Imperfect Financial Markets, External Debt, and the Cyclicality of Social Transfers

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VERY PRELIMINARY

Abstract

This paper deals with optimal government spending over the business cycle. I document evidence that government expenditure tends to be more procyclical the higher are a country's borrowing cost. Decomposing government expenditure components shows that the cyclical correlations of social transfers and insurance spending are the most important in driving cross-country differences. I build a simple model of optimal fiscal policy and income inequality where government spending is financed by taxation and by external debt in form of a risk free bond. Government spending consists of a public good providing direct utility, and of transfers to private agents. Transfers are used for redistribution and to smooth low income agents consumption. The government is benevolent but cannot commit to repay its debt. This generates endogenous risk premia due to default risk, which act like borrowing constraints. The government runs a procyclical tax policy in the neighborhood of the constraint and a countercyclical policy when it does not face risk premia. Transfer policy is procyclical also when risk premia are zero, because the government already anticipates a borrowing constraint in case of an enduring recession. Since it cannot borrow easily without hitting the borrowing constraint quickly, transfers cannot fulfill their role of consumption smoothing, but only redis- tribute income to some extent. In contrast, government spending on public goods is always procyclical. The result is stronger the higher the inequality in income. The results implied by the theoretical model are qualitatively consistent with the data.

JEL classification: E62, F34, F41.
Keywords: Procyclical fiscal policy, default risk, redistribution, emerging markets.

1   Introduction and Literature

Why is government expenditure countercyclical in countries with high GDP per capita and better access to international financial markets? In this paper I argue that the extent to which a government can use international financial markets for smoothing revenue and expenditure is important in determining the cyclicality of government spending. In particular, market conditions affect mostly government spending that is supposed to facilitate private consumption smoothing. I use a break down of government spending according to economic function, such

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as health, defense, social assistance, and public order. Government spending that is targeted towards a certain group of the population - such as social assistance - has a transfer character and acts as a substitute to private spending. Other spending components - such as defense spending or public order - have a public good character, and are complementary or neutral in a utility sense to private consumption.

Existing studies such as Kaminsky, Reinhart and Végh (2005) or Vegh and Vuletin (2012) focus on the behaviour of total government expenditure. Ilzetzki and Vegh (2008) look at both government consumption and government expenditure, and find that the cyclical behaviour of government consumption as a function GDP per capita is less clear than that of government expenditure. The conclude that the big difference across countries is in transfers. I use data for small open economies to show evidence that transfer like spending components are countercyclical in rich countries, whereas they are procyclical in the Latin American countries. The cyclical behavior of government transfers and the relative sizes of the spending components determine the overall cyclicality of government spending. On the other hand, government transfers constitute a lower fraction of total government spending in developing countries. Thus, even when during longer periods of good financial conditions for these countries redistributive policies could be set for an overall countercyclical policy, the correlation between government expenditure and GDP might be still be positive due to the minor importance of transfer spending.

I set up a small open economy model with a benevolent government who faces frictions in international financial markets. Government spending is divided into a public good, which optimally comoves with private consumption, and redistributive transfers. The government needs to finance spending using costly taxation. In absence of the borrowing friction, the government uses financial markets to distribute the tax cost optimally over the business cycle and transfers to low income agents are countercyclical. When borrowing constraints bind, transfers are procyclical and total government spending becomes very procyclical.

The aftermath of the recent financial crisis has seen a large number of countries in economic decline. Subsequently many governments are facing rising risk premia due to default risk and find themselves in fiscal distress. In many of these cases, governments embark on some sort of spending cuts program in order to limit or reverse the primary deficit. This runs contrary to the belief that fiscal policy should stabilize economic activity during downturns, which is consistent with countercyclical government expenditure. In developed countries, government expenditure indeed tends to be countercyclical. To a large part this is due to automatic stabilizers. These are spending components that react in order to smooth consumption of private households despite income fluctuations and to maintain aggregate demand. The spending cuts and austerity programs that we observe in countries like Greece were not a regular feature during the past decade, but can find parallels during events like the Great Depression.[1] In contrast, the perceived borrowing constraints and the inability of governments to smooth out recessions by subsidizing private sector spending is usually a more common phenomenon in developing countries and emerging markets.

The recent experience in developed economies confirms the importance of my suggested mechanism, which links procyclical government expenditure and policies to borrowing constraints due to default risk. I argue that these endogenous borrowing constraints can help to explain why governments run procyclical policies during recessions when they anticipate to hit a borrowing constraint, or if they find themselves already unable to issue more debt and need to cut spending. In this case, not only the public goods component of government expenditure falls. This part would optimally fall during recessions, because it is positively correlated with private consumption. When borrowing becomes expensive, governments will also lower transfers during

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[1] For the experience in the case of Germany, see Fisher and Hornstein (2002) and the references therein.

recessions and fiscal policy becomes strongly procyclical.

This paper contributes to the literature on optimal fiscal policy business cycle models with financial market imperfections. In particular, I show that financial market incompleteness is theoretically and quantitatively an important factor for the correlation of government expenditure components and GDP over the business cycle. Government expenditure tends to be negatively related to GDP over the business cycle in developed countries, and positively in developing economies. The same holds for the menu of assets available to public and private entities to insure against idiosyncratic country risk, the so-called 'incompleteness of financial markets'. Limited access to international financial markets is further restricted by high interest rates (low bond prices).

Neumeyer and Perri (2005) and also Uribe and Yue (2006) find these to be highly counteryclical in emerging markets and many developing countries. They impose the relationship between interest rates and GDP (total factor productivity) from the data in their model as an exogenous function. The findings suggest that countercyclical interest rates can explain key stylized facts of emerging markets, such as countercyclical current account and the excess volatility of consumption. Papers in the class of Arellano (2008) and Cuadra, Sanchez and Sapriza (2010) try to explain jointly the behavior of country interest rates and macroeconomics variables. These models internalize the repayment decision and can thus generate risk premia when the country is expected to default on its debt.

The literature on fiscal policy over the business cycle with a focus on developing countries can be divided into two main strands. The first strand emphasizes political economy frictions. Here, the paper closest to mine is (Ilzetzki 2011), who analyses optimal transfers under political disagreement and stochastic turnover regarding different groups in the population. In his model, transfers are procyclical when disagreement, or 'ethnical polarization', is sufficiently high. In constrast to this paper, agents in his model are homogeneous in terms of individual preferences and there is no idiosyncratic uncertainty, whereas I study transfers as an insurance device in the presence of idiosyncratic uncertainty. Furthermore, the government in the model has commitment to repay its international obligations, so it can borrow and save freely at the risk free rate.

The second strand focuses on the role of budgetary constraints for the cyclical properties of fiscal policies. In a widely cited paper, Aizenman, Gavin and Hausmann (2000) analyze a two period model of tax policy with endogenous credit constraints due to default risk. They show that when bond spreads rise during a recession, the government increases the tax rate when (partial) default is still too costly. The model cannot make any quantitative statements on the probability of those situations to occur. More recently, some authors have developed quantitative business cycle models with credit constraints. Cuadra et al. (2010) find that the endogenous borrowing constraints that arise due to the default option for the government, optimal tax policy becomes procyclical when the constraint starts binding, while government consumption is procyclical regardless of the introduction of a borrowing constraint. The authors use a representative agent model with government consumption only and thus cannot provide a further breakdown of government expenditures as I do here.

Recently, Golosov and Sargent (2012) have studied optimal redistribution using a closed economy with income inequality and domestic debt. In their model, the government can borrow and save with agents who can use a risk free bond to (partly) insure against aggregate risk. The authors find that the level of public and private debt are indeterminate in this economy, due to the presence of lump-sum transfers and the desirability of redistribution. Furthermore, tax smoothing now needs to be traded off with redistribution, which is contrary to the result in

the corresponding economy with a representative agent. My model differs in several dimensions: first, I do not allow agents to borrow. Second, I assume that the government can target transfers towards low income households. Third, I use an open economy and focus on the interactions of borrowing constraints with redistribution.

I introduce income redistribution into a small open economy model to show the impact of external financial market imperfections on the properties of government expenditures. In my model, government spending is financed by costly taxation and facilitated by borrowing and saving in international financial markets. The government can only set a single proportional tax rate on income. Redistribution happens via transfers to private households, which are conditional on their income. I illustrate the basic mechanism using the extreme cases of autarky and complete international financial markets. Between these two cases government transfers are qualitatively different: they are countercyclical under complete markets, and procyclical under incomplete markets. Necessary assumptions for this result to hold are that taxes imply a convex welfare loss, which is also at least weakly concave in aggregate productivity.

I then use a version of the model with a risk free bond and endogenous borrowing constraints due to limited commitment to show that this indeed drives the qualitative difference in transfer policy over the business cycle. In the neighborhood of the borrowing constraint, the policy function for bonds flattens out because the government is anticipating the constraint and tries to avoid a sharp drop in consumption. Consequently, international borrowing and saving become less good an instrument to smooth consumption over the business cycle and transfers become procyclical in this area of the distribution of assets. When debt is outside this region, transfers are countercyclical because the government can jointly use taxes and assets to stabilise domestic demand. I also find that the procyclicality of transfers is higher the tighter is the borrowing constraint for the government.

