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Imperfect financial markets and the cyclicality of social spending ☆

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ABSTRACT

This paper explores the link between default risk and fiscal procyclicality. We show that countries with higher sovereign risk have a more procyclical fiscal expenditure policy, which is driven mostly by transfers. We build a small open economy model with income inequality, social transfers, and default risk to rationalize this fact. Without default risk transfers are countercyclical, inequality is procyclical, and external debt is used to smooth distortionary taxation. With default risk, transfers account for most of fiscal adjustment because taxation becomes costly for the government. Transfers become procyclical and inequality worsens during times when risk premia are high. We confirm the predictions of the model in the data: in recessions in economies with default risk, transfers take the bigger burden relative to government consumption, whereas the opposite is true in economies with low default risk.

1. Introduction

In stark contrast to developed economies, there is ample evidence that governments in emerging markets conduct *procyclical* fiscal policy. In this paper, we explore the drivers of this phenomenon both empirically and theoretically. The cross-country differences in fiscal expenditure cyclicality cannot be explained by government consumption, but rather are driven by differences in social transfers (Michaud and Rothert, 2018). We build a theory which links the two facts and show, that the borrowing costs faced by developing countries, especially during periods of financial distress, drive the procyclicality of social transfers, which in turn account for the procyclicality of government expenditure in the model. In addition, as in the data interest rates are countercyclical and exacerbate the financing problem during recessions.[1]

Our paper has two objectives. First, we contribute to the empirical literature on fiscal policy by analysing the cyclicality of different fiscal expenditure components and their links to sovereign risk. We use data for a panel of advanced and emerging small open economies and show that overall, fiscal expenditure cyclicality correlates negatively with sovereign risk, proxied by the average sovereign spread. This is most evident for social transfers and holds after controlling for institutional quality.

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[1] See Reinhart and Rogoff (2011a), Kaminsky et al. (2005), Neumeyer and Perri (2005) and Uribe and Yue (2006) for contributions to this literature.

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Second, we propose a theory that links the cyclicality of the two components of fiscal expenditure to sovereign risk. We build a small open economy model with endogenous default risk, heterogeneous households, labour supply choice, and active fiscal policy. There are two types of fiscal expenditures: social transfers, which are perfect substitutes for private income, and a public good which provides direct utility to households but is not a substitute for private income. Households differ in their labour productivity. This inequality motivates lump-sum social transfers as a way to redistribute income. The government can finance its expenditures by taxation or by borrowing and saving in international financial markets. Bonds are not state-contingent and are subject to default risk, because of limited enforcement. The domestic economy is subject to persistent shocks to total factor productivity, so external financial markets are the only way to insure against aggregate income fluctuations.

Taxes are distortionary because the labour supply is elastic. Thus, the government trades off utility gains from redistributing consumption across households and over the business cycle against welfare losses from taxation. When income inequality is non-negligible, the government effectively redistributes income using a positive tax rate and positive transfers.

During periods of low output, it is more costly to use taxation to raise revenue and redistribute income. With good access to financial markets, the government relies more on borrowing and lending abroad to raise revenue. Taxes fall in recessions and transfers increase. The increase in transfers happens for two reasons. First, total household income falls and the government tries to smooth all households' incomes over time. Second, income fluctuations are more costly for low-income households, so countercyclical transfers shift more resources towards them during recessions, leading to procyclical consumption inequality. Public good consumption is procyclical and comoves with private consumption. Due to the countercyclicality of social transfers, the ratio of social transfers to government consumption is countercyclical.[2]

We calibrate the model to an average emerging, 'risky', economy as well as an advanced, 'safe' economy and conduct several sensitivity analyses to understand the role of default risk, preferences, and inequality. We find that all matter for optimal fiscal policy, but the presence of default risk in the stationary equilibrium of the economy matters most. Between economies, preferences and inequality explain little of the observed differences. Higher inequality exacerbates the procyclicality of public spending, because welfare losses from redistribution are higher and impede insurance policies in the absence of external insurance, but its marginal contribution is lower. Within a risky economy, fiscal policy becomes significantly more procyclical during periods of elevated sovereign risk and when the government has accumulated a high level of debt.

Default risk limits access to financial markets because it lowers the price of debt issued by the government. The incentives to default are higher during recessions, as potential income losses from repayment are more costly because of risk aversion. The government has fewer resources at its disposal and cuts transfers and public good spending because the welfare costs from taxation outweigh the insurance gains from countercyclical redistribution. When spreads are high, the current account reverses and the government needs to effectively transfer resources to its creditors.

We show that default risk also affects how expenditure components behave over the business cycle and analyse optimal fiscal adjustment during times of fiscal distress. In our model, there is a trade-off between taxes and transfer spending. Tax increases lead to welfare and output losses, but social transfer cuts are also detrimental to welfare because of economic inequality. We show that all instruments are used for fiscal adjustment. Tax rates increase and transfer spending is cut, while the government still attempts to smooth public good spending. Thus, the model predicts that the ratio of social transfers to public good consumption becomes more procyclical in periods with elevated default risk and contrasts sharply with the behaviour in the safe economy. We confirm that the cyclicality of the transfer to public good ratio is positively related to sovereign risk also in the data, consistent with our mechanism.

Finally, we provide a robustness exercise to analyse the role of income effects. Under plausible parametrizations which also allow the income effect to dominate the substitution effect, we show that our main results are robust and optimal transfer policy is still procyclical in the risky economy and countercyclical in the safe economy.

2. Literature

This paper contributes to the literature on optimal fiscal policy over the business cycle. Following Gavin and Perotti (1997) who analysed Latin American economies, the empirical literature has pointed out that fiscal policy in emerging markets is, in contrast with advanced economies, procyclical. Kaminsky et al. (2005) revisit the evidence and confirm the procyclical nature of fiscal policy in a comprehensively broad set of countries and extend the analysis to include monetary policy. They coin the term by which the phenomenon of procyclical policies is often called *when it rains, it pours*. They also emphasize that current accounts are countercyclical in developing countries. In our contribution, current account turns countercyclical when the economy becomes prone to default, which in turn drives the procyclicality of social transfers. Végh and Vuletin (2015) build a dataset on tax rates and find that tax policy is acyclical in industrial countries but mostly procyclical in developing countries. Our empirical contribution builds on Michaud and Rothert (2018), who show that fiscal procyclicality in emerging economies does not equally apply to all components of fiscal expenditure. In particular, social transfers are highly procyclical in emerging and highly countercyclical in advanced economies, while public good consumption is mostly acyclical in both groups. They use a small open economy model to study the consequences of different cyclicalities of social transfers. We complement their study in two dimensions. First, we show that the cyclicality of transfers correlates strongly not only with the binary category of advanced/emerging economies but also with sovereign risk. Second, we provide a theory that can endogenously and quantitatively explain these observations.

[2] If the government could insure perfectly against country-specific productivity shocks, public good spending would be acyclical.

We are not the first to link the cyclicality of fiscal policy with public debt and default risk. Aizenman et al. (2001) propose a theory that leads to procyclical tax policy (tax rates rise in bad times) for countries that are susceptible to default and are likely to face borrowing constraints more often as a result. Cuadra et al. (2010) build on the sovereign default model of Eaton and Gersovitz (1981), introduce endogenous production and distortionary taxes and also find procyclical tax policy when the borrowing constraint starts binding while government expenditure does not depend on risk.[3] In a similar framework, Arellano and Bai (2017) analyse fiscal policy and default under fiscal constraints. Fiscal constraints arise because taxes are fixed and the government has to choose whether to cut transfers to a representative agent, government consumption, or default. As in our case, transfers are used for fiscal adjustment, but in their model, this happens when the exogenous fiscal constraint binds. Furthermore, as taxes are exogenous and there is only a representative household, there is no additional trade-off arising for the government. Tax hikes can prevent only "fiscal defaults" (happening due to liquidity constraints), but not aggregate defaults (happening due to resource constraints). Yet, raising taxes during a crisis can deepen the recession. In our case, transfers are used for redistribution and we allow the government to choose both taxes and spending when studying optimal fiscal adjustment.

Similarly to Ferriere (2015), we introduce inequality and endogenous tax progressivity into the sovereign default model, and we also find that more unequal (less tax progressive) economies have higher incentives to default. We quantify this channel in a similar setting and find that the effect is rather small. Jeon and Kabukcuoglu (2019) show that more inequality leads to higher default risk. They introduce shocks to the income distribution which are correlated with output, adding a dimension of risk and volatility to government revenues as taxes are progressive and fixed. We also find inequality exacerbates the country's borrowing constraints in a comparative statics exercise, but both policy and inequality are endogenous in our setting. In a recent contribution, Bianchi et al. (2023) introduce a Keynesian demand channel to study the trade-off between fiscal stimulus (countercyclicality) and austerity (procyclicality). In their model, procyclical policies can be optimal in a recession to prevent the country from subsequently entering a debt crisis. Our model studies a similar trade-off, albeit predominantly on the supply side, with a three-way trade-off between efficiency, equality, and consumption smoothing. In our model not only debt, default and government consumption are decided endogenously but also taxes and transfers, which allows us to draw the difference between transfers-based and government consumption-based countercyclical policies. Bianchi et al. (2023) also emphasize that optimal policy is procyclical when the country enters the recession with a high (risky) level of debt, which is consistent with our findings.

Another strand of literature focuses on political economy frictions as a reason for procyclical fiscal policy. In Andreasen et al. (2019), economic inequality and the degree of tax progressivity matter for the default decision of the government and determine debt sustainability, because spending cuts can only be made by a political agreement. A more unequal economy with regressive taxes will be less likely to accept strong fiscal tightening. Our contribution provides a complementary theory of the role of economic inequality in making countercyclical policies more costly to sustain. Talvi and Végh (2005) show how volatile tax revenues can translate into strongly procyclical government expenditures when governments face political pressure to run budget deficits and engage in excessive spending to their constituencies during booms. Alesina et al. (2008) propose a political agency problem to rationalize this behaviour, where voters try to limit the extraction of political rents by demanding more spending and taxes during economic booms. Ilzetzki (2011) proposes rent-seeking behaviour by polarized political parties as a mechanism for procyclicality. Optimal transfers are procyclical when disagreement between parties is sufficiently high. While in his model agents are homogeneous and transfers are rents paid only to one part of the population, we study transfers as an insurance and redistributive device in the presence of income inequality. Furthermore, the government in that model has a commitment to repay its obligations, so it can borrow and save freely at the risk-free rate, but faces an exogenous borrowing constraint, whereas this is endogenous in our model.[4]

Among others, Ilzetzki (2011) and Alesina et al. (2008) argue that the role of financial factors for fiscal procyclicality is driven by weak institutions. Alesina et al. (2008) propose empirical evidence that borrowing constraints, proxied by credit ratings, cannot account for procyclical fiscal policy once a measure for the quality of institutions is accounted for. However, Bianchi et al. (2023), using the same institutional quality proxy, show that the anticipation of default risk is still a key driver for fiscal procyclicality in the data. Their theoretical results also rely on an asymmetry with optimal procyclical policy following in recessions only if the government's initial position is close to an endogenous borrowing constraint, whereas Ilzetzki (2011) only considers fiscal procyclicality across macroeconomic states and finds them to be similar on average, concluding that this cannot be driven by borrowing constraints. We provide tentative evidence in the spirit of Alesina et al. (2008) and Ilzetzki (2011) that suggests the role of sovereign risk survives controlling for institutional quality, proxied by control of corruption.

