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James Madison, George Soros, and Feldstein-Horioka: Disfavored Creditor Groups and Sovereign Debt

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James Madison, George Soros, and Feldstein-Horioka: Disfavored Creditor Groups and Government Debt*

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Abstract

This paper examines the effect of reduced transaction costs in the trading of assets on the ability of governments to issue debt. We examine a model with two types of creditors, favored and disfavored. Governments are more inclined to default if a large proportion of their debt is held by the disfavored group. For example, the fledgling U.S. government paid soldiers in the U.S. with Pierce's notes, many of which were later bought by US Revolutionary War speculators at steep discounts. In an international context, governments may care more about the welfare of domestic creditors than foreign creditors. We show that reductions in transaction costs, for example due to greater international openness, which make it easier to sell debt to disfavored creditors can increase the likelihood of default, raise the cost of credit, and reduce welfare. Multiple equilibria may exist if disfavored creditors are less risk averse than favored ones. Even without transaction costs, home bias in placement of government debt may persist, because with default risk the return on government debt is correlated with the tax burden required to pay the debt.

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1. Introduction

> "To do what he (Alexander Hamilton) knew to be right was apparently to take sides with the wealthy against the poor, to champion the speculative profiteer against the poverty-stricken veterans of the Revolution who had parted with their evidences of indebtedness for a mere pittance and were now filled with rage at the thought that the purchases would reap a reward out of all proportion to the sums they had paid." Grayson, *Leaders and Periods of American Finance,* 65.

In many cases, governments are more favorably disposed to some creditors than to others. Historically, James Madison argued that the U.S. government had more responsibility for paying Revolutionary War soldiers who had been compensated with promissory notes than for paying speculators who had bought these notes at a discount. A future U.S. government may be more concerned with the impact of inflating away debt on domestic creditors' finances than with its impact on foreign creditors. Many governments presumably place greater value on the welfare of their citizens than on that of foreigners, because those governments are directly responsible to and elected by the former. This paper takes the possibility of such favoritism seriously and derives its implications for the ability of governments to issue debt.

The possibility of such favoritism is indeed relevant to present and future U.S. debt markets. In the last three decades and especially in the last ten years, foreign holdings of U.S. treasury securities have substantially increased both in absolute terms and as a fraction of the total amount of public debt privately held.[1]

[1] In December 2006, the U.S. Treasury estimated that US$ 2.104 trillion of the public debt was held by foreign investors, while US$ 4.122 trillion was held by private investors.

Foreign ownership of sovereign debt is more broadly assuming increasing importance for rich countries. Many feel that transaction costs in the international trading of assets have been falling, due both to technological changes (such as the introduction of the internet) and to policy changes (such as the relaxation of rules limiting foreign investment by pension funds). In fact, the Feldstein and Horioka (1980) finding on the near absence of net capital flows among countries seems to be weakening (Feldstein and Bacchetta, 1989; Frankel, 1993). If this trend continues and transaction costs continue to fall, capital markets may someday become much more fully integrated.

To examine the case in which different creditor groups may exist, we consider a government which issues debt, but can later default. Default is costly. In our basic model presented in Section 2, a domestic government issues nominal debt to both domestic and foreign creditors. Default can happen through inflation, which creates distortions. The government maximizes domestic social welfare. This makes domestic creditors favored creditors and the government willingness to default an increasing function of the amount of debt held by foreign (disfavored) creditors.

An important assumption in our model is that the government cannot selectively default only to one group. If a market exists so that resale of the debt cannot be controlled, it will not be possible to pay only one class of creditors. For instance, if the government announces that it will not pay its debt obligations to foreign claimants, then foreign bondholders can just sell their bonds to domestic citizens. With a competitive market, foreign bondholders will receive from domestic buyers exactly the amount of debt repayment that a domestic bondholder can expect to receive from the government.[2]

[2] Broner, Martin, and Ventura (2006) also argue that secondary markets can solve the potential commitment problem of repaying foreign creditors. Similarly to us, they argue that if this was a problem,

In this environment, favored creditors who sell some of the asset to disfavored creditors increase the amount of debt held by the disfavored group and reduce the value of the asset to all creditors (e.g., by increasing the probability of default or by increasing target inflation). This reduction in asset value is miniscule, so individuals will not internalize this effect, and holdings will be determined by portfolio diversification considerations. Assuming that the return on government debt is stochastic and imperfectly correlated with other assets, portfolio considerations will make it individually optimal for disfavored creditors to hold some government debt, even though all creditors bear an uncompensated reduction in asset value as a result of sales to disfavored creditors. In a rational expectations equilibrium, creditors will account *ex ante* for these sales when making portfolio decisions, and the government will have to pay more for credit. Thus, we show in Section 3 the counterintuitive result that by enlarging the pool of possible creditors to include disfavored citizens, the government can face smaller prices for its debt, and social welfare can decrease.