The paper is organised as follows. First, I present data on government expenditure and a break down into different . Then, I set up a model with exogenously incomplete markets and default risk. We can look at the mechanism analytically in the two benchmark cases of autarky and complete international financial markets in an endowment economy. Section 4 contains the numerical solution and and the results from simulating the model. I conclude in the final section 5.

2   Data

There is a significant positive correlation between the cyclicality of government expenditure and the average external borrowing cost for governments. Figure 2 plots the correlation of the cyclical government spending component with GDP against S&P's foreign currency sovereign credit rating.[2] Credit rating letters have been encoded into numbers ranging from $AAA = 1$ ("lowest cost"), to $B- = 16$ ("highest cost"). Countries with a better credit rating, thus lower and less volatile average interest rates, tend to have more countercyclical government expenditures. Borrowing costs are also reflected by a country's bond spreads. These are higher in developing countries and strongly countercyclical (Neumeyer and Perri 2005).

Total government expenditure is the sum of government consumption expenditure, transfer payments including social security contributions, government investment expenditure and interest payments. A similar graph is in Ilzetzki (2011), Kaminsky et al. (2005), and Vegh and Vuletin
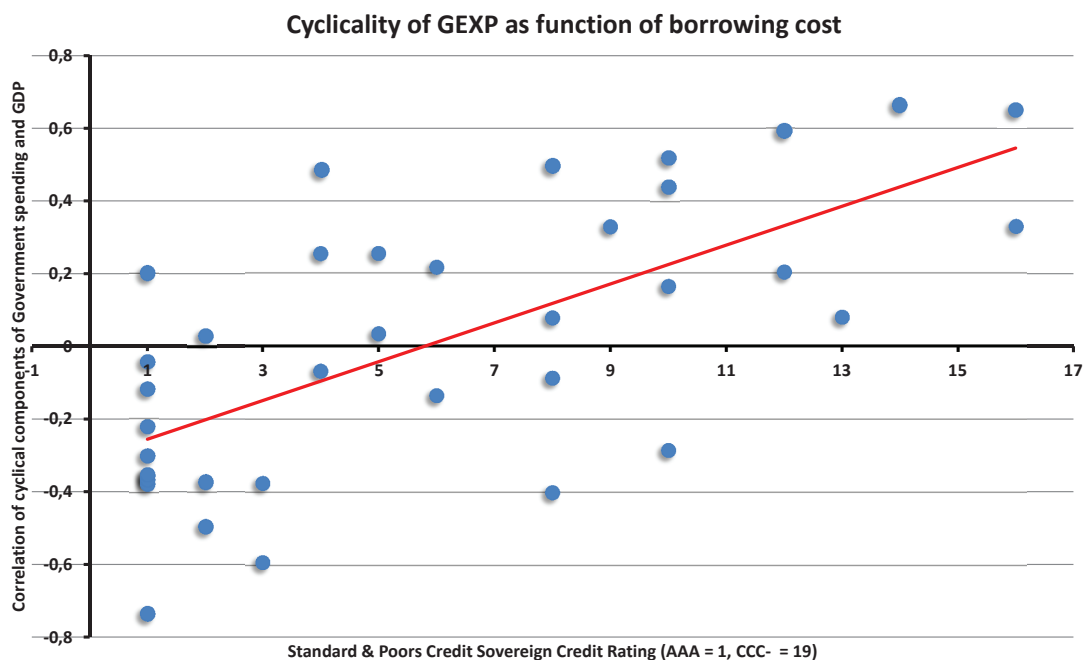
Figure 1: Correlation between cyclical components of total government spending and GDP as a function of sovereign credit rating. *Source: IMF, OECD, Oxford Economics Database, National Statistics, S&P'.*

(2012). The latter use central government data.

There are several ways of decomposing government spending. The United Nation's Classification of the Functions of Government [COFOG] is a convenient breakup because it is consistent with my theoretical approach to government expenditure. It divides government spending into categories such as *Defence, Health, Education,* and most importantly for us *Social protection.*[3] Data are bundled according to this classification in the IMF's Government Finance Statistics, in the EUROSTAT database, and in the General Government Accounts of the OECD.

I present empirical evidence for four variables, *Defense* [GDEFENSE], *General Public Services* [GPUBSERV][4], *Health* [GHEALTH], and *Social Protection* [GSOCIAL]. The order ranks the categories according to their public good character. I call a public good a good that is non-excludable, non-rivalrous, *and* whose provision by the government cannot easily be substituted by a decentralized market. *Defence* has the strongest public good character, and *Social protection.* Please consult the appendix with an overview over the remaining categories subject to data availability.

My sample consists of 17 countries, 8 of which are emerging small open economies: Argentina, Brazil, Colombia, Chile, Mexico, Thailand, Paraguay, and Uruguay. 9 are rich countries: Australia, Austria, Canada, Denmark, Netherlands, New Zealand, Norway, United Kingdom, and the USA. All series are annual and have been filtered using differences in logs. The table below lists the correlation between components of government expenditure and GDP. I chose this method due to the lack of sufficiently long series in several cases to apply a more developed

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[2]Rating as of January 28, 2013.

[3]See http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=4&Lg=1&Top=1, accessed on January 24, 2013.

[4]*General Public Services* are indeed a very general category; an important spending category is *foreign aid*.

filter, such as the HP-Filter. However, for the series where a comparison was possible, the difference with HP-Filtered series was not qualitative. Rather, the filtering through differencing exaggerates correlations at 'business cycle frequency' as defined by the HP Filter.

	GEXP	GDEFENSE	GPUBSERV	GHEALTH	GSOCIAL
Argentina	0,32753018		-0,01831137	0,2100088	0,419415
Brazil	0,49570163	0,23144137	-0,0006252	0,5016354	0,48017806
Chile	0,48537246	0,35622248	0,02696144	0,52085446	0,18873582
Colombia	0,1635308	0,01623589	-0,16676945	0,05696128	0,07088576
Mexico	0,32649282	0,27819195	0,16944643	0,24600632	0,46833424
Paraguay	0,07919135	n.a.	0,36156168	0,44143726	0,08508199
Thailand	0,07711857	0,19555213	0,12238288	0,18721293	-0,07408101
Uruguay	0,51731804	-0,0772117	-0,15988898	0,18020122	0,34394049
Australia	-0,22182007	-0,23225949	-0,39267209	0,41810859	-0,13939765
Austria	0,02850962	-0,20374675	0,23753728	0,04549469	-0,14437755
Canada	-0,11485444	0,14356734	-0,23897319	0,1786028	-0,40399325
Denmark	-0,35471235	0,11397517	-0,45148735	-0,31357452	-0,20484302
Netherlands	-0,19279696	-0,16638247	0,03326213	0,03420548	-0,1796104
New Zealand	-0,59241916	n.a.	0,12107986	0,25966175	-0,04913966
Norway	-0,35166414	-0,00962319	-0,37500106	-0,08887552	-0,37243331
United Kingdom	-0,30063075	n.a.	0,27095679	-0,22215879	-0,62678866
USA	-0,4964541	0,2225776	0,18713724	-0,37545344	-0,55107401

Table 1: Correlations of government expenditure components and GDP

Table 1 shows the correlations of public spending components with GDP. The countries are grouped by development status (except for lonely Portugal). As we can see, government expenditure is countercylical or acyclical in our sample of rich countries. We cannot say this for GDEFENSE or GPUBSERVE. Only for GHEALTH and GSOCIAL, strongest for the last category, does a clear pattern as for total expenditure emerge.

I add several figures to argue for the different impact of functional spending components on the cyclicality of goverment consumption. My argument links the strength of the relationship of category-wise cyclicality compared to that of overall spending and its contribution. Figure 3 plots the relationship between the cyclicality of government expenditure and of GDEFENSE, GSOCIAL, respectively. There is no signifcant relationship between GDEFENSE and GEXP in this sample. In contrast, GSOCIAL is almost perfectly aligned with GEXP.

Figure 2 shows the intermediate public good categories, GPUBSERV and GHEALTH. There is a relationship between GHEALTH and GEXP, but it is weaker than that of GSOCIAL. For GPUBSERV finally, the relationship is not statistically significant in this sample, but seems to exist at first sight.