Finally, there is a large literature on the impact of default risk and countercyclical interest on business cycle characteristics among other factors in emerging markets. Neumeyer and Perri (2005) and Uribe and Yue (2006) show that interest rates are highly countercyclical in emerging markets, and they can explain at least some of the observed excess volatility in consumption and countercyclicality of current accounts.[5]

[3] In a similar vein, albeit in a different framework (Camous and Gimber, 2018) explain tax policy procyclicality by a coordination failure in a multiple equilibria world: if the inherited stock of debt is large enough households restrict their labour supply in anticipation of a high tax rate, which induces the government to set a high tax rate.

[4] An earlier political economy contribution is Tornell and Lane (1999) who rationalize procyclicality through a *voracity effect*, where governments operating in countries with weak institutions and concentrated power will engage in procyclical spending (rent-seeking) in response to windfall gains.

[5] Aguiar and Gopinath (2006, 2007) argue that the structure of shocks plays an important role in the observed differences in business cycles as well as *endogenous* interest rate movements due to default risk. See also the discussion in a recent contribution by Rothert (2020) which is more nuanced.

3. Stylized facts

In this section, we present empirical evidence on the cyclicality of different components of government expenditure. Our contribution is to link the cyclicality of expenditure categories with the degree of sovereign risk, which we proxy by the average sovereign spread. We show that the cyclicality of government expenditure components that have more of a transfer or insurance component varies significantly with sovereign risk. For government expenditure components which have more of a public good character, cyclicality varies less with sovereign risk.

We use publicly available data from two main sources. Michaud and Rothert (2018) provide a dataset on detailed government expenditure and GDP.[6] The data on sovereign spreads comes from an updated dataset accompanying (Born et al., 2020).[7] We complement these sources with data on national income inequality from the World Inequality Database.[8] The final dataset is an annual panel of 30 countries, emerging and developed, for 26 years between 1990 and 2015.

Total government expenditure is the sum of the use of goods and services (henceforth *government consumption*), social transfer payments (henceforth *transfers*,) compensation of employees, subsidies, and interest payments (and other). On average, total expenditure is 31% of GDP in emerging markets and 45% in advanced economies. Our main focus is on the first two categories, transfers and government consumption, which jointly account for around 50% of total expenditure (47% in emerging and 52%, respectively). Thus, while the overall size of government is significantly smaller in emerging markets, the share of expenditure going to these two categories is very similar. These two categories sharply differ in their economic function. Government consumption, defined as the "value of goods and services used for the production of market and non-market goods and services", is more of a public good: non-excludable and non-rivalrous, and whose consumption tends to be neutral or complementary to private income and consumption. Transfers in turn are "transfers receivable by households related to social risks such as sickness, unemployment, retirement, housing, and education". They work more as an insurance good or a substitute for private income.

We use the average spread as a proxy for the riskiness of the country's sovereign debt. This riskiness drives access to foreign credit, which is an important source of financing especially for emerging economies. As a result, in emerging economies, access to foreign credit is procyclical and countercyclical spreads are an important driver of the business cycle (Neumeyer and Perri, 2005). Table 8 in the Appendix presents time averages of spreads and fiscal expenditure components by country and for the two groups.

Figs. 1 and 2 show the empirical relationship between the cyclicality of government expenditure components and sovereign risk. The cyclicality of government expenditure is the correlation between the cyclical components of government expenditure (consumption and transfers) and GDP. We colour-code observed cyclicalities using the IMF "developed economies" classification. Advanced economies are coded in red and emerging economies in blue. The classification has changed over the years for some economies. When this is the case, we assign an economy to the category it was classified in for the majority of the sample time.[9] Table 8 in the Appendix lists the economies included in each subsample.

Fig. 1 plots the cyclicality of total government expenditure (left panel) and that of social transfers (right panel) against the average sovereign spread. Countries with lower average spreads have more countercyclical government expenditure. The correlation between cyclicality and the average spread is significant and estimated at 0.57. Transfers are also significantly more procyclical in countries with higher spreads. The average correlation between transfers' cyclicality and spreads is 0.6. On average, transfers are procyclical in emerging markets (weighted average correlation with GDP cyclicality is 0.35), whereas they are countercyclical in advanced economies (weighted average correlation with GDP cyclicality is −0.43).

Fig. 2 shows the same relationship for two further spending categories: government consumption (goods and services expenditures) and compensation of employees. The relationship between sovereign risk and government consumption is also positive, but weaker than that for transfers, with a correlation of 0.25. On average, government consumption is acyclical in advanced economies (weighted average correlation with GDP is 0.01), whereas it is also procyclical in emerging economies (weighted average correlation with GDP is 0.25).

We also note that the relationship between the cyclicality of the compensation of employees and sovereign risk is weaker than that of government consumption and markedly weaker than that of transfers, with a correlation of 0.16. Since this category is on average the second largest in both groups, it can account for part of the difference in cyclicalities, too.

The figures suggest that transfers are a significant driving force behind the observed cyclicality of total fiscal expenditure and that pro-cyclicality is strongly correlated with the riskiness of government debt. The finding is robust to the exclusion of outliers and the length of the period for which the cyclicality is calculated. We interpret this evidence as descriptive, establishing a link between the cyclicality of fiscal policy and sovereign risk, rather than a casual link in one direction. Indeed, our model features endogenous borrowing costs which respond to fiscal policy.

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6 The authors harmonize the Government Finance Statistics Dataset (GFS) by the IMF with the macroeconomic aggregates from the World Development Indicators (WDI) by the World Bank. The sample has been selected based on the availability of the detailed expenditure breakdown, see Michaud and Rothert (2018) for details.

7 We also use average country credit ratings to complement our evidence. The spread data is constructed in the following way. For a subset of emerging economies, the data comes from J.P. Morgan's Emerging Markets Bond Index (EMBI) spreads. For a subset of the Euro Area economies, the data is based on the "long-term interest rate for convergence purposes" and CDS spreads. For the subset of non-eurozone advanced economies, the data is based on foreign-currency-denominated bonds and CDS spreads. All spreads are calculated on similar-maturity foreign-currency bonds. The details of the spread construction with illustrative examples are laid out in Born et al. (2020).

8 WID.world, accessed online May 2023.

9 Economies who changed classification are mostly those in Central and Eastern Europe, and mostly from emerging to advanced (although Hungary, for a few years, went from advanced to emerging).

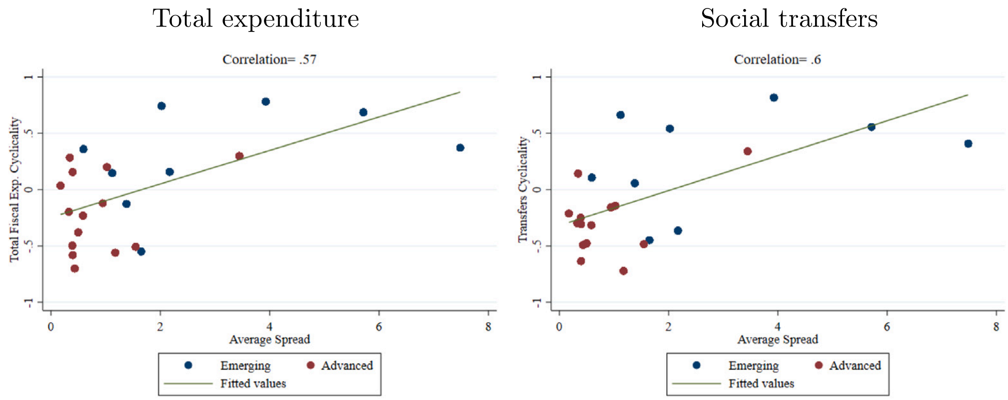

Fig. 1. Cyclicality of total expenditure and transfers vs. country risk. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)
Source: Own calculations based on Michaud and Rothert (2018) and Born et al. (2020).

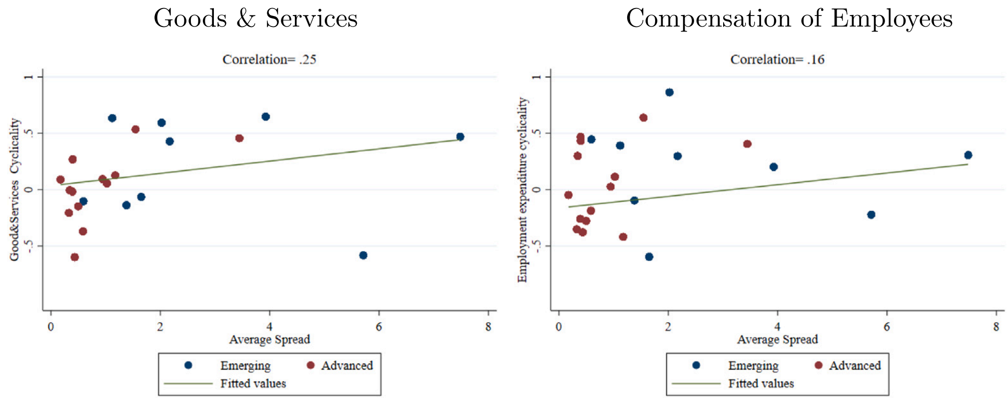

Fig. 2. Cyclicality of government consumption and compensation of employees vs. country risk. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)
Source: Own calculations based on Michaud and Rothert (2018) and Born et al. (2020).

We present additional results from regressing cyclicality on a measure of the quality of institutions (control of corruption) as in Alesina et al. (2008) and Ilzetzki (2011) in Appendix (7.2). The results suggest that there is a potential role for borrowing costs even when institutions are controlled (and instrumented) for.