Additionally, our model suggests that domestic citizens will be more likely to own government debt even in the absence of any transaction costs. This is because the real return on government debt and the real tax burden are negatively correlated, since default on the debt reduces the tax burden required to pay the debt. Holding domestic debt therefore works as an insurance device against future tax payments. Moreover, if all domestic agents were potential creditors, our model would predict that all debt would be placed domestically even in the absence of transaction costs. We show those results in Section 4.

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foreign creditors could sell their debt to domestic agents before repayment and domestic creditors would individually have incentives to buy this debt.

As discussed in Section 5, when willingness to bear risk increases with wealth, there may be multiple equilibria. We present a model in which disfavored creditors have greater wealth (and hence lower risk aversion) than favored creditors. Because disfavored creditors are more willing to bear risk, and the government is more likely to default the greater is the amount held by the disfavored creditors, there may be two equilibria. There may be a favored ownership equilibrium, in which all debt is held by the favored group and the default risk and cost of credit are therefore low. There may also be a disfavored ownership equilibrium, in which disfavored creditors hold some positive proportion of government debt, and the default risk and cost of credit are correspondingly higher.

We also explore in Section 5 how the results from our model can be extended to the choice of domestic versus foreign currency denominated debt. Finally, in our concluding remarks we discuss how these insights can be potentially applied to broader contexts such as corporate finance.

1.2. Related Literature

The problem of time inconsistency in fiscal and monetary policy is well-developed in the literature. In particular, many have noted that a government with nominal liabilities to foreign claimants may have an incentive to pursue an inflationary monetary policy to redistribute wealth from foreign to domestic citizens.[3] We consider in this paper how the time inconsistency problem discussed by these authors changes as frictions in international financial markets are reduced.

Our paper also relates to an extensive literature on sovereign debt that mostly focuses on the role of reputation and direct penalties as mechanisms for enforcing

[3] See Calvo (1978), Kydland and Prescott (1977), Persson et al. (1987), Bohn (1990a) and Bohn (1991).

repayment.[4] Motivated by the institutional setup of international borrowing in the 1970s and 1980s, this literature focuses on the case in which the repayment decision can vary with the identity of the creditor.

Consistent with the increasing liquidity of secondary markets for government bonds since the 1990s, this paper considers a non-segmented market for sovereign debt in which domestic and foreign creditors can trade government claims and in which there is therefore no possibility of selective default. We are close to Broner and Ventura (2007) in following this approach. They adopt this non-discrimination assumption in order to study how globalization affects market incompleteness and social welfare. In contrast with our paper, Broner and Ventura focus on the enforcement by a domestic government of repayments from domestic citizens to both foreigners and other domestic citizens.

2. A General Equilibrium Model of International Public Finance with Favored and Disfavored Creditors

Consider the following two-period general equilibrium model. A government wishes to raise money in the first period in order to invest in some public good which generates utility for domestic (favored) citizens in the second period. The government raises the money by issuing D units of nominal debt to both domestic and foreign creditors at the market price p per unit. The public good enters into the domestic citizens' utility as an increasing function of the amount of investment ($p.D$) made.

Domestic creditors are favored and foreign ones are disfavored. In the first period, the government issues D units of debt; each unit of debt pays 1 (in nominal terms) in the second period. After D is chosen by the government, domestic and foreign creditors make

[4] See Bulow and Rogoff(1989a and 1989b), Kehoe and Perri (2002) and Amador(2003) for example. See Eaton and Fernadez (1995) for an excellent survey.

a portfolio decision in the first period to divide their wealth between the two available assets: government debt, and a safe asset which pays 1 (in real terms) in the second period. Creditors can purchase debt directly and can also trade it amongst themselves. In the second period, the government sets a target inflation rate to reduce the real value of its debt repayment; actual inflation, which is stochastic, is realized; and the government pays off its debt.