The empirical evidence confirms the various roles of different government spending components. While the traditional spending components do not seem to greatly influence the overall cyclicality of government expenditure, spending components that are a prominent feature of developed economies today are. These are predominantly targeted towards a certain group in the population, such as social transfers. Here the development status makes a big difference, and if we see economic development as a proxy for financial development, then financial frictions can contribute to explain fiscal procyclicality along a new dimension.
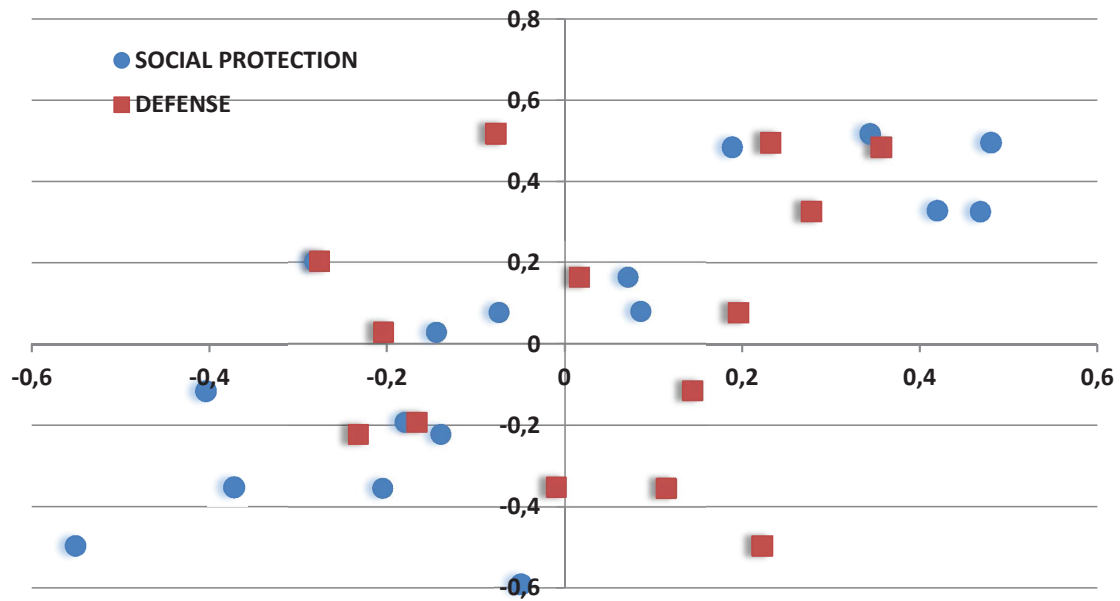
Figure 2: Cyclical correlations of GHEALTH and GPUBSERV. x-axis: correlation of GEXP and GDP.

2.1 The case of Mexico

Table 2 shows basic business cycle characteristics of the Mexican economy, which I choose as the benchmark emerging market economy. Table 3 gives a broad overview over the statistics of the aggregates and prices. The data are quarterly from 1980:1-2006:Q4. I construct a real interest rate according to Neumeyer and Perri (2005) using the EMBI Global spread for Mexico, the US 90-days T-Bill rate, and expected inflation from the GDP deflator. I construct an effective tax rate following Mendoza, Razin and Tesar (1995). The tax revenues are for VAT and taxes on "special goods", respectively. The series are deflated using the GDP deflator. The variables are seasonally adjusted, and filtered using the HP-Filter. For comparison I also report the statistics from Baxter-King filtered series. The data for the aggregate variables are from Banco de Mexico. In particular, I construct a series for transfers to private households and firms as reported in the public finance statistics for the business cycle characteristics.[5] Transfers to public sector enterprises are substracted from the total figures.[6]. The correlation with GDP qualitatively the same as the one of annual social spending with GDP.

The Mexican business cycle is characterized by excess volatility of consumption and much stornger of government expenditure. Furthermore, the interest rate and the trade balance to GDP ratio are countercyclical and there is evidence of procyclical tax and transfer policy. Total expenditure accounts for around 28% of GDP during the period, and transfers are around 5%

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[5]The GFS data with social transfers, health spending, etc., are only available on an annual basis, so I use the category from the economic classification instead.

[6]Transfers to state governments are listed under a separate revenue-sharing category and do not enter into the figures
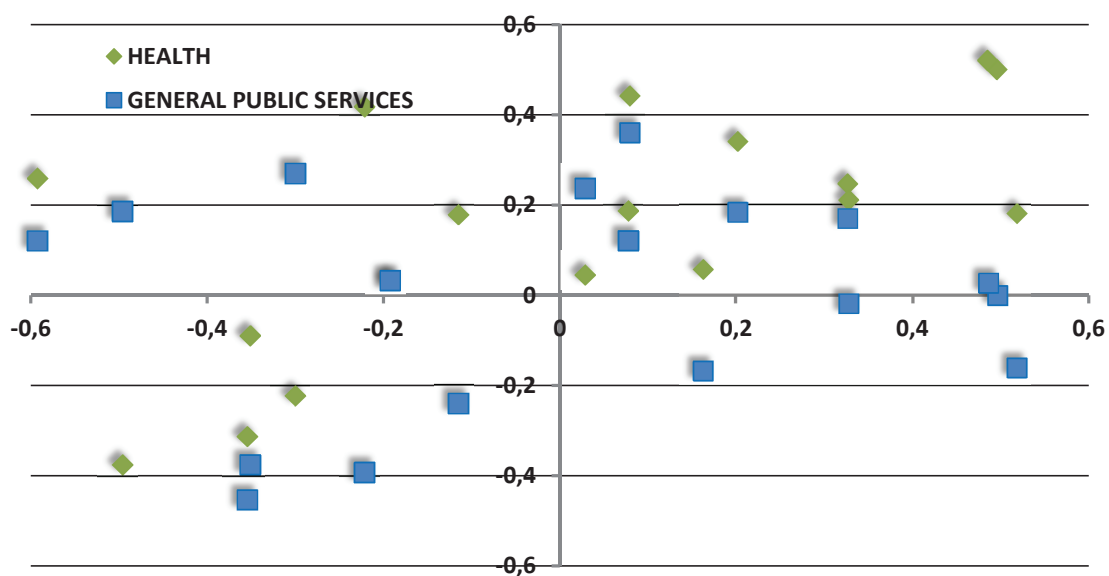
HEALTH

GENERAL PUBLIC SERVICES

0,6

0,4

0,2

0

-0,2

-0,4

-0,6

-0,6   -0,4   -0,2   0   0,2   0,4   0,6

Figure 3: Cyclical correlations of GDEFENSE and GSOCIAL. x-axis: correlation of GEXP and GDP.

of total expenditures (1.3% of GDP).

	HP Filter	
Variable	Standard Deviation (%)	Correlations with GDP
GDP	2.37	
C	2.90	0.92
GCons	3.05	0.41
GEXP	6.32	0.35
Transfers	14.03	0.41
Tax	0.47	-0.30
TB/Y	2.03	-0.72
R	2.32	-0.36

Table 2: Business Cycle statistics Mexico

	Mean (%)	Median (%)	Std
GEXP/GDP	28.26	27.62	3.19
TRANS/GEXP	4.83	4.92	1.68
TRANS/GDP	1.34	1.35	0.44
C/Y	70.03	69.89	1.98
GCONS/Y	10.58	10.75	0.96
TB/Y	3.39	3.34	0.04
R	7.21	7.29	3.99

Table 3: Basic Descriptive Statistics, Mexico

3 Model

I consider a production economy with heterogeneous agents, a benevolent government and competitive international financial markets with risk neutral investors. The government provides a public good to private households and transfers to low income agents. Expenditures are financed by taxing households and by borrowing and saving internationally. Taxation is costly because the government cannot collect lump sum taxes. Instead, it can only levy a proportional labor income tax on households. With elastic labor supply, it is possible that the marginal output loss due to taxation depends positively on total factor productivity. I assume that the government has access to a risk free bond in external financial markets only, and it has no commitment to repay the debt. I build on the small open economy framework with endogenous default risk due to willingness-to-pay as in Arellano (2008), with fiscal policy as in Cuadra et al (2010).

After the setup of the model, I demonstrate the effect of financial market incompleteness using the two extreme scenarios: complete international financial markets, and autarky, before I report results from simulating the numerical solution of the exogenously incomplete markets model.

We assume that the household sector in the domestic economy is populated by ex ante identical agents of mass 1. Ex post, agents differ according to their labor productivity e^i. e^i can take on two values, $\{e^h, e^l\}$. Households supply labor elastically, and I denote hours worked of household with productivity e^i h^i. In addition to idiosyncratic income risk, there is also aggregate productivity risk in the economy, A, such that total pre-tax income is $Ae^i h^i$. A fraction $\sigma(A)$ has high labor productivity e^h. This fraction can depend on the current realization of total factor productivity. The dependence will be exogenous, as in Krusell, Smith and Jr. (1998), where the transition probability into and out of unemployment is a function of aggregate productivity. I assume that A can be represented by a stationary first order autocorrelated process.

Households value their expected lifetime utility, a discounted stream of instantaneous utility functions that depend on consumption and hours worked and on government consumption on a public good:

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

subject to the budget constraint

$$(1+\tau_t)c_t^i = A_t e_t^i h_t^i + T_t^i, \qquad \forall i = h, l.$$

$T_t^i \geq 0$ is a non-negative subsidy payment from the government. g_t is government spending on a public good, which we assume to be additively separable in the utility function. The weights on private and public consumption are κ and $(1-\kappa)$, respectively. With this formulation, the marginal utility of private consumption is independent of public consumption. Hence, public and private consumption are not complements in the utility function. Still, demand for public consumption will be increasing in private consumption because the utility functions are concave. τ_t is a tax rate on consumption expenditures.

The state variables of the individual problem are A and e^i The problem in state space form reads:

$$V^i(A, e^i) = \max_{h^i} \kappa u(c^i, h^i) + (1-\kappa)v(g) + \beta \mathbb{E}[V(A', e^{i,\prime})|A, e^i] \qquad (1)$$

subject to

$$(1+\tau)c^i = Ae^i h^i + T^i, \qquad \forall i = h, l. \qquad (2)$$

Denote by c^{i*}, h^{i*} the policies that solve the household problem.[7] The first order optimality conditions of the household satisfy the equations (2) and

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

I define total output net of total factor productivity to $\sigma(A)e^h n^{h*} + (1-\sigma(A))e^l n^{l*} \equiv y(A)$, and GDP is $Y \equiv Ay(A)$.