To sum up, the transfers component of government expenditures, an important component of overall spending in both advanced and emerging countries today, affects the cyclicality of government expenditure more significantly across countries than government consumption and can explain a large share of differences between advanced and developing countries. Transfers typically serve as an insurance device for private households (such as sickness or unemployment benefits) or are targeted towards certain groups in the population. External debt remains an important source of finance in many emerging economies and the degree of financial frictions is much higher in developing countries. Issuing (external) debt is more costly. Furthermore, as default incentives on external debt are highly countercyclical, borrowing constraints tighten during bad times and it becomes increasingly costly to fund social expenditure.[10] The presence of financial frictions can thus potentially explain fiscal procyclicality driven by transfers. In the next section, we present and calibrate a model that features this mechanism.

4. Model

The model is a production economy with heterogeneous agents, a benevolent government and competitive international financial markets with risk-neutral investors. The government provides a public good (g^P) and social transfers (g^T) to households.

Total expenditures are financed by costly and by borrowing and saving internationally with risk-neutral investors. We use an affine tax system in this paper. This system collects revenue through a proportional tax and redistributes income through a lump sum

[10] This does not necessarily hold for domestic debt (Paczos and Shakhnov, 2019).

transfer.[11] The marginal tax rate is constant. However, the average tax rate is increasing in earnings, which is governed by transfers: the transfer shifts down total tax payments by the same amount for all households, so lower-income households, who face a lower tax bill, may end up receiving a net subsidy, depending on the level of transfers. The level of transfers (and taxes) in turn depends on the degree of inequality: for very low levels of inequality, a negative transfer (and thus lump-sum tax) would be optimal. The higher is inequality, the more the government wishes to use transfers at the expense of higher taxes. It thus uses transfers and taxes as incompletely targeted but separate and complementary instruments. In the model, the level of taxes and transfers are determined endogenously. We find that when we calibrate the model to match even low, but empirically plausible levels of inequality, transfers are optimally positive and there is "effective" redistribution towards lower-income households.[12]

We assume that international financial markets are incomplete: the government has access to a non-state-contingent bond only, but it has no commitment to repay the debt it owes to international creditors.

There is a continuum of households in the domestic economy. The population size is constant and normalized to 1. Households differ in their labour productivity e^i, which takes on different values in the interval $e^i \in (0,1]$. A constant fraction σ^i has productivity e^i and the individual productivities are private information. Households supply labour elastically, and we denote hours worked by household with productivity e^i by h_t^i. There is an aggregate total factor productivity risk in the economy, A_t, such that total pre-tax income is $A_t e^i h_t^i$.

Households maximize expected lifetime utility, a discounted stream of utilities from private consumption, leisure, and public good consumption:

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t [\kappa u(c_t^i, h_t^i) + (1-\kappa) v(g_t^P)], \tag{1}$$

subject to the budget constraint

$$(1+\tau_t) c_t^i = A_t e^i h_t^i + g_t^T, \qquad \forall i. \tag{2}$$

The public good g_t^P is additively separable in the utility function. The weights on private and public consumption are κ and $(1-\kappa)$, respectively. With this formulation, preferences for public and private consumption are additively separable: the marginal utility of private consumption is independent of public consumption. τ_t is the proportional tax rate on consumption expenditures, and g_t^T is a lump sum transfer from the government.

Households have no access to financial markets. Thus, two interpretations of productivity heterogeneity are possible in this framework. On the one hand, agents can be assumed to be ex-ante identical; due to the absence of financial market access, their productivity level will be the only relevant state variable. On the other hand, the economy is one of persistent inequality, both in income and in the distribution of skills.

Denote by c^{i*}, h^{i*} the policies that solve the household problem. As the problem is static, we suppress time subscripts for ease of notation. The first order optimality conditions satisfy Eq. (2) and:

$$-\frac{u_h(c^{i*}, h^{i*})}{u_c(c^{i*}, h^{i*})} = \frac{A e^i}{(1+\tau)}, \qquad \forall i. \tag{3}$$

Total output is defined as $Y \equiv A \sum_i \sigma^i e^i h^{i*}$. The government can borrow and save in international bond markets with risk-neutral creditors. Risk-neutral creditors discount future consumption at a constant rate $\delta = (1+r)^{-1}$, where r is the world interest rate. The government likes to front-load consumption because the world interest rate is lower than its subjective discount rate: $\beta < (1+r)^{-1}$. This implies there is a persistent difference between interest rates in the country and the rest of the world.

The government cannot commit to repaying its international obligations. Instead, it can decide in each period to default on all currently outstanding debt. It then temporarily loses access to financial markets. If it repays, it retains market access.

Define that aggregate state of the economy as $S = (A, b)$, where b is a level of public debt. Debt affects households' decisions via its effect on taxes and both fiscal expenditures. Denote by $V^d(S)$ the value function of the government if it defaults and by $V^{nd}(S)$ the value function if the government repays. The default decision is made at the beginning of each period, after the realization of the productivity state. The value function of the government reads:

$$V^0(S) = \max_{d \in \{0,1\}} (d V^d(S) + (1-d) V^{nd}(S)). \tag{4}$$

International creditors have perfect information about the fundamentals in the borrowing country and anticipate default decisions. Denote by $\pi^{def}(b'(S), A)$ the probability that the country defaults when borrowing b' today. $\pi^{def}(b'(S), A)$ is the cumulative probability that the country will default given the current state A. There is free entry into the credit market. Thus, the bond price will be such that creditors' profits are zero on average.

$$-q(b'(S), A) b'(S) + \frac{(1-\pi^{def}(b'(S), A))}{1+r} b'(S) = 0. \tag{5}$$

[11] Recent works formulating optimal tax and transfer policy using this functional form are Bhandari et al. (2017, 2021) in a rich optimal fiscal-monetary and debt policy model with heterogeneity. Ferriere (2015) also uses an affine tax system to analyse the relationship between default risk and tax progressivity. Heathcote and Tsujiyama (2021) use an affine tax system as one of the tax (and transfer) systems comparing welfare outcomes to optimal Mirrlees policy as a system that allows the introduction of lump sum transfers for redistribution, in contrast to a standard progressive taxation schedule.

[12] We discuss the potential implications of this assumption for the quantitative properties of the model in Section 5.4, where we vary the degree of inequality as well as the preferences for redistribution. In our benchmark models, we match the ratio of transfers to GDP which produces different degrees of progressivity of the overall system.

If $\pi^{def}(b'(S), A)$ is positive for some A, the bond price falls. If the government wants to roll over its debt, it needs to use additional resources to finance repayment since creditors are only willing to extend new debt at a discount: Default risk leads to endogenous borrowing constraints and makes borrowing more costly.

The government maximizes total welfare. There is a fraction σ_i of productivity type i in the population. The government attaches welfare weight α_i to this type.[13] The government chooses optimal policies such that households' first-order conditions are satisfied, and its budget constraint holds.

When the government has market access, it chooses taxes, public consumption, transfers and bond issuance $\{\tau(S), g^T(S), g^P(S), b'(S)\}$ as functions of the aggregate state $S = (A, b)$. It solves the following maximization problem:

$$V^{nd}(S) = \max_{\{\tau, g^T, g^P, b'\}} \left\{ \kappa \sum_i \alpha^i u(c^{*i}, h^{*i}) + (1-\kappa)v(g^P) + \beta \mathbb{E} V^0(S'|S) \right\} \tag{6}$$

subject to households' budget constraint (2), their first order condition (3), bond discount price (5) and government budget constraint:

$$g^P + g^T + qb' = \tau C^* + b \tag{7}$$

where aggregate consumption is defined as $C^* = \sum^i \sigma^i c^{*i}$. We adopt a notation in which public debt is represented by a negative b. The price of consumption is normalized to 1.

After a default, the government loses market access. With a constant probability μ it regains access to markets in subsequent periods. It re-enters markets with zero assets and no negative credit history. Furthermore, following literature, we assume that the country incurs an asymmetric proportional productivity loss θ during the default spell[14]:

$$A^d = g(A) = \begin{cases} A & \text{if } A < \theta \mathbb{E}[A] \\ \theta \mathbb{E}[A] & A \geq \theta \mathbb{E}[A]. \end{cases} \tag{8}$$

Part of the total output loss is endogenous due to elastic labour supply. When the government defaults, it chooses g_d^P, g_d^T, τ_d to maximize:

$$V^d(S) = \max_{\{\tau_d, g_d^T, g_d^P\}} \left\{ \kappa \sum_i \alpha^i u(c^{*i}, h^{*i}) + (1-\kappa)v(g_d^P) + \beta \mathbb{E}\left[\mu V^0(S') + (1-\mu)V^d(S')|S\right] \right\} \tag{9}$$

subject to (2), (3) and its budget constraint in default:

$$g_d^P + g_d^T = \tau_d C^*. \tag{10}$$

4.1. Equilibrium

Definition. Equilibrium

A dynamic recursive equilibrium in this economy is a set of households decisions $\{c^i(S), h^i(S), c_d^i(S), h_d^i(S)\}$ government default policy $d(S)$, government policies $\{g^T(S), g^P(S), b'(S), \tau(S), g_d^T(S), g_d^P(S), \tau_d(S)\}$, and a bond price policy function $q(S)$ such that:

(a) Given bond prices and government policies, the household decisions solve the households' maximization problem (1).
(b) Given bond prices and household decisions, the government policies solve the government's maximization problem (4).
(c) Lenders' beliefs are consistent with default probabilities and the resulting bond prices satisfy the zero profit condition (5).

In the benchmark specification, we assume that household preferences are of the GHH form:

$$u(c,h) = \frac{\left(c - \chi \frac{h^{1+\phi}}{1+\phi}\right)^{1-\gamma}}{1-\gamma}, \qquad v(g^P) = \frac{g^{P\,1-\gamma}}{1-\gamma}. \tag{11}$$

With GHH preferences, there is no income effect on labour supply. This specification allows to abstract from direct supply-side effects of transfers. Furthermore, these preferences are frequently used in small open economy models, including recently for models including fiscal policy, see e.g. the discussion in Michaud and Rothert (2018). We provide a discussion of the robustness of our main results with preferences that have an income effect in Section 5.7.

