, vol. 26. Basil Blackwell Oxford.
- MCKAY, A., AND R. REIS (2016): “The role of automatic stabilizers in the US business cycle,” *Econometrica*, 84(1), 141–194.
- MENDOZA, E. G., AND P. M. OVIEDO (2006): “Fiscal policy and macroeconomic uncertainty in developing countries: The tale of the tormented insurer,” Discussion paper, National Bureau of Economic Research.
- MICHAUD, A., AND J. ROTHERT (2018): “Redistributive fiscal policies and business cycles in emerging economies,” *Journal of International Economics*, 112, 123–133.
- PIESCHACON, A. (2012): “The value of fiscal discipline for oil-exporting countries,” *Journal of Monetary Economics*, 59(3), 250–268.

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