The government can borrow and save in international bond markets with risk neutral creditors. Risk neutral creditors discount future consumption at a constant rate $\delta = (1+r)^{-1}$. I assume that the government likes to frontload consumption because the world interest rate is lower than its subjective discount rate: $\beta < (1+r)^{-1}$. This prevents divergent positive asset holdings in the stationary equilibrium of this economy.

The government cannot commit to repay its international obligations. Instead, it can decide in each period whether to default on current outstanding debt or whether to repay. If it defaults, it defaults on all currently outstanding debt and loses access to financial markets. If it repays, it retains market access. Denote by $V^{aut}(A_s)$ the value function of the government if it defaults on its debt given the realization of total factor productivity. $V^{nd}(b_s, A_s)$ is the value function if the goverment does not default but repays its debt. Default occurs if

$$V^{aut}(A_s) > V^{nd}(b_s, A_s).^{[8]} \tag{4}$$

I can then define the value function in the beginning of the period, before the decision on defaulting or repayment is made:

$$V^0(b, A) = \max_d(dV^{aut}(A) + (1-d)V^{nd}(b, A)). \tag{5}$$

where

$$d(b, A) = \begin{cases} 1 & \text{if } V^{aut}(A) > V^{nd}(b, A) \\ 0 & \text{otherwise} \end{cases}$$

International creditors have perfect information about the borrowing countries' fundamentals and anticipate default decisions. Denote by $\pi^{def}(b', A)$ the probability that the country defaults when borrowing b' today. $\pi^{def}(b', A)$ is the sum of conditional probabilities of the future state given the current state A, for which default occurs. Creditors set the bond price in order to satisfy the zero profit condition

$$-q(b', A)b' + \frac{(1-\pi^{def}(b', A))}{1+r}b' = 0. \tag{6}$$

If $\pi^{def}(b', A)$ is non zero, the bond price falls. If the government wants to roll over its debt, it needs to use additional resources to finance the repayment since creditors are only willing to extend new debt at a discount. Hence default risk leads to endogenous borrowing constraints.

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[7]For notational simplicity, we suppress further details. The household policy functions will depend on the tax rate, transfers, aggregate and individual productivity.

[8]Whenever the government is indifferent between defaulting and repaying, it is assumed that it repays.

The value functions of repayment and default are the solutions to the maximization problem whether the government has market access in the current state or not. The government maximizes ex ante welfare. A benevolent government will place equal weights on all agents in the population when agents are ex ante identical. The government chooses optimal policies such that the households' first order conditions are satisfied, and its own budget constraint holds. When the government has market access, this budget constraint is

$$g + \sigma(A)T^h(1 - \sigma(A))T^l + qb' = \tau C(A) + b. \tag{7}$$

If the government defaults on its debt, I follow the literature and I assume that it immediately loses market access and defaults on all outstanding debt. With a constant probablity μ it regains access to markets in subsequent periods. It re-enters markets with zero assets and no negative credit history. Furthermore, the country incurs an asymmetric output loss during the default spell. An output cost can be justified by trade embargoes and losses of access to trade credits for exporting firms. I assume as Cuadra et al (2010) that

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

When the government is currently in the state of default, its budget constraint reads accordingly

$$g + \sigma(A^d)T^h + (1 - \sigma(A^d))T^l = \tau C(A^d). \tag{9}$$

The optimal policy when the government repays is a 5-tuple of optimal policies as a function of the governments' state variables (A, b), $\{\tau(A, b), T^h(A, b), T^l(A, b), b(A, b), g(A, b)\}$, that solves the ramsey problem in the following equations:

$$V^{nd}(A, b) = \max_{\{\tau, T^h, T^l, b', g\}} [\kappa \int_0^1 u(c^{*i}, h^{*i})f(i, A)di + (1 - \kappa)\nu(g)] + \beta\mathbb{E}[V^0(A', b')|A, b] \tag{10}$$

subject to

$$-\frac{u_n(c^{*i}, h^{*i})}{u_c(c^{*i}, h^{*i})} = (1 - \tau)Ae^i, \qquad \forall i = h, l. \tag{11}$$

$$(1 + \tau)c^{*i} = Ae^i h^{*i} + T^i, \qquad \forall i = h, l. \tag{12}$$

$$g + \sigma(A)T^h + (1 - \sigma(A))T^l + qb' = \tau C(A) + b. \tag{13}$$

$$b_0 = 0. \tag{14}$$

The first order conditions to this problem yield the optimality conditions to the households' problem and three conditions which determine aggregate dynamics in this economy. In what follows, I assume that household preferences are of the GHH (1988) form:[9]

$$u(c, h) = \frac{(c - \frac{h^{1+\theta}}{1+\theta})^{1-\gamma}}{1 - \gamma} \tag{15}$$

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[9]Greenwood, Hercowitz and Huffman (1988).

These preferences assume away a wealth effect on labor supply - the marginal rate of substitution between consumption and hours worked is independent of consumption. I make this assumption for two reasons: first, it simplifies the analysis by abstracting from direct supply side effects of transfers. Second, these preferences have been shown to match the stylized facts of small open economies quite well. The elasticity of hours worked with respect to the wage rate is constant and equal to $\frac{1}{\theta}$.

Optimal hours worked can be solved for using the marginal rate of substitution directly:

$$h^{*i} = [(1 - \tau)A_t e^i]^{\frac{1}{\theta}}, \qquad \forall i = h, l. \tag{16}$$

And consumption becomes, using households' budget constraint:

$$c^{*i} = [(1 - \tau)A e^i]^{\frac{1+\theta}{\theta}} + T^i, \qquad \forall i = h, l. \tag{17}$$

The first aggregate condition is the Euler equation which determines aggregate consumption dynamics:

$$(1 - \kappa)\nu'(g)\left[q(b', A) + b'\frac{\partial q(A, b')}{\partial b'}\right] = \beta\mathbb{E}_{A': d(A', b')=0}(1 - \kappa)\nu'(g') \tag{18}$$

There are two interesting aspects of this equation are. The first is the right hand side. When choosing bond policy today, marginal utility of government consumption is equalized only with marginal discounted expectation of future marginal utility in the states when the government repays. This is of course because there is no inter temporal decision to be made when defaulting, and the allocation is not time dependent, so it does not affect the bond choice directly. The effect is only through the interaction with transition and default probabilities, and the bond price.

Secondly, the pricing term on the left hand side shows the effect of default risk as a borrowing constraint on consumption. $b'\frac{\partial q(A,b')}{\partial b'}$ 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 will positive. Since $b' < 0$, the whole term falls. Hence, ceteris paribus, when the bond price falls due to a risk of default (and does so when debt increases), marginal utility is higher: the government needs to cut down consumption when the borrowing constraint starts binding.

If the constraint on non-negativity of transfers is not binding, the first order condition for optimal transfers and for public consumption determine the relationship between private consumption and public consumption:

$$\kappa u'(c^{l*}) = (1 - \kappa)\nu'(g). \tag{19}$$

Since taxation is costly, the government will never give transfers to the agent with high endowment and the constraint on non-negativity of transfers will be always binding in this case, $T^h(A, b) = 0, \forall A, b$, and the marginal utilities of high income agents and the government are not equalized. Consumption of the high income agent is then equal to $c_t^{*h} = [\frac{A_t e^i}{1+tau_t}]^{\frac{1+\theta}{\theta}}$.

The tax rate is set such that the difference in marginal utilities, corresponds to the tax distortion. Define as $\xi_{h,\tau}$ the elasticity of hours worked with respect to the tax rate:

$$\xi_{h,\tau} := \frac{dlnh}{dln\tau} = -\frac{1}{\theta}\frac{\tau}{1-\tau}. \tag{20}$$

The elasticity is constant *for a given tax rate*, and it is increasing in the tax rate. Thus, the distortion due to the taxation of labor supply and the welfare loss are convex in τ.

The first order condition for the tax rate then reads

$$u'(c^{*h}, h^{*h}) = \left[1 + \xi_{h^h,\tau} + \frac{\sigma}{1-\sigma}\xi_{h^l,\tau}\left(\frac{e_l}{e_h}\right)^{\frac{1}{\theta}+1}\right]u'(c^{*l}, h^{*l}). \tag{21}$$

The term preceding h^{*l} is to convert low productivity labor supply to the units of each high productivity agent. Unless $\xi_{h,\tau} = 0$, marginal utility is optimally not equalized across states - the government leaves some idiosyncratic risk to the high income agents. That is, costly taxation drives a positive, possibly time-varying wedge between consumption in the high income and the low income state.

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

The value function when the government defaults is the solution to the maximization problem:

$$V^d(A^d) = \max_{\{\tau, T^h, T^l, g\}}[\kappa\int_0^1 u(c^{*i}, h^{*i})f(i, A^d)di + (1-\kappa)\nu(g)] + \beta\mathbb{E}[\mu V^0(A', b') + (1-\mu)V^d(A^{d'})|A, b] \tag{22}$$

subject to

$$-\frac{u_n(c^{*i}, h^{*i})}{u_c(c^{*i}, h^{*i})} = \frac{A^d e^i}{1 + tau^d}, \qquad \forall i = h, l. \tag{23}$$

$$(1 + \tau^d)c^{*i} = A^d e^i h^{*i} + T^i, \qquad \forall i = h, l. \tag{24}$$

$$g + \sigma(A^d)T^h + (1 - \sigma(A^d))T^l = \tau C(A^d). \tag{25}$$

The optimality conditions to this problem are analogous to those of the problem with market access.