In the benchmark specification, the elasticity of hours worked with respect to the wage rate is constant and equal to $1/\phi$. For simplicity, we suppress the functional dependence of the optimal policies on the state variables in the following paragraphs. There is a closed-form solution for hours worked as a function of fiscal policy from the marginal rate of substitution:

$$h^{*i} = \left(\frac{1}{\chi}\frac{Ae^i}{(1+\tau)}\right)^{\frac{1}{\phi}}, \qquad \forall i. \tag{12}$$

[13] When $\sigma_i = \alpha_i, \quad \forall i$, the government is utilitarian.

[14] Mendoza and Yue (2012) and Kaas et al. (2020) provide a microfoundation of how asymmetric output losses can arise in equilibrium when firms use imported inputs in production.

And, using households' budget constraint, consumption reads:

$$c^{*i} = \frac{1}{\chi}^{\frac{1}{\phi}} \left(\frac{Ae^i}{(1+\tau)} \right)^{\frac{1}{\phi}+1} + \frac{g^T}{1+\tau}, \qquad \forall i. \tag{13}$$

Furthermore, note that

$$\frac{\partial h^i}{\partial \tau} = -\frac{1}{\phi(1+\tau)} h^i \tag{14}$$

and define the elasticity of labour supply in response to the tax rate $\xi_{h,\tau}$ as

$$\xi_{h^i,\tau} = \frac{\partial h^i}{\partial \tau} \frac{\tau}{h^i} = -\frac{\tau}{\phi(1+\tau)}. \tag{15}$$

The first aggregate condition (when the government has market access) is the Euler equation which determines aggregate public good consumption dynamics:

$$v'(g^P) \left[q + b' \frac{\partial q}{\partial b'} \right] = \beta \mathbb{E}_{A' : d(A',b')=0} v'(g^{P\prime}) \tag{16}$$

When choosing bond policy today, today's marginal utility of government consumption is equalized only with the marginal discounted expectation of future marginal utility in the states when the government repays. This is because the problem is static when the government does not have access to foreign credit. Secondly, the pricing term on the left-hand side shows the effect of default risk as a borrowing constraint on consumption: $b' \frac{\partial q}{\partial b'}$ is zero whenever the country is not going to default on its debt in any state in the future. However, when $\pi^{def} > 0$ (for some A given b'), then the derivative is positive. Since $b' < 0$, the whole term on the LHS decreases when π^{def} increases. Hence, ceteris paribus, when the bond price falls due to a risk of default the government needs to cut down public consumption.

Eq. (17) determines the relationship between private and public good consumption when transfers are chosen optimally. The government chooses the transfer such that the weighted sum of marginal utilities from consumption equals the marginal utility from spending on the public good. This is a consequence of the assumption that transfers cannot be targeted to each type, leading to a risk-sharing wedge: in that case, transfers would equalize weighted marginal utilities of consumption. In this model, where transfers cannot be targeted to a specific type, the risk-sharing wedge is zero *on average*:

$$\kappa \sum_i \alpha^i u_c^i(c^i, h^i) = (1-\kappa) v'(g^P). \tag{17}$$

Lastly, Eq. (18) is the optimal choice of the tax rate. The aggregate distortion on output summarized by the elasticity of labour supply with respect to the tax rate $\xi_{h^i,\tau}$, and weighted by each type's output, equals the net utility cost from an additional unit of taxation, weighted by individual consumption. In other words, the tax rate is set such that the difference in marginal utilities in consumption units, corresponds to the marginal utility cost of the output loss due to the tax distortion, converted to output units. The elasticity is constant *for a given tax rate*, and it is increasing in the tax rate (Eq. (15)). Thus, the distortion due to the taxation of labour supply and the welfare loss is convex in τ.

$$\sum_i \alpha_i \kappa u_c^i(c^i, h^i) c^i - \sum_i (1-\kappa) \sigma^i v'(g^P) c^i = (1-\kappa) v'(g^P) A \sum_i \sigma^i e^i h^i \xi_{h^i,\tau} \tag{18}$$

The extent to which the government can use international financial markets also determines residual idiosyncratic income risk. If financial markets are a good instrument to smooth consumption, borrowing and saving will be complementary instruments to the tax rate. Public good spending is not an instrument to help smooth private consumption, as its demand by private households is complementary to their consumption.

The assumption of elastic labour supply is important for two reasons: first, without elastic labour supply, taxation is not costly and the government can adjust the tax rate to finance spending, independently of the size of the tax rate, and the state of the economy. There is thus no well-defined trade-off between taxation and spending. Second, and as a consequence, if the tax rate is not distortionary, it is optimal for the (utilitarian) government to tax away all income and equalize consumption across agents. Unless the country can fully insure against domestic productivity shocks, consumption will co-move with GDP. Even if full insurance is possible, transfers (and consumption) could at most be acyclical. Because all income derives from transfers, transfers will be procyclical. This case is both counter-intuitive because the trade-off between taxing and spending is missing and counterfactual because this correlation is not observed in the data.

In the next section, we detail the calibration of the model and discuss the results for the benchmark economy and several robustness exercises to explore the role of default risk and inequality in optimal fiscal policy.

To build intuition, we characterize optimal policy in the two cases of complete financial markets and financial autarky in the Appendix (see section 7.3).

5. Results

The calibrated model aims to illustrate the relationship between default risk and the cyclicality of fiscal expenditures when both variables are endogenous. Our strategy is to compare the dynamics of a typical economy with default risk to one without. Hence, we do not aim to replicate the actual data of any particular country. Yet, for the exercise to be meaningful, we aim for

Table 1
Set parameters.

	Parameter	Value	Source
γ	Risk aversion	2	Standard in the literature
r	Risk-free rate	1.0%	Standard in the literature
ϕ	Inverse of Frisch elasticity	0.6	Michaud and Rothert (2018)

Table 2
Calibrated parameters.

	Parameter	Value		Target	Value	
		Risky	Safe		Emerging	Advanced
χ	Labour disutility	1.08	1.05	Time worked	0.33	0.33
κ	Private utility	0.991	0.9785	Transfers-to-public good	2.86	3.19
ρ_A	TFP persistence	0.983	0.936	Output persistence &	0.92	0.93
σ_ϵ	TFP volatility	0.002	0.0032	volatility	2.6%	2.0%
μ	Re-entry prob.	0.2	NA	Market exclusion	5	NA
β	Discount factor	0.955	0.99	Debt service/GDP &	2.10%	NA
θ	Output penalty	0.9925	0.01	default frequency	2.4%	NA
λ	Welfare weights exp	2.04	1.37	Transfers/GDP	11%	17%
e^i	Productivities	{0.30, 0.51 0.59, 0.68, 1}	{0.33, 0.56, 0.64, 0.72,1}	Pre-tax income ratios	{0.04, 0.17, 0.25, 0.36, 1}	{0.05, 0.21, 0.30, 0.42,1}

Notes: The table lists calibrated parameter values for the risky and safe model economies and empirical targets for these calibrations, which are averages (weighted by GDP per capita) across emerging and advanced economies. The data sources for the target values are listed in Section 5.1. The descriptive statistics for emerging and advanced economies are Appendix 7.1.

overall consistency. We follow a standard calibration in the literature as closely as possible and in the dimensions that require more rigorous quantitative treatment, the parameters are calibrated to target the weighted averages of the moments of countries in our sample.

5.1. Calibration and functional forms

The period in the model is a quarter. We use standard values for three parameters, as shown in Table 1. We set risk aversion γ to 2 and the risk-free rate r at 1% quarterly. Following Michaud and Rothert (2018), we set the inverse of the Frisch elasticity, ϕ, to 0.6.[15]

Table 2 provides a summary of the calibration for the risky and the safe economy. We construct weighted averages of emerging and advanced economies as calibration targets for the risky and safe economy, respectively, using the database of Michaud and Rothert (2018).[16] The moments at the country level are weighted using GDP per capita in the year 2000 sourced from the World Bank.[17] We set the weight on the disutility of labour χ at 1.08 in risky and 1.05 in safe economy, such that households spend one-third of their total time (which is normalized to one) working in both economies. The weight on private consumption in households' utility κ is estimated at 0.99 in the risky and 0.98 in the safe economy to match the average transfers-to-public-good ratio (g^T/g^P) of 2.86 in emerging and 3.19 in advanced economies, respectively.

Total factor productivity is stochastic, and it follows a log-normal AR(1) process:

$$\log(A_t) = \rho \log(A_{t-1}) + \epsilon_t, \quad \epsilon_t \sim N(0, \sigma_\epsilon). \tag{19}$$

The quarterly persistence ρ and the standard deviation ϵ of the TFP process are such that the simulated output series have the same persistence and standard deviation as the cyclical component of output in emerging and advanced economies. As before, we extract the cyclical component by removing the linear-quadratic trend in the GDP annual series in logs. We then transform the annual targets into quarterly targets for each economy and calculate the weighted averages. The estimated values for ρ are 0.92 in emerging and 0.93 in advanced economies and for ϵ are 2.6% in emerging and 2.0% in advanced economies.[18]

We calibrate individual productivities e^i to match pre-tax income quintiles using the data on pre-tax national income distributions from the WID. Income is reported as total income per capita, from labour and capital, before taxes and transfers (but after pensions), for each quintile, in local currency with PPP in constant 2021 prices. Income quintiles are calculated in the following way: in each country, for every year we calculate the income of the first four quintiles relative to the fifth quintile, then we take an average over

[15] Others, e.g. Cuadra et al. (2010), use a value of 0.45.

[16] As discussed previously, the classification of an economy as emerging or advanced is based on the IMF classification and reflects the majority of the time a country spent in either classification, if applicable. The sample averages are robust to the inclusion of individual countries in the advanced and emerging markets samples. We note that transfers and inequality are significantly higher in the group of emerging European economies. In Section 5.6, we run a robustness exercise that highlights some quantitative implications of these features while leaving our main results largely unaffected.

[17] Series WB: NY.GDP.PCAP.CD, accessed June 2023.

[18] Aggregating an AR(1) process from quarterly to yearly series one gets $\rho^y_{quarter} = \rho^y_{year}{}^{1/4}$ and $\epsilon^y_{quarter} = \epsilon^y_{year} / \sqrt{1 + \rho^y_{quarter}{}^2 + \rho^y_{quarter}{}^4 + \rho^y_{quarter}{}^6}$.

Table 3
Model fit.