There is no analytical solution to this problem, so I will use a stylized version of the model to demonstrate how the limit to market access affect the cyclical behavior of transfer policy. The stylized version assumes inelastic labor supply, and ad hoc tax function as in Aizenman et al. (2000). I confront a closed economy with a world of a full set of state contingent assets. Results for the numerical solution of the model with a tentative calibration are presented and discussed in section 4.

3.1 Complete Markets and Autarky with endowment model

We will now consider two benchmark cases of international financial market structure: complete markets and autarky. In particular, we show that the behaviour of transfers under complete markets is qualitatively different from that in autarky, at least for a range of particular cases. For simplicity, I use an endowment economy. I show that when we restrict parameters to a range that excludes counterfactual movements in consumption, transfers are always countercyclical under complete markets. Unfortunately, it is not possible to derive a general result in analytic form for the case of autarky, so I use a graphic extension of results for a particular set of parameters.

In the endowment economy, the government maximizes

$$E_0 \sum_{t=0}^{\infty} \beta^t [\kappa(\sigma u(c_t^h) + (1-\sigma)u(c_t^l)) + (1-\kappa)\nu(g_t)] \tag{26}$$

subject to

$$c_t^i = (1-\tau_t)A_t e_t^i + T_t^i, \forall i = h, l \tag{27}$$

and

$$g_t + \sigma T_t^h (1-\sigma) T_t^l + b_{t+1} + \Gamma(\tau_t, A_t) = \tau_t Y + (1+r_t) b_t. \tag{28}$$

$\Gamma(\cdot)$ is an ad hoc function of the cost of taxation. It has the following properties:

$$\Gamma_\tau(\cdot), \Gamma_{\tau\tau}(\cdot) > 0,^{10} \qquad \Gamma_A(\cdot) \geq 0. \tag{29}$$

In the scenario with complete markets, the government chooses quantities of state contingent assets at prices $p(A_{t+1})$, for every possible realization of A_{t+1}. The goverment is a price taker. The world prices of state contingent assets are set competitively by risk neutral agents. Under appropriate assumptions on the stochastic process, allocations in this economy are not history dependent. We can summarize borrowing and lending per period by the balance, $l_t \equiv \int_{A_{t+1}} p(A_s) b(A_s) \, dA_s - b(A_t)$. l_t takes on as many values as there are aggregate states and their value is pinned down by the expected zero profit condition of the risk neutral agent[11]

$$\mathbb{E}_{-1} \sum_{t=0}^{\infty} \beta^t l_t = 0. \tag{30}$$

The budget constraint of the government reads:

$$g_t + \Gamma(\tau_t, A_t) + \sigma T_t^l + (1-\sigma_t) T_{2t} + \int_{A_{t+1}} p(A_s) b(A_s) \, dA_s = \tau_t Y_t + b(A_t). \tag{31}$$

Under the aforementioned assumptions on international financial markets, the actuarially fair price for the state contingent asset $b(A_{t+1})$ when the current value of productivity is A_t is $p(A_{t+1}|A_t) = \beta f(A_{t+1}|A_t)$. From the Euler equation, this implies that government consumption is constant across states and across time, that is, international financial markets absorb all country risk:

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[10]See below for dynamics if this assumption is relaxed.

[11]This condition can be derived by setting up the social planner problem of the economy, which amounts to maximizing the weighted sum of expected discounted utilities of the risk averse country (government and private households) and risk neutral international investors.

$$p(A_{s+1}|A_s)\nu'(g_s) = \beta f(A_{s+1}|A_s)\nu'(g_{s+1}), \qquad \forall s \geq 0. \tag{32}$$

$$\Rightarrow \qquad \nu'(g_t) = \nu'(g_s) = \nu'(g), \quad \forall s,t \geq 0, \ s \neq t. \tag{33}$$

From the first order condition for transfers (see above), marginal utilities of the public good and the consumption of the low productivity agent are equalized if the nonnegativity constraint on transfers is not binding, thus, consumption of the low productivity agent is also perfectly smooth. Intuitively, this is an optimal policy because it is more costly for the government to let consumption of the low income agent fluctuate with aggregate productivity, because marginal utility is decreasing in consumption. Hence, small changes in consumption lead to large changes in utility and welfare.

$$c_s^l = c_t^l = c^l, \quad \forall s,t \geq 0, \ s \neq t. \tag{34}$$

The complete markets version of the consumption dispersion or risk sharing equation then reads

$$u'(c_t^h) = \left[1 - \frac{\Gamma'(\tau_t, A_t)}{\sigma A \epsilon^h}\right] u'(c^l) \tag{35}$$

Because consumption of the low productivity agents is smoothed across aggregate productivity states, we can derive a consumption smoothing equation for high productivity agents:

$$\frac{u'(c_H^h)}{u'(c_L^h)} = \frac{\left[1 - \frac{\Gamma'(\tau_H, A_H)}{\sigma A_H \epsilon_1}\right]}{\left[1 - \frac{\Gamma'(\tau_L, A_L)}{\sigma A_L \epsilon_1}\right]}, \qquad A_H > A_L. \tag{36}$$

As we can see here, consumption of the high productivity agent is not necessarily smoothed across aggregate productivity states when financial markets are complete, either. Moreover, this equation introduces parameter restrictions such that the properties of the solution do not imply counterfactual business cycle facts. Most importantly however, we can show immediately that these assumptions are sufficient (though not necessary) for countercyclical transfers policies.

Assumption: We assume that the cost function is such that consumption of the high productivity agents is procyclical.

Proposition: If consumption of the high productivity agent is procyclical, then transfers are countercyclical under complete markets.

Proof of Proposition: Consider the budget constraints of a low productivity agent for two levels of aggregate productivity, $A_H > A_L$. Then, due to the consumption smoothing condition for low productivity agents, the two are equal:

$$(1 - \tau_H)A_H e_l + T_H = (1 - \tau_L)A_L e_l + T_L.$$

Rearranging and using the assumption gives

$$\underbrace{(1 - \tau_H)A_H - (1 - \tau_L)A_L}_{>0}]e_l = T_L - T_H. \quad \square$$

Under autarky, the government does not have access to international financial markets. The equilibrium is characterized by the following relationships:

$$u'(c_t^h) = \left[1 - \frac{\Gamma'(\tau_t, A_t)}{\sigma A_t \epsilon_1}\right]u'(c_{lt}) \tag{37}$$

$$\kappa u'(c_t^h) = (1 - \kappa)\nu'(g_t) \tag{38}$$

In this case, consumption of the low productivity agent is state-dependent. In order to characterize the equilibrium relationship between transfers and GDP, suppose that $u(x) = \nu(x) = \frac{x^{1-\gamma}}{1-\gamma}$, and without loss of generality we set $\kappa = \frac{1}{2}$. Furthermore, we assume that $\Gamma(\tau, A) = \frac{1}{2}\tau^2 A^m$, with $m \geq 0$. We can solve for c_{lt} using the risk-sharing, the private-public consumption condition, and the aggregate resouce constraint:

$$c_t^l = \frac{A_t y - \frac{1}{2}\tau_t^2 A^m}{\sigma[1 - \frac{\tau A^{m-1}}{\sigma \epsilon^h}]^{-\frac{1}{\gamma}} + 2 - \sigma} \tag{39}$$

The tax rate then solves the following equation, which is derived using the budget constraint of the low productivity agent and the government, inserting the expression above:

$$(2 - \sigma)\frac{A_t y - \frac{1}{2}\tau_t^2 A_t^m}{\sigma[1 - \frac{\tau_t A_t^{m-1}}{\sigma \epsilon^h}]^{-\frac{1}{\gamma}} + (2 - \sigma)} + \frac{1}{2}\tau^2 A_t^{m-1} - \tau_t y - (1 - \sigma)(1 - \tau_t)e^h = 0. \tag{40}$$

For the case of $m = 1$, (40) shows that the tax rate is independent of aggregate productivity, hence constant, which implies that transfers are procyclical in this scenario.

Proposition When the tax cost is convex in the tax rate and linear in aggregate productivity [GDP], then transfers in Autarky are procyclical, while they are countercyclical under complete markets.

Proof of Proposition: the case of complete markets has been shown above. For the case of autarky, consider c^l for two levels of A, $A_H > A_L$:

$$T_H = \frac{A_H y - \frac{1}{2}\tau^2 A_H}{\sigma[1 - \frac{\tau}{\sigma \epsilon_1}]^{-\frac{1}{\gamma}}} - (1 - \tau)A_H e^l, \qquad T_L = \frac{A_L y - \frac{1}{2}\tau^2}{\sigma[1 - \frac{\tau}{\sigma \epsilon^h}]^{-\frac{1}{\gamma}}} - (1 - \tau)A_L e^l$$

$$\rightarrow \quad T_H - T_L = (A_H - A_L)\left(\frac{y - \frac{1}{2}\tau^2}{\sigma[1 - \frac{\tau}{\sigma \epsilon^h}]^{-\frac{1}{\gamma}} + 2 - \sigma} - (1 - \tau)e^l\right) > 0. \quad \square \tag{41}$$

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4 Numerical Solution and Results

We assume that the utility functions has CRRA:

$$u(c) = \frac{(c - \frac{n^{1+\theta}}{1+\theta})^{1-\gamma}}{1-\gamma}, \qquad \nu(g) = \frac{g^{1-\gamma_g}}{1-\gamma_g}. \tag{42}$$

Total factor productivity is stochastic, and it follows a lognormal AR(1) process.

$$\log(A_t) = (1-\rho)\log\bar{A} + \rho\log(A_{t-1}) + \epsilon_t, \quad \epsilon_t \sim N(0, \sigma_\epsilon) \tag{43}$$

We assume the following parameter values:

parameter	value	target
γ, γ_g	2	coefficient of relative risk aversion
σ	0.7	share of high productivity agents
β	0.975	$std(G)/std(Y)$
r	0.01	risk free interest rate
κ	0.8	average share of public consumption
e^h, e^l	1, 0.8	productivity of high, low individual state
ρ	0.85	GDP Mexico
σ_ϵ	0.058	GDP Mexico
$\bar{A}$	1	Scaling parameter of GDP
μ	0.1	average time spend in default
θ	0.99	debt service to GDP ratio

We discretize the stochastic process using the method described in Tauchen and Hussey (1991), using 20 states for aggregate productivity. The incomplete markets model is solved using value function iteration. The statistics below are from simulating the model 1000 times for 100 periods, discarding the first 50. The series have then been filtered using the HP-Filter. The model is calibrated to the Mexican economy. Persistence parameter ρ and standard deviation of the innovation σ_ϵ are set as to match the output volatility in Mexican data for the period (**sometime in the past**).

β, the countries' exogenous discount factor, calibrates the relative volatility of public consumption relative to GDP. The coefficient for relative risk aversion of the private sector is a value commonly used for small open economy models of emerging markets. I follow Cuadra et al. (2010) and set the coefficient of relative risk aversion for public consumption also to $\gamma_g = 2$. The share of high productivity agents reflects the 70% upper part of the earnings distribution. the ratio between e^h, e^l approximate the degree of earning inequality. κ is set as to match the ratio of public to private consumption in Mexico of around 15% for the data period. I calibrate the asymmetric output loss in (8) such that the model generates an average debt service to GDP ratio of around 4.5%. μ is taken from Cuadra et al (2010) who use results from the literature on average time without market access.

The role of default risk

Default risk has several effects in this model. First, it endogenously limits the debt that can be accumulated by the country. Second, it potentially limits the government's ability to smooth

income when the bond price falls and an endogenous borrowing constraint starts binding. If the government cannot borrow when it incurs a series of bad shocks, transfers cannot be 'smoothed', that is - in this model - set in a procyclical fashion. When borrowing constraints are slack, the correlation of transfers and GDP is significantly lower than when they are tight. Thus, this model shows that borrowing constraints lead to more procyclical transfer policies and strongly procyclical government expenditure.

The policy function for transfers and bond holdings illustrate the mechanism. Figure 4 plots the policy function for bonds for high and low aggregate productivity, respectively. As we get closer to the borrowing limit, the policy function for low aggregate productivity flattens out. Hence, relative to a situation when the country finds itself further away from the borrowing limit (with higher asset levels), it is optimal to borrow less in order to make it less costly when the borrowing constraint is eventually hit. In this model, the government already anticipates higher borrowing costs when it has assets, so the distance between borrowing during good and bad times becomes smaller quite quickly.
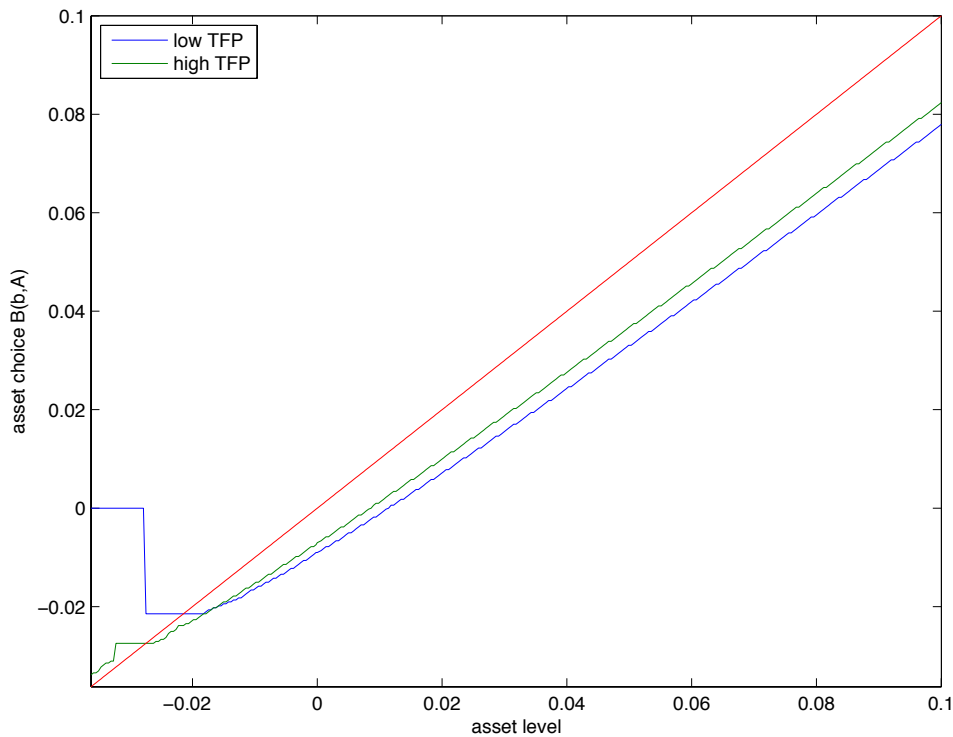

Figure 4: Asset choice as a function of asset holdings: Around the borrowing constraint.

The endogenous borrowing constraint and its anticipation also affect the policy function for transfers and taxes. I start to discuss transfers, which are plotted in figure 5. For higher levels of assets, the government borrows unconstrained during bad times and pays out more transfers to low income households. However, when the policy function for bonds starts flattening out, the relationship reverses for transfers during good and bad times. Now the government does not borrow enough during bad times in order to run a countercyclical transfer policy and relatively more resources are allocated to cutting back borrowing. The gap between transfers during good and bad times is widening the closer asset holdings approach the borrowing constraint. When the country defaults, transfers jump as a result of the wealth effect in the default period. Recall that the model assumes that default has no additional cost when aggregate productivity is below the unconditional mean, and default is full. Thus, the marginal increase in resources is non-negligible.
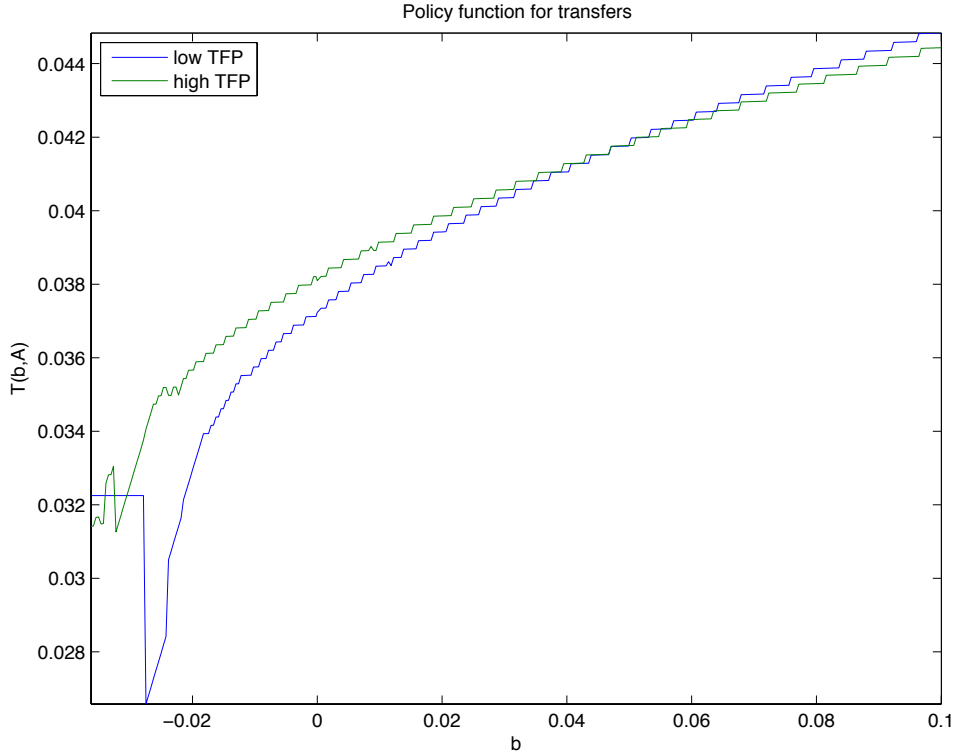
Figure 5: Transfers as a function of asset holdings

The relationship between the borrowing constraint and transfers can be recovered also by simulating the model. I plot the correlation between transfers and GDP against mean asset holdings for 1000 different series of shock realizations. The results in figure 6 confirm the intuition from the state dependent policy function. The lower is the upper bound for our bond interval, the higher is the correlation between transfers and GDP. This stands in contrast to the region of assets for which the relationship between transfers and GDP is reversed, which would be on the right side of figure 5: the correlation is negative and more so, the further we move away from the borrowing constraint.

The other component of government expenditure, government spending on public goods, is always procyclical when markets are incomplete. Thus, the presence of a borrowing constraint does not qualitatively effect government spending that enters the maximization problem in this way. Government consumption falls during recessions and it falls relatively more than transfers.