Statistic	Model: Risky	Data: Emerging	Model: Safe	Data: Advanced
Output Persistence	0.92	0.92	0.93	0.93
Output Standard Deviation	2.68%	2.6%	1.95%	2.0%
Debt service-to-GDP	2.2%	2.1%	NA	11.8%
Transfers-to-GDP	11.06%	11.02%	17.2%	17.11%
Transfers-to-Public Good	2.84	2.86	3.18	3.19
mean(Spread)	2.56	2.99	0	0.71

Notes: The empirical moments are averages (weighted by GDP per capita) of advanced and emerging economies, data sources are detailed in Section 5.1. Model moments are based on own calculations.

the years and the GDP-weighted cross-country group average. The resulting data targets and values in the calibrated models are listed in Table 2.[19]

We calibrate the welfare weights α^i in the government's utility function to match the transfer to GDP ratio in the two economies and parametrize the function of welfare weights as follows:

$$\alpha_i = \frac{\lambda^i}{\sum_i \lambda^i}. \tag{20}$$

With $\lambda = 1$ the government is utilitarian and weighs all income groups equally. When $\lambda > 1$ the government puts more weight on high-income groups, which reduces redistribution, and when $\lambda < 1$ the government puts more weight on low-income groups, which increases redistribution. The transfers-to-GDP ratio is 11% in the average emerging and 17% in the average advanced economy, resulting in a value of 2.04 in the risky and 1.37 in the safe economy, respectively.

In the risky economy, we calibrate the remaining three parameters, the subjective discount factor β, the output loss θ and market exclusion upon default μ in the following way. First, all three parameters jointly determine the debt policy of the government. We follow the literature and target the debt-service-to-GDP ratio.[20] For this, we use the "public and publicly guaranteed debt service (% of GNI)" series for the years 1990–2015 from the World Development Indicators (World Bank, 2023). While β and θ change the mean debt service in the model, μ critically affects how much the government can indebt itself in bad times: the lower the probability of re-entry, the lesser the government is willing to take on debt when output is low. Second, the probability of market re-entry, μ also governs the expected time of exclusion following a default, which is equal to $1/\mu$. Empirically observed exclusion periods differ widely from 4.7 to 13.7 years (Schmitt-Grohé and Uribe, 2017), while the quantitative sovereign default literature usually uses values of μ between 0.1 (Cuadra et al., 2010) and 0.282 (Arellano, 2008). We choose a value in between and set $\mu = 0.2$, which implies an expected exclusion time of 5 quarters and a reasonable debt policy during bad times, with an average simulated spread close to the corresponding data moment. Third, all three parameters jointly determine the frequency of default. For this, we note that literature usually targets default frequencies between 1% and 3% (for example Brazil had two defaults on foreign debt in the postwar period in 1961 and 1983 Reinhart and Rogoff, 2011b, which gives an annual probability of 2.8% when calculated from 1945 to 2016). We set the target default frequency at 2.5%. Having set $\mu = 0.2$ the remaining parameters are set to $\theta = 0.9925$ and $\beta = 0.955$ to match debt service and default frequency. In Section 5.5 we study the sensitivity of the results subject to changes in these latter two parameters.

In the safe economy, the government never enters the zone of positive risk premia. This is achieved by calibrating the default penalty θ very low and the discount factor β very high. Since in the benchmark risky economy, the government is less patient than the market, this alone if carried over to the safe economy, would result in the government always choosing the maximum permissible level of debt on the grid. Thus, we increase the patience of the government by setting $\beta = 1/(1+r) - \epsilon$, where $\epsilon = 10^{-6}$. We set $\theta = 0.01$. The default penalty is the inverse of the value of commitment: with a low value, the government is effectively discouraged from ever choosing to default.[21]

Table 3 presents the model fit against the targeted moments. It lists those from the simulated risky economy against the empirical counterparts of an average emerging economy and similarly for the simulated safe economy (an average advanced economy). We obtain these moments by simulating the model 50 times for 1000 periods, discarding the first 50 periods.

5.2. Policy functions

Default risk has several effects in this model. First, it endogenously limits the debt that can be accumulated by the country. Second, a falling bond price leads to the tightening of an endogenous borrowing constraint. This potentially limits the government's ability to smooth consumption, in particular during recessions as this is when default incentives are high. If the government chooses

[19] We have also solved the model with only two types of households and with ten types of households. While the model with two types does not provide a satisfactory approximation of inequality, the results of the model with ten types were quantitatively very similar to the model with five types.

[20] Chatterjee and Eyigungor (2012) show that introducing long-term debt is key to obtaining high enough debt-to-output ratios as observed in the data.

[21] The incomplete markets model is solved by value function iterations using the two-loop algorithm suggested by Hatchondo et al. (2010). The productivity is discretized with 41 states, the first loop iterates on the current account grid with 2001 points and the second loop iterates on the asset grid with 1001 points, which are comfortably twice as high as in Cuadra et al. (2010).

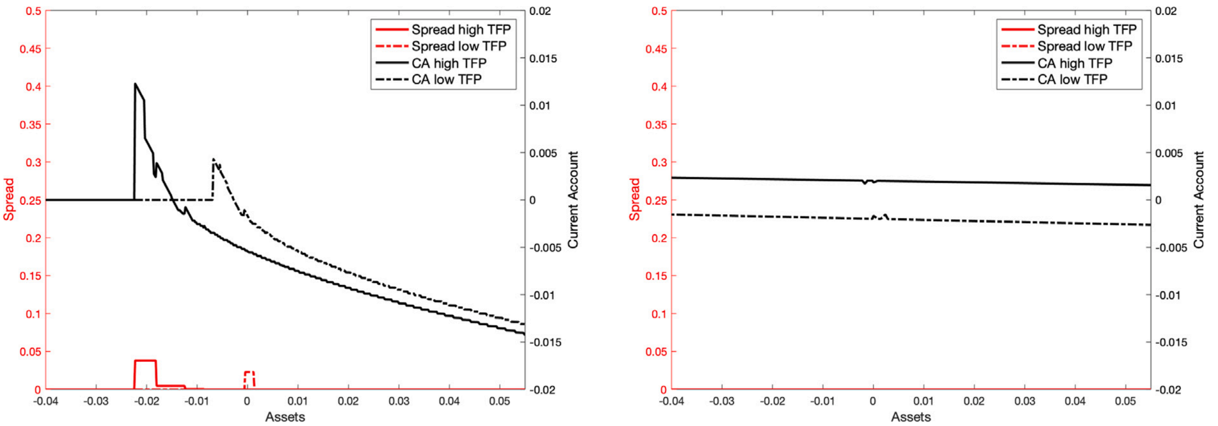

Fig. 3. Current account as a function of asset holdings in the risky (left) and safe economy (right). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)
Source: Own calculations.

not to default yet when bond prices are low, it needs to cut expenditures on public consumption, transfers, or increase taxes. In the following, we explore the role of default risk for this adjustment, starting with optimal policies in the calibrated risky and safe economies. In each case, we plot jointly optimal policies for risky and safe economies. For simplicity, we use "low TFP" to indicate a recessionary period and similarly "high TFP" for a boom.

The policies for borrowing (as visible in the current account) are standard in the literature, and the mechanism for taxes is the same as in Cuadra et al. (2010), so we describe them only briefly below. Fig. 3 plots the current account policy for the risky economy in the left panel and for the safe economy in the right panel.

The government in the safe economy (right panel) conducts a countercyclical current account policy. It borrows from foreign investors (runs a negative current account) in recessions and repays during booms. Debt is always safe and the spread is always zero. In contrast, in the risky economy, as more debt is accumulated, the spread increases and it does so more in recessions for a given level of debt, because incentives to default fall during recoveries, leading to a procyclical current account.[22]

The endogenous borrowing constraint and its anticipation also affect the policy function for taxes. Taxes and foreign borrowing are the two sources of revenue for the government, so their equilibrium behaviour will impact and interact with the spending policies, transfers and public consumption. In the safe economy, tax policy is countercyclical — while it is procyclical in the risky economy. When the government cannot borrow, it will shift towards financing expenditure by increasing the tax rate. The graphs showing the behaviour of tax rate and public consumption are relegated to Appendix 7.7.

Optimal transfer policies are plotted in Fig. 4. Similarly to the current account policies, the government in the safe economy conducts countercyclical fiscal policy: transfers are high when TFP is low and are low when TFP is high. This is driven by the consumption smoothing motive. The government intends to pay out more when aggregate productivity is low to support low-income households and, crucially, can do so as debt is safe and spread is zero. It should be noted, that transfers are expressed in absolute terms (as are all other variables plotted in this section). The countercyclicality of transfer policy is even stronger, and significantly so, when they are expressed relative to GDP.

Transfer policy in the risky economy is very different. The government always runs a procyclical transfer policy and thus "solves" the consumption smoothing-equality trade-off in the opposite direction. The intuition is the following: When TFP is high, absolute inequality (which enters the social welfare function) increases. This requires transfers to be increased. The consumption smoothing motive requires transfers to be decreased. This motive is weakened by the fact, that the government discounts the future strongly and anticipates borrowing constraints.

Furthermore, the gap between transfers during good and bad times is wider, the closer the economy gets to the risky zone. A positive spread acts like an active endogenous borrowing constraint. The policy function for transfers is steeper during low productivity realizations and its slope increases in the immediate neighbourhood of the risky zone. This illustrates the adjustment of transfer expenditure to anticipated and acute financing restrictions, which amplifies the procyclical motive of transfers, albeit through a different channel. When the country defaults, transfers increase sharply as a result of the wealth effect in the default period. Recall that when TFP is below the threshold value as detailed in Eq. (8), default has no additional cost (other than temporary market exclusion), and that default is full. Thus, the marginal increase in resources is non-negligible.

[22] Note that we use "procyclical" here as for other (fiscal) policy tools: it refers to borrowing decisions amplifying rather than dampening the effect of productivity shocks on available resources. The average cyclicality in the simulated model is a quantitative question. It depends on the two driving forces of exogenous TFP shocks (switching between the lines on the graph) and endogenous debt policy (movement along the lines). We show the moments in the calibrated economies in Section 5.4.