Figure 4 shows the ratio of aggregate transfers to spending on public goods. As the level of debt falls, transfers increase by more than government consumption. The ratio of transfers to public good spending is also countercyclical, which follows from countercyclical transfer policy for high levels of assets. However, it is still countercyclical until the borrowing constraint effectively binds and the bond price falls. Now the revenue from taxation goes into financing of the debt.

The policy function for taxes displays similar dynamics as the policy function for transfers. In figure 8 we can see the optimal tax rate for two levels of aggregate productivity (low and high, respectively) in the neighborhood of the borrowing constraint. As for the case with transfers, the policy functions cross in this region. For asset levels higher than the critical point, the tax rate is positively correlated with GDP, which I denote as 'countercyclical tax policy' in line with the literature. For asset levels lower than the crossing point, tax policy becomes procyclical. This
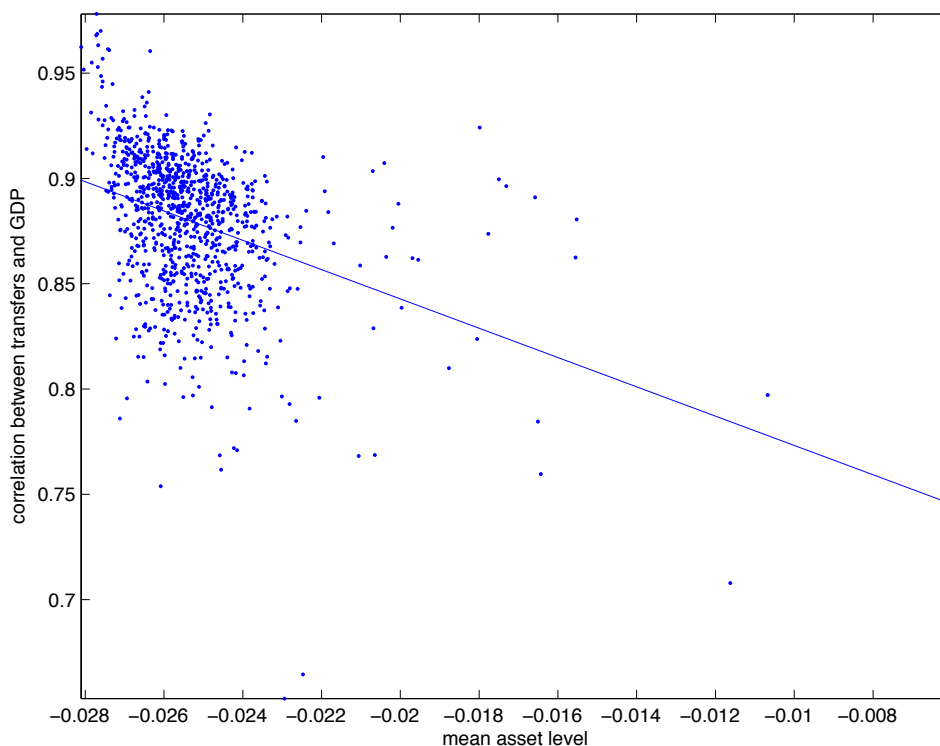
Figure 6: Correlation between transfers and GDP, simulated data.

is consistent with results from the recent quantitative literature on fiscal policy ant default risk: When the government cannot borrow, it will shift towards financing expenditure by increasing the tax rate. As opposed to transfer policy, the reversal of cyclicality occurs at a different point. Whereas for transfers, this was the case at much higher levels of assets - or lower levels of debt, for this region tax policy is still countercyclical. The government tries to avoid increasing the cost of taxation during recessions until it faces active borrowing constraints.

Finally, in figure 4 I plot consumption dispersion for high and low debt levels as a function of aggregate productivity. We can see that consumption dispersion is procyclical. This can be related both to distortionary taxation and to procyclical income dispersion (see below). An increase in the tax rate induces higher welfare losses during recessions than during booms, which limits the scope for consumption smoothing with imperfect financial markets. Furthermore, when the government is approaching the borrowing constraint, transfers become procyclical and consumption dispersion does not fall during recessions as it would if the government were able to borrow against low income.

As one important modification, I change the standard deviation of idiosyncratic productivity. What is the impact of higher inequality on optimal transfer policy? On the one hand, it is more costly to let the consumption of low productivity agents vary, hence transfers should become more countercyclical. On the other hand, income dispersion is higher and in levels becomes more procyclical. Furthermore, total production is also lower. This could make countercyclical transfers a more difficult policy to implement.

The results for the base model and for the model with higher inequality are listed in table 4.

A possible issue in the current setup is the procyclicality of the pre-tax and transfers income
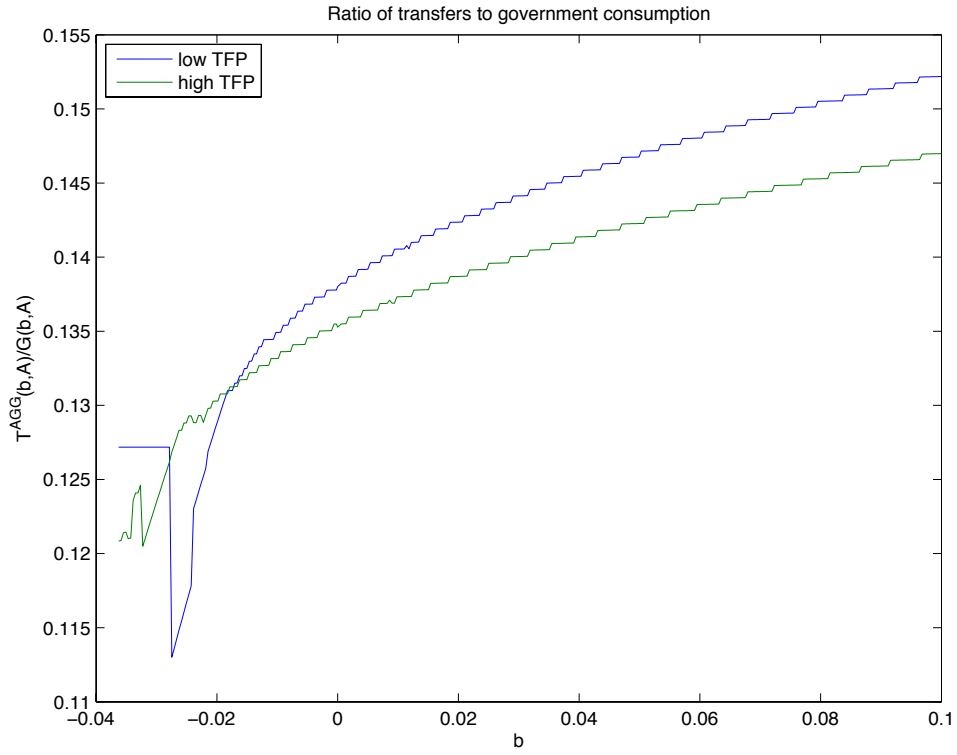
20

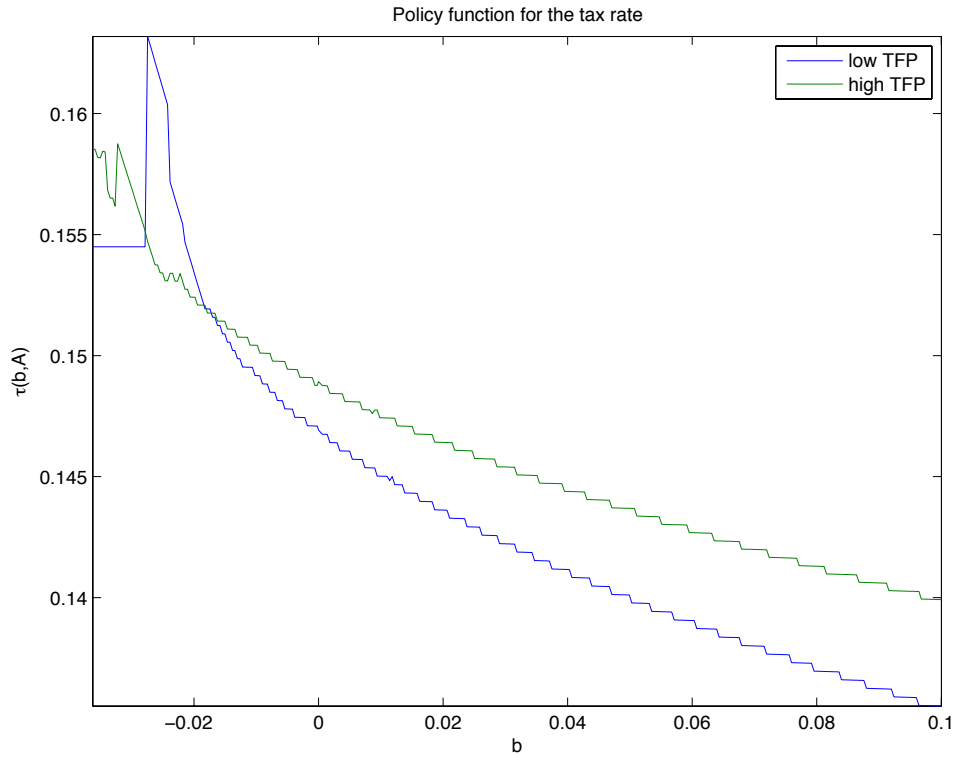Figure 7: The ratio of transfers to government consumption

Figure 8: Tax rate as a function of asset holdings.

dispersion. Consider the 'earnings inequality' across agents depending on the value of aggregate productivity:

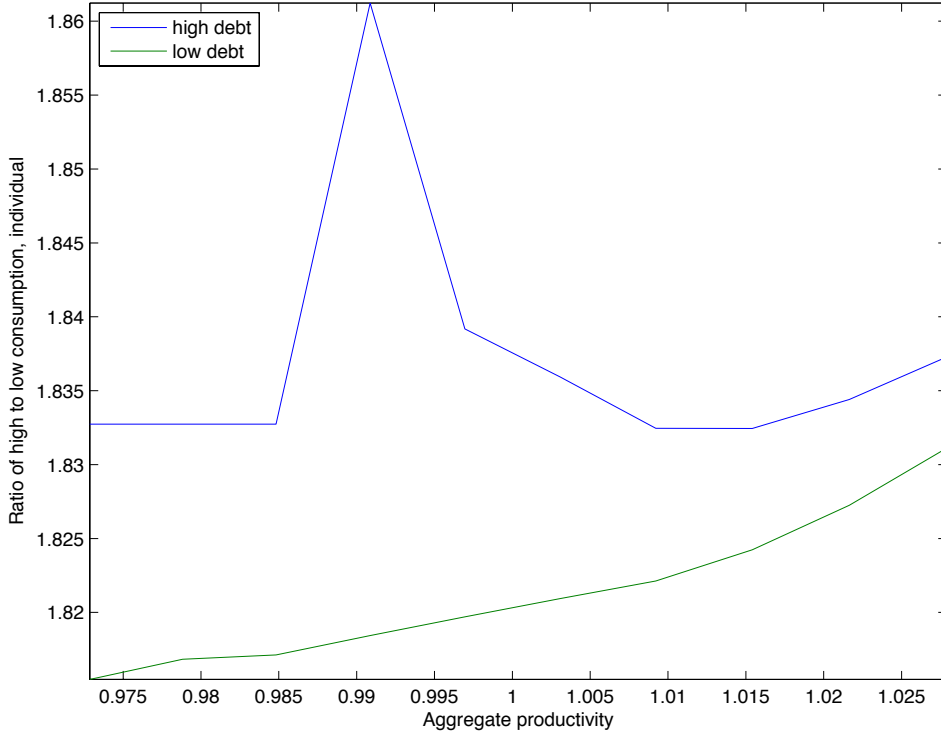$$\Delta_{y_i} = A_t[\sigma e_h - (1 - \sigma)e_l]. \tag{44}$$

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Figure 9: Consumption dispersion as a function of aggregate productivity

Moment	base model	high inequality
$std(Y)$	2.26	2.26
$std(G)$	2.49	2.49
$std(C)$	2.32	2.32
$corr(T,Y)$	0.9	0.98
$corr(\tau,Y)$	-0.4	-0.39
$\bar{(r)}$	1.4%	1.4%

Time varying income distribution

We can see that income inequality is procyclical, which implies that more resources are needed to equalize consumption during good times than during bad times. in terms of the level. This is consistent with recent evidence on wage dispersion over the business cycle (Morin 2012). However, it implies that the redistribution component of government policies per se is biased against procyclical transfers. Countercyclical transfers thus arise as the result of the government's concern to smooth a weighted average of consumption, and to distribute the cost of taxation optimal across the business cycle. Storesletten, Telmer and Yaron (2004) find that the variance of idiosyncratic uncertainty is higher during recessions. This does not imply that income differences in levels are countercyclical, as also in this paper aggregate productivity is assumed to be multiplicative in the level of wages. Countercyclical idiosyncratic dispersion weakens the dispersion on the aggregate level, however.

I use the findings from these papers and assume that idiosyncratic risk is perfectly negatively correlated with total factor productivity. When A is low, the relationship between e_h and e_l is a mean preserving spread relative to when A is high. I assume that e_h increases by 5% from booms to recessions. The volatility cannot be deliberately increased, as a higher number of e_h during bad shocks will lead to higher output and thus GDP will be negatively correlated with productivity shocks.

During recessions, there are typically more people who are eligible for transfers, both in the form of tax benefits or social benefits. This part of automatic stabilizers can only be introduced with state dependent income distribution. While data on unemployment is easily available, it is more difficult to measure earnings dispersion over the business cycle. The income process typically used in these studies is broadly compatible with the one used here, as aggregate and idiosyncratic components are additive in logarithmic wages, thus multiplicative in levels. Krusell et al. (1998) have a model with unemployment, and assume that the unemployment rate during bad times increases by 8 percentage points relative to good times. I assume that the share of low productivity is 30% on average, and falls from 32% to 28% from trough to boom.

The results for these two extensions are in table 4.

	base model	idiosyncratic risk	changing distribution
$std(Y)$	2.26	2.26	2.45
$std(G)$	2.49	3.05	2.72
$std(C)$	2.32		2.54
$corr(T,Y)$	0.9	0.98	0.84
$corr(\tau,Y)$	-0.4	-.39	-0.23
$\bar{(r)}$	1.4%	1.4 %	1.32%
$-\frac{b}{y}$	4	4.5%	5.3%

Table 4: Results from two extensions.

Of the extensions, only the change in the distribution of idiosyncratic productivity levels improves the fit of the model towards generating a lower correlation of transfers and GDP by construction. The reason for the model with countercyclical idiosyncratic risk is the effect on the cyclicality of GDP.

5   Conclusion

I have used a simple model of income redistribution in order to show the impact of external financial market imperfections on the cyclical properties of government expenditures. In the model, the government finances expenditures with distortionary taxation and by issuing non state contingent one period bonds in external debt markets. The government cannot commit to repay its debt, which leads to endogenous borrowing constraints due to default risk. Government expenditures are composed of spending on public goods and social transfers, which can be targeted towards low income agents. I illustrate the main mechanism using two extreme cases of autarky and full insurance in an endowment economy, where I assume an ad hoc tax cost function. Between these two cases government transfers are qualitatively different: they are counteryclical under complete markets, and procyclical under incomplete markets. Necessary assumptions for this result to hold are that taxes imply a convex welfare loss, which is also at least weakly concave in aggregate productivity.

The example illustrates the two roles of social transfers: (i) the redistribution of income, which can also be viewed as the partial insurance against idiosyncratic shocks. (ii) To help consumption smoothing of low income households across aggregate states. The lack of market access shuts down the second role, so transfers are procyclical.

I use a model with endogenous production, distortionary taxation and default risk to show that default risk indeed drives the qualitative difference in transfer policy over the business cycle.

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In the neighborhood of the borrowing constraint, the policy function for bonds flattens out because the government is anticipating the constraint and tries to avoid a sharp drop in consumption. Consequently, international borrowing and saving becomes less good an instrument to smooth the tax cost over the business cycle and transfers become procyclical in this area of the distribution of assets. I also find that the procyclicality of transfers is higher the tighter is the borrowing constraint for the government. Consistent with the recent literature on financial market imperfections and fiscal policy, I find that tax policy is also procyclical due to the borrowing constraint. However, the effect of the borrowing constraint on optimal transfers is much stronger than on taxes.

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	GCONS	GEXP	GEDU	GORDER	GHOUSE	GCULT
Argentina	0,32829734	0,32753018	0,22641477	0,52996458	0,18468944	0,55909868
Brazil	0,3220468	0,49570163	0,56018494	0,44707592	-0,08106177	0,64166925
Chile	0,49304207	0,48537246	0,45602455	0,14389305	0,67637057	
Colombia	0,17596204	0,1635308	0,28243308	0,33431492	-0,14664506	0,15284975
Mexico	0,6273889	0,32649282	0,68137402	0,57770396	0,57396253	0,20707412
Paraguay	0,34612261	0,07919135	0,33357796	0,62825266	0,38343529	0,51530004
Thailand	0,30542896	0,07711857	0,2012479	0,46539622	0,25454251	0,07491949
Uruguay	0,41485616	0,51731804	0,39534634	0,29720283	0,15359418	0,19764504
Australia	-0,15556793	-0,22182007	-0,22558606	-0,05806825	-0,01207668	-0,18306943
Austria	0,41802421	0,02850962	-0,10782897	0,55387006	0,15416843	0,1854202
Canada	-0,2209612	-0,11485444	0,13371363		-0,01523523	0,17313415
Denmark	-0,2503154	-0,35471235	-0,2907727	0,44719876	-0,01975115	0,18393033
Netherlands	0,02430191	-0,19279696	0,19779928	-0,05332874	-0,18561426	-0,13433656
New Zealand	0,25406857	-0,59241916	0,24201827	0,12596566	0,53098881	-0,13239822
Norway	0,08870319	-0,35166414	-0,09793476	-0,19604678	-0,17641903	-0,32927827
United Kingdom	-0,10301281	-0,30063075	0,25170586	-0,14163843	-0,14949276	0,17081649
USA	-0,08564601	-0,4964541	-0,0668813	-0,18409775	-0,22231505	-0,03029374

Table 5: Cyclical correlation of government spending components and GDP. *GCONS: Government consumption. GEXP: Total government expenditure. GED: Education. GORDER: Public order. GHOUSE: Housing and community amenities. GCULT: Recreational, cultural, religious services.*