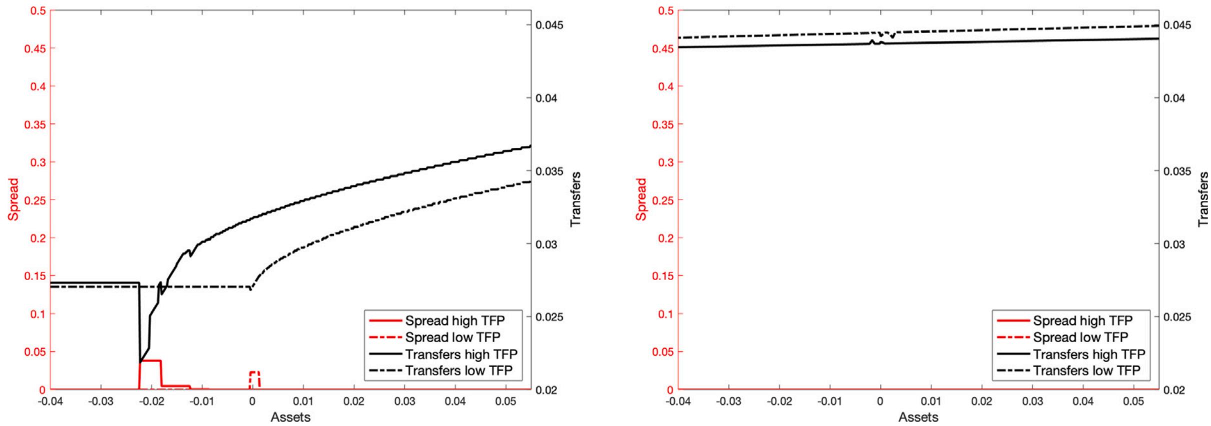

Fig. 4. Transfers as a function of asset holdings in the risky (left) and safe economy (right). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)
Source: Own calculations.

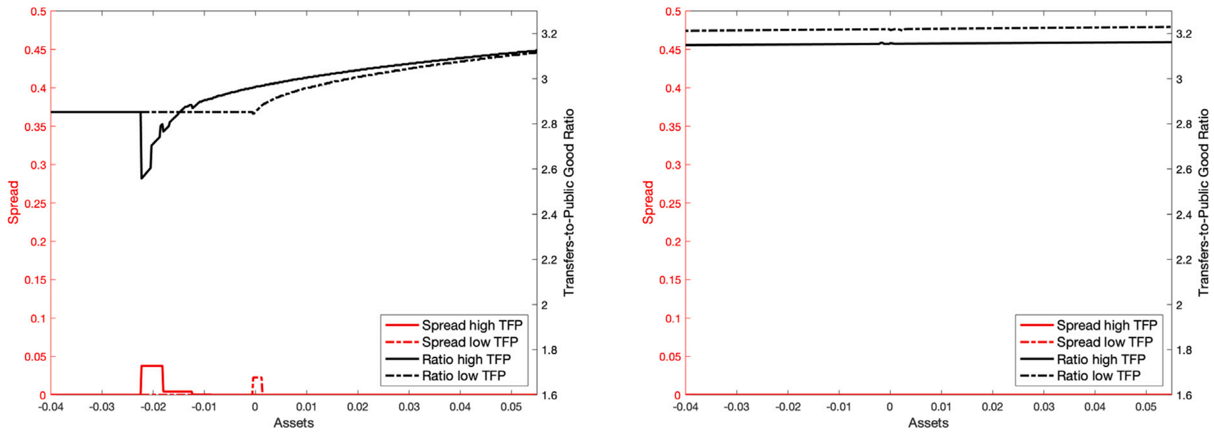

Fig. 5. Transfers-to-public good ratio as a function of asset holdings in the risky (left) and safe (right) economy. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)
Source: Own calculations.

Importantly, both sovereign risk and government expenditure are endogenous in the model: bond spreads respond to fiscal policy, which in turn responds to the changes in bond spread.

The other component of government expenditure, public good, is always procyclical when markets are incomplete, both in the risky as well as in the safe economy. This is because it is optimally set in accordance with aggregate income, as shown also by the zero-average risk sharing wedge in (17).[23]

5.3. Fiscal adjustment

Fig. 5 shows the ratio of transfers to public good spending. In the safe economy, this ratio is countercyclical. Intuitively, in a recession, the government cuts public good spending more relative to transfers because transfers are used to smooth private consumption. Furthermore, during these episodes, consumption inequality is procyclical as a result of active redistribution. Given welfare weights, the government can borrow abroad, increase transfers and cut taxes such that the marginal utility loss of poorer households is mitigated.

[23] As we show in Table 4, government consumption is acyclical in advanced economies and mildly procyclical in emerging markets on average, respectively. In the model, government consumption comoves almost perfectly with GDP. In the safe economy, the correlation is lower but remains significantly positive. Our model is thus not able to capture all stylized facts successfully. Still, incorporating government consumption in the model is useful for our purposes, as it provides a richer set of policy tools and trade-offs for the government. It also allows us to test a prediction of our model in the data, namely how these two spending components are adjusted in relative terms (the transfers to spending ratio) over the business cycle and how borrowing constraints affect this adjustment (see Section 5.3).

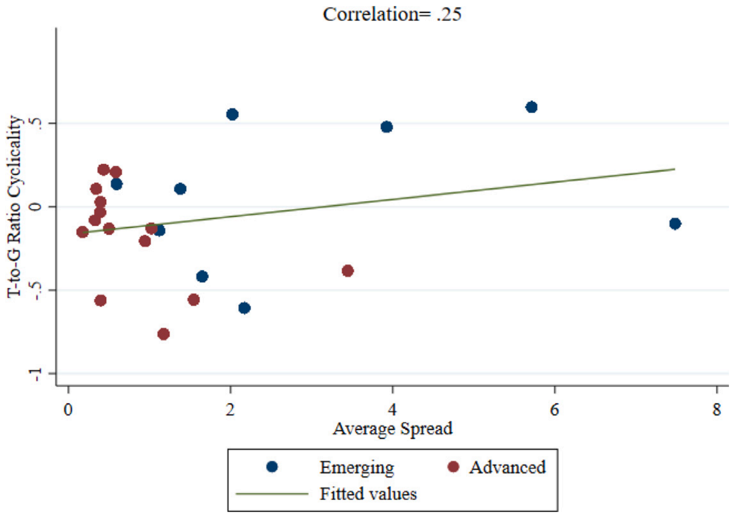

Fig. 6. Cyclicality of transfers-to-public-good spending ratio and country rating. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)
Source: Own calculations based on Michaud and Rothert (2018) and Born et al. (2020).

However, in the risky economy, the ratio of transfers to public good spending is procyclical because the economy is borrowing-constrained. When the country gets close to the risky borrowing zone, a larger share of the revenue from taxation goes into financing the debt. As long as the government finds it optimal to repay, it needs to run a positive current account in recessions and transfers are adjusted more than proportionately in response to productivity shocks. The adjustment of transfers in this case is relatively less costly, because transfers are a perfect substitute for earnings, whereas a tax increase would lower output further and make even fewer resources available for redistribution. As a result, in the risky economy, in a recession, the government cuts transfers relatively more than public good spending.

Thus, in the risky economy, the model predicts that the ratio of transfers to public good spending is more procyclical during periods of tighter borrowing constraints. Indeed, in the simulated model, the correlation with GDP is 0.57 for periods when the spread is more than a standard deviation above its average, and it is 0.15 when the spread is more than a standard deviation below.[24]

Optimal policies from the benchmark models suggest that the cyclicality of the spending ratio changes with the average level of riskiness of the economy and offers a testable implication of the model predictions. Fig. 6 plots the observed cyclicality of the spending ratio against the average spread (proxying for sovereign risk), using the data from Section 3. We can confirm a positive correlation empirically, corroborating the model prediction. See also Table 4 and discussion below for moments from the models and weighted country groups data.

5.4. Untargeted moments

Finally, we discuss the model predictions along the untargeted dimensions. Table 4 compares the cyclical properties of the risky economy against the safe economy and, against the empirical moments of the emerging and advanced economy groups. The empirical moments are, as in the calibration section, weighted averages across countries.[25]

The current account is mildly countercyclical in the benchmark risky economy (foreign borrowing is procyclical), as it is in the data for emerging economies. It is strongly procyclical in the benchmark safe economy, while the data are more nuanced. The government optimally saves during booms. As there is no capital in the model, net (external) public sector debt flows determine the dynamics of the current account over the business cycle. Most importantly, emerging economies are more likely than advanced to become net savers during recessions with higher borrowing costs. In the model, this is so, because they want to avoid default. The average spread in our model is slightly slower than in the data as we do not target it directly and have chosen an intermediate value for the probability of re-entering.

[24] The benchmark preference specification may provide a lower bound on this difference: if government consumption were fixed, the difference in the cyclicalities would tend to be stronger, but at the cost of not allowing for a margin of adjustment that we are interested in. The same is true when we compare the polar cases of autarky (risky economy) and complete markets (safe economy). Government consumption is optimally constant in the complete markets setup (see Appendix 7.3).

[25] There is significant variation across countries in most of these moments, but comparing medians instead of means and discarding outliers still confirms qualitative differences in key moments.

Table 4
Cyclical properties of untargeted moments: Risky vs. Safe economy.

Moment (Weighted average)	Model: Risky	Data: Emerging	Model: Safe	Data: Advanced
corr(Current Account, GDP)	−0.20	−0.41	0.75	−0.26
corr(Transfers GDP)	0.81	0.35	−0.07	−0.43
corr(Public Good, GDP)	0.92	0.25	0.52	0.01
corr(Transfers/Public Good, GDP)	0.20	0.08	−0.74	−0.14
std(Consumption)/std(GDP)	1.07	1.17	0.78	0.91
corr(Spread, GDP)	−0.27	−0.41	N/A	−0.25

Notes: The empirical moments are averages (weighted by GDP per capita) of advanced and emerging economies, data sources are detailed in Section 5.1. Model moments based on own calculations.

In the risky economy, transfers are strongly procyclical. Absent sovereign risk, transfers turn mildly countercyclical. While the model produces significant quantitative and qualitative differences between the risky and safe economies in the way fiscal policy is set, it overestimates the cyclicality of transfers compared to the data in both risky and safe economies. Part of this is likely driven by the simplified way in which transfers and heterogeneity are modelled.

The predominant, time-varying motive for countercyclical transfers in the model is aggregate consumption smoothing. Other motives such as inequality do not vary over time and absolute income differences are procyclical given our assumptions on preferences. (We relax this assumption in Section 5.7.) Most importantly, our mechanism produces significant differences in transfer policies and consumption dynamics, driven by default risk: lack of consumption smoothing and sharp adjustments in transfers during periods of elevated risk results in pronounced procyclical redistribution. During these periods, the cyclicality of transfers is 0.89, whereas it is on average 0.75 when constraints are less binding. As discussed above, this also leads to a significantly stronger relative adjustment in transfers compared to government consumption.

Tax policy is qualitatively similar to Cuadra et al. (2010): procyclical in the risky economy and countercyclical in the safe one. As in the case of transfers, the model predicts significantly more procyclicality during stress periods, a correlation of −0.57 vs. −0.15 during less risky times.[26]

Consumption also exhibits excess sensitivity to GDP — it falls by more than output, as consumption smoothing fails. Consumption falls both because taxes increase, and transfers decrease. Consumption inequality widens during recessions with rising risk premia as a result of this procyclical behaviour of fiscal policy.

The correlation of public good expenditures with GDP in the risky economy is close to one, whereas in the safe economy, it is still strongly positive, but somewhat lower. Given that public good spending and transfers are highly correlated with output, overall government expenditure will be strongly procyclical as well, but better access to financial markets leads to significantly lower volatility and procyclical adjustment.[27]

5.5. *Sensitivity analysis: the role of borrowing constraints*

We now analyse the contributions of several key model features to the cyclicalities of taxes and fiscal expenditures. We are particularly interested in the marginal effects of those determining default risk and savings incentives as these affect the ability and willingness of the government to conduct a countercyclical transfer policy. We run seven different scenarios. In each, we simulate our risky economy, which is calibrated as in the benchmark case, but which inherits one at a time (or more) feature of the safe economy. Table 5 presents the results of this exercise. For convenience, the first and the last columns report again the moments for the benchmark risky and safe economy, respectively.

As these results show, the parameters we use to calibrate the economy's borrowing behaviour on average and its propensity to default have a significant impact on the cyclicality of transfers. In contrast, the parameters that drive the tax rate, and the ratios of transfers and public good spending have little quantitative impact on cyclical properties and critical moments.

Inequality. In the first scenario, the risky economy inherits the individual productivities from the safe economy, which leads to a slightly lower pre-tax inequality. However, welfare weights are unchanged, thus leading to less effective redistribution as transfers are only 9% of GDP compared to 17% in the safe economy. This results in a slightly higher post-tax Gini of 0.39, compared to 0.36

[26] Tax procyclicality, while an important part of our mechanism, is not our main contribution. There is a range of findings in the literature, e.g. Cuadra et al. (2010) document procyclicality, Végh and Vuletin (2015) acyclicality in emerging economies, whereas Michaud and Rothert (2018) find strong countercyclical behaviour using an average total tax rate. We omit a data comparison in this case as there is no consistent and universally accepted data counterpart for the economies in our sample.

[27] In fact, it follows from Eq. (17) that optimal government consumption is acyclical in the polar case of complete markets.

Table 5
Sensitivity analysis.
Source: Own calculations.

Scenario Moment	Risky	(1) e^i	(2) κ	(3) λ	(4) (ρ,σ)	(5) β	(6) β+θ	(7) β+θ+(ρ,σ)	Safe
$prob(Def)$	2.4%	2.4%	2.8%	2.4%	2.3%	0%	0%	0%	0%
T/Y	11%	9.4%	10%	20%	11%	11%	11%	11%	17%
Pre-tax Gini	0.46	0.43	0.46	0.46	0.46	0.46	0.46	0.46	0.43
Post-tax Gini	0.42	0.39	0.42	0.39	0.42	0.42	0.42	0.42	0.36
$corr(CA,Y)$	−0.20	−0.21	−0.20	−0.14	−0.32	0.28	0.34	0.71	0.75
$corr(T,Y)$	0.81	0.80	0.81	0.83	0.85	0.72	0.52	−0.17	−0.07
$corr(\tau,Y)$	−0.19	−0.21	−0.19	−0.14	−0.31	0.28	0.35	0.71	0.75
$corr(T/G,Y)$	0.20	0.21	0.20	0.14	0.31	−0.28	−0.36	−0.71	−0.75

Notes: The table lists moments from model simulations. The first column presents moments of a benchmark risky economy and the last column presents moments of a benchmark safe economy. Columns numbered (1)–(7) present the results of sensitivity analyses. In each, the risky economy inherits one (or more) parameters of the benchmark safe economy, listed at the top of the column. The models are not recalibrated.

in the safe economy. The other moments are almost unchanged. Default probability and the average spread decline slightly (at the second decimal point), leading to a very small 0.01 p.p. increase in average debt service.[28]

Preference for private consumption. In the second sensitivity scenario, we lower the preference for private consumption κ from 0.991 in risky to economy to 0.9785 calibrated for the safe economy. In this scenario, the government is using fewer transfers (10%), but the cyclicalities of fiscal instruments are quantitatively unchanged. A relatively lower weight on private consumption makes default slightly less costly, increasing the frequency of defaults (2.8% compared to 2.4% in the benchmark case).

Welfare weights. In the fourth sensitivity scenario, we implement government welfare weights from the safe economy, captured by the parameter λ from Eq. (20). The safe economy places a higher weight on low-income households, but also has lower pre-tax inequality. Having more weight put on lower-income households, under higher inequality leads to more redistribution and higher transfers than in the safe economy. The procyclicality of tax policy is weaker, resulting mainly from the higher cost of procyclicality in a high tax regime and slightly lower effective borrowing costs in equilibrium: There is a very small reduction in the default probability and the average spread, leading to a less than 0.1 p.p. increase in average debt service.[29]

TFP process. We equip the risky economy with the productivity process of the safe economy. The probability of default decreases slightly and the government uses less debt on average. Procyclicality becomes slightly more pronounced for borrowing, transfers and taxes. This is because the calibrated TFP process for the safe economy is less persistent and more volatile than in the risky economy which has several effects.[30]

All else equal, less persistent shocks lower the value of default relative to repayment. In contrast, higher volatility increases the value of default (Aguiar and Gopinath, 2006). But as default is more costly in booms, the overall effect in the risky economy is (slightly) fewer defaults, higher spreads and more procyclicality as the government prefers fiscal adjustment to default, at least in some states of the world.

More generally, the overall effect is conditional on whether or not there is a significant level of default risk in equilibrium, i.e. whether or not borrowing constraints are expected to bind. If they do (scenario 4) fiscal policy becomes *more procyclical* as the government is willing to engage in more fiscal adjustment instead of defaulting. If they do not (scenario 7), transfers become less procyclical (even countercyclical) as the government saves more and redistributes less in good times. In this way, there is an interaction between borrowing constraints and the incentives to conduct a countercyclical transfer policy in equilibrium.

Discount factor. We now set the discount factor equal to the one in the safe economy. This significantly lowers the incentives to accumulate debt as well as the value of default, all else equal. Default does not occur in equilibrium, which reverses the cyclicality of the current account (net debt flows). As in Cuadra et al. (2010), tax policy is now countercyclical. Transfer policy remains strongly procyclical, even though the correlation falls somewhat. This is a result of default still occurring out of equilibrium, which reduces the amount of effective consumption smoothing the government chooses to do as it wishes to avoid borrowing constraints.

Discount factor and output penalty. In the sixth scenario, we keep the high discount factor and increase the output penalty to the level of the safe economy. This effectively removes the incentives to default. While default risk does not occur in equilibrium, the higher cost of default also lowers the anticipation of borrowing constraints (off-equilibrium), increasing the positive correlation

[28] The results are consistent with Jeon and Kabukcuoglu (2019) who propose a model where higher inequality leads to more defaults and less debt sustainability. However, the mechanism leading to this result is slightly different: their model takes tax policy as given, so inequality shocks lead to a more volatile income process and lower the default threshold, especially in periods of high inequality, which lowers the relative cost of default. In our model, only the latter channel is present.

[29] This result is consistent with Ferriere (2015) who argues that inequality increases relative risk aversion, which is one of the results of increasing the weights on lower-income households. They also find that higher taxes increase debt sustainability and lower defaults and spreads, which is the case in our model, albeit quantitatively negligible, partly because our scenarios induce less variation in fiscal policy than the ones considered in that paper.

[30] GDP in the safe economy is more persistent and less volatile than in the risky economy, because of the absence of defaults, which induce exogenous productivity drops.

Table 6
The role of inequality and welfare weights.
Source: Own calculations.

Moment	Risky (benchmark)	Utilitarian gov.	Low ineq.
$prob(Def)$	2.4%	2.1%	2.2%
B/Y	2.3%	2.3%	2.2%
T/Y	11%	28%	2%
Pre-tax Gini	0.46	0.46	0.28
Post-tax Gini	0.42	0.36	0.27
$corr(CA,Y)$	−0.20	−0.10	−0.21
$corr(T,Y)$	0.81	0.84	0.43
$corr(\tau,Y)$	−0.19	−0.09	−0.21
$corr(T/G,Y)$	0.20	0.10	0.20

Notes: The table lists moments from model simulations. The first column presents moments of the benchmark risky economy. The second column presents moments of a risky economy where welfare weights are not calibrated but assumed to be equal (utilitarian government). The third column presents moments of a risky economy where inequality has been reduced such that optimal transfers are, on average, close to zero.

of net debt flows further. This further lowers the cyclicality of transfers and increases the cyclicality of taxes. The distribution of assets is also still wide, but markedly lower and on average significantly negative as a result of higher debt sustainability.

Discount factor, TFP process, output penalty. In the final scenario, we add the TFP process to the previous two parameters. As a result, the cyclical properties of fiscal policy are now very close to the one in the calibrated safe economy. Debt policy is highly countercyclical, tax policy is highly procyclical, and transfer policy becomes countercyclical. We note that transfers are even more countercyclical in this economy than in the safe economy. This is the result of higher effective inequality in this scenario compared to the safe economy. The effect of the TFP process on fiscal policy dynamics is different than in the fifth scenario (i.e. on the risky economy) because there is no binding borrowing constraint or anticipation thereof, which leads to procyclicality during these periods.

5.6. Robustness: The role of inequality and redistributive preferences

In this section, we use the model to study two separate counterfactual scenarios. In the first, we assume the government is utilitarian and set the welfare weights in (6)–(10) equal to the population weights, $\alpha_i = 0.2 \quad \forall_{i=\{1,\dots,5\}}$. In the second exercise, we reduce inequality to a level that still admits positive transfers at the margin, and study how far it goes in altering the cyclical behaviour of the economy. Table 6 presents the results for the benchmark model in the first column, for the utilitarian government in the second column, and the low inequality in the third column.[31]

Utilitarian government. The benchmark model is calibrated to match the empirical transfers-to-GDP ratio. This is achieved by placing a higher weight on higher-income households. Instead, when the government is utilitarian, it will place an equal weight on all households. Transfers play two important roles in the model: they allow intertemporal consumption smoothing as well as they reduce intratemporal inequality. The first motive is countercyclical, while the second motive is acyclical. The utilitarian government weighs low-productivity agents more than the benchmark one which strengthens the redistribution motive. In this exercise, the transfers-to-GDP ratio is (counterfactually) high (28%). Taxes are also higher, and the tax system is effectively more progressive than in the benchmark model. Inequality is greatly reduced: the Gini coefficient after taxes and transfers is much lower than in the benchmark model (0.36 vs. 0.42). The probability of default falls (from 2.4% to 2.1%) which is in line with the results in Ferriere (2015): less progressivity encourages default since the cost of raising tax revenue from a larger mass of low-income households outweighs the cost of default. However, as a result, transfers become more procyclical than in the benchmark case (0.84 vs. 0.80) as the government cuts transfers more to prevent default and using taxes is more costly. Yet, it should be noted that the effect on the default probability is relatively small. Foreign borrowing is less procyclical: the correlation of the current account with output is −0.1 compared to −0.2. This is because the government is becoming more risk averse through the higher weight on low-income households.

Low inequality. In the second exercise we calibrate inequality to a level where transfers are very close to zero, but always positive, so there is almost no redistribution. Notice that, as discussed in Section 4 this happens only at some positive levels of inequality. With small or no inequality the government would intend to use negative transfers instead, as they are non-distortionary.

We calibrate inequality such that transfers are only marginally positive on average, and the average transfers-to-GDP ratio is 2%. Pre-tax income ratios are set to $\{0.16, 0.4, 0.6, 0.8, 1\}$ in this scenario, which gives a pre-tax Gini coefficient of 0.28. Since there is almost no redistribution, the post-tax-and-transfer Gini (0.27) is only marginally lower than the pre-tax one. Low inequality greatly reduces the intratemporal redistribution motive, and the government puts higher weight on the intertemporal consumption smoothing motive, compared to the benchmark one. This helps to qualitatively change the tax and debt policy over the business

[31] These experiments are fleshed out versions of scenarios (1) and (3) in Section 5.5. The scenarios serve predominantly to decompose the quantitative differences between the safe and risky economies.

Table 7
Cyclical properties with income effect: Risky and safe economy.
Source: Own calculations.

Scenario	Benchmark		Preferences with income effect			
Moment	GHH		$\gamma = 2, \phi = 0.6$		$\gamma = 2, \phi = 1.5$	
	Risky	Safe	Risky	Safe	Risky	Safe
corr(τ, Y)	−0.19	0.74	0.07	0.96	−0.02	0.93
corr(T, Y)	0.81	−0.07	0.72	−0.70	0.89	−0.10
corr(G, Y)	0.92	0.52	0.92	0.13	0.94	0.32
corr(T/G, Y)	0.92	0.25	−0.07	−0.96	0.03	−0.89
corr(hours, Y)	0.99	0.99	−0.67	0.87	−0.84	0.72
std(C)/std(Y)	1.07	0.78	1.09	0.39	1.09	0.44
mean(spread)	2.56	0	2.56	0	2.43	0
corr(spread, Y)	−0.27	N/A	0.18	N/A	0.03	N/A

Notes: The first and second columns present the benchmark risky and safe model economies from Section 5. Columns (3)–(6) present moments for two alternative economies with income effects — each of them calibrated to a risky and safe economy. The table lists untargeted moments. All alternative economies are recalibrated to match target moments as in Section 5, Table 3. The calibrated values of all parameters are listed in Table 10 in Appendix 7.8.

cycle. The correlation of transfers with GDP drops from 0.81 to 0.43. It should be noted, that the GDP is much higher in this economy, as with this level of relative productivities, the whole economy is, on average, more productive than the benchmark economy. Even though the transfer policy is close to absent, the tax rate is positive on average, as the tax proceeds are used to pay off foreign debt and fund the public good. Low inequality also slightly reduces the riskiness of the economy: the probability of default drops from 2.4% to 2.2%.

5.7. Robustness: The role of income effects

We choose additively separable preferences where we can fine-tune several of the margins of adjustment to illustrate the dynamics of the model when income effects become very strong. We assume the following additively separable preferences which are frequently used in the literature.[32] The optimality conditions, in this case, will change as the schedule for optimal transfers will take into account the income effect of labour supply.

$$u(g^P, c_i, h_i) = \kappa \left(\frac{c_i^{1-\gamma}}{1-\gamma} - \chi \frac{h_i^{1+\phi}}{1+\phi} \right) + (1-\kappa) \frac{g^{P\,1-\gamma}}{1-\gamma} \tag{21}$$

The Frisch elasticity is equal to $\frac{1}{\eta}$ as before. The strength of the income effect is governed by γ. Heathcote et al. (2014) show analytically that in a model without transfers when $\gamma > 1$, the income effect dominates the substitution effect and hours worked fall in response to an increase in earnings. In our model setup, because households receive transfers, the threshold also depends on the ratio of earnings to consumption and might vary across the income distribution.

We recalibrate the model to the benchmark risky and safe economies, using this alternative utility function.[33] In the first scenario, we set $\gamma = 2$ and $\phi = 0.6$ as in the benchmark calibration with GHH preferences. However, with preferences specified in (21) these parameter values imply relatively strong income effects. The high value for the Frisch elasticity is frequently used in models aiming to match business cycle moments but implies a strong dispersion of hours worked across the income distribution and a counterfactually high negative correlation between hours worked and earnings. However, the degree to which households use their labour supply margin is important for the way taxes and transfers are set, both intratemporally and intertemporally. To address this, we also show a scenario where we set $\phi = 1.5$, close to a micro elasticity, while keeping $\gamma = 2$. We recalibrate all remaining parameters to match the moments listed in Table 2, for each scenario separately. The values of parameters are shown in Table 10 in Appendix 7.8.[34]

Table 7 reports key moments from this exercise. The overall fit of the model in the risky economy is worse than in the benchmark model without income effects. In particular, hours worked are countercyclical, while they remain procyclical in the safe economy, although less so than in the benchmark model. This is due to the differences in fiscal policy. While taxes and transfers are set in a more countercyclical way in safe economies, taxes remain strongly procyclical in the risky economies. Tax policy is almost acyclical in the risky economy.

The strongly countercyclical tax and transfer policy in the safe economy more than offsets the income effect from higher wages, and hours worked remain procyclical. For a given tax policy, ceteris paribus, the income effect lowers the correlation of tax revenues with GDP because labour supply may fall in response to an increase in productivity. The government in the safe economy finds it optimal to offset this during periods of high productivity — as it wishes to save. In the risky economy, however, the government

[32] Recent applications with a dynamic macro focus using this specification are, among others, Bhandari et al. (2017, 2021), Romei (2017), Michaud and Rothert (2014), and Ferriere (2015).

[33] We do not target additional aggregate moments in the data. While Aguiar and Gopinath (2006) note that hours are less cyclical in emerging markets (which could point towards stronger income effects), Neumeyer and Perri (2005) argue some of these different dynamics may be due to quality issues in hours worked data. Intuitively, the higher importance of informality and tax evasion could potentially explain part of this phenomenon in measured economic activity.

[34] Romei (2017) uses a value of $\phi = 1$, Bhandari et al. (2021) choose $\phi = 2$, and Heathcote et al. (2014) estimate a value of $\phi = 2.14$ using U.S. data.

needs to run a less procyclical tax policy in order to increase revenues during recessions. This mechanism is stronger when labour supply responds more elastically (scenario 1) and taxes are slightly more procyclical in this case.

With income effects, labour supply declines when transfers increase. Thus, in a risky economy, the revenue from taxes would fall if the government were to increase transfers in a recession. At the same time, in recessions, high-productivity households adjust their labour supply more, which increases inequality. This means the government now has a higher welfare loss from reducing transfers.[35] This effect is also weaker in the model with lower elasticity, leading to stronger procyclicality of transfers in this scenario. Government consumption is less procyclical in the safe economy, which reflects the role of the income effect in reducing the variation of marginal utilities across the business cycle. Lastly, consumption in the safe economy is smooth compared to income.

To summarize, introducing significant income effects into this model affects the business cycle properties along several dimensions. While tax policy becomes acyclical in the risky economy, optimal transfer policy remains significantly procyclical, even when income effects are strong. The fit of the model with income effects is worse than the fit of the model without. Nevertheless, our results on the role of borrowing constraints for the cyclicality of fiscal policy and the prediction of how they impact the relative adjustment of spending components remain robust.

6. Conclusion

Empirical evidence shows that fiscal policy is procyclical in emerging economies, while it is countercyclical in developed countries. This paper proposes a novel mechanism that links this procyclical behaviour to default risk and borrowing constraints. We build a simple incomplete markets model with transfers, taxes and public goods. Public goods are valued by households, transfers are lump-sum to all households and are motivated by earnings inequality and consumption smoothing. In the model, the government finances expenditures with distortionary taxation and by issuing non-state-contingent debt in international credit markets. The government cannot commit to repaying its debt, which leads to endogenous borrowing constraints due to default risk.

Transfers serve two functions: (i) they provide insurance to households against aggregate risk, and (ii) they redistribute income, which can also be viewed as insurance against idiosyncratic shocks. If the government faces a borrowing constraint due to default risk or anticipates hitting one in the future, they cease to fulfil both of these functions and the optimal policy is reversed, the more so the tighter the constraints become.

We calibrate the model to match a weighted average of moments for a sample of emerging market countries (a "risky" economy), as well as a "safe" economy that matches some key features from developed economies and run a number of sensitivity analyses to highlight the role of default risk for the quantitative properties of the economy and optimal fiscal policy. We show that default risk indeed drives the qualitative difference in optimal policy between the countries. In the simulated risky economy, the optimal policy is significantly more procyclical during periods of elevated risk, when debt and default risk are high. Consistent with the recent literature on financial market imperfections and fiscal policy, we find that tax policy is also procyclical.

The model predicts that transfers take a larger share of fiscal adjustment than public good spending in the risky economy (between countries) and especially during periods of elevated risk (within a country): the ratio of transfers to public good spending is countercyclical in the safe economy, whereas it is procyclical in the risky economy. We confirm this pattern is also present in the data: the cyclicality of transfer to public good spending is positively related to average country spreads.

We show that endogenous default risk can rationalize the way that fiscal policy is set over the business cycle. We thus contribute to recent literature that documents the role of procyclical transfers in explaining the business cycle features of emerging markets and developing countries.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary material related to this article can be found online at https://doi.org/10.1016/j.euroecorev.2024.104786.

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[35] This effect could partly be offset as lower taxes can reduce inequality, which reduces the need for countercyclical transfers, although the answer to this depends on the parametrization as it does not need to be monotonic across the income distribution.

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