The domestic population is divided into two groups, whom we label capitalists and workers. We assume that workers do not act as creditors, because (for instance) the transaction costs are too high, or because they face informational, liquidity, or capital market constraints. They have some fixed endowment, immune to inflation, in the second period. For instance, this endowment might be agricultural output or wage income. We set their wealth equal to 0 and their size equal to 1.[5]

The government pays off its debt by levying taxes in the second period on domestic agents. Since future tax payments are a source of shocks to future income, they will influence domestic creditors' portfolio decisions in the first period. In order to simplify our analysis, we will initially assume that taxes are levied only on workers. This is the only role played by the group of workers in this section. As discussed in Section 4, all the key results hold when we allow taxes to be levied on all domestic citizens and tax payments to influence the portfolio decision of domestic creditors.

In this economy, there are transaction costs associated with trading debt. We have in mind here asymmetric transaction costs which might affect foreign creditors but not domestic ones. For instance, the secondary market for sovereign debt may be frictionless

[5] The results are invariant with respect to choice of the endowment and size, so we set them respectively equal to 0 and 1, for convenience.

for trades among domestic creditors, yet may involve logistical transaction costs or legal restrictions when foreign citizens purchase government bonds from domestic creditors. Alternatively, there might be important information, relevant for investment decisions on domestic bonds, which is more costly for foreigners to obtain. We let transaction costs on the foreign ownership of government debt be indexed by C, so that for each unit invested by foreign creditors on government debt, they incur an additional cost of C. Domestic creditors do not incur any additional cost while investing in the risky asset.[6]

It is worth noting that under rational expectations, equilibrium asset allocations and price will be the same whether the government places its debt domestically and then trade occurs between domestic and foreign creditors, or if the government places its debt on an international market. In the former case, domestic creditors correctly anticipate the amount of debt that foreign creditors will want to hold and the price at which the debt will trade; the government will place all of its debt domestically at that price, and then domestic creditors will sell the correctly anticipated quantity to foreign creditors. In the latter case (which corresponds to our model) domestic and foreign creditors initially purchase the equilibrium allocations of debt at the equilibrium price, and there is no further trade among the creditors. In either case, the existence of rational expectations guarantees that the placement price and secondary market price of debt will be identical.

There is a continuum of identical domestic and foreign creditors (i.e., with identical wealth and preferences) of measure n_d and n_f. Domestic creditors and foreign creditors have constant absolute risk aversion preferences, defined over wealth *w*, given by $u(w) = e^{-rw}$. The coefficient of absolute risk aversion, *r*, is common to both groups of

[6] None of the results presented change if we assume instead that foreign creditors earn only a fraction λ on the return from domestic debt.

creditors. We set the wealth endowment of all creditors to 1.[7] Let Γ_f and Γ_d denote the aggregate quantity of debt held by disfavored and favored creditors, respectively, at the beginning of period 2.

Let π denote the inflation rate (i.e., the ratio of the change in prices to period 1 prices). Then $\tau \equiv \frac{\pi}{1+\pi}$ represents the fraction of the real value of wealth eroded by inflation, and $1-\tau$ is the ratio of real to nominal value of wealth in the second period. In the second period, the government sets some target τ_e (and hence an implicit target inflation rate π_e). The value of realized τ is stochastic; it is normally distributed with mean τ_e and variance σ^2.[8] We require that inflation be stochastic so that government debt is, indeed, a risky asset, and that there is a non-trivial asset allocation problem faced by the agent. Since the equilibrium concept here is a rational expectations equilibrium, if $\sigma^2 = 0$, creditors will correctly anticipate the government inflation decision in period 1, and the equilibrium price of debt will be set equal to the real value of 1 unit of wealth in period 2. Government debt would then be a safe asset, offering the same return as the other asset in the economy, and there would be no portfolio decision to make.

Next we consider the foreign creditors' portfolio decision. Let *p* denoted the market price of government debt. Let *q* denote the (stochastic) return on 1 unit of wealth

[7] This is not a normalization. Rather, we are free to fix the creditors' endowment at any level as long as the creditors' optimal portfolio decisions are interior in equilibrium. With CARA preferences and interior portfolio decisions, there are no wealth effects, so the creditors' portfolio decision of how much to invest in the risky asset is independent of their wealth endowment. Furthermore, all wealth not invested in debt is held as a safe asset, so that the comparative statics on welfare are unaffected by choice of initial endowment. Hence, all results are invariant with respect to the endowment of the creditors.

[8] Admittedly, the symmetric distribution of τ about its mean results in an asymmetric distribution of π. We stipulation the distribution of τ instead of π for analytical convenience. Since, in practice, π is bounded above -1, τ should be bounded below 1. In this model, τ has unbounded support, but we take σ^2 to be small, so that the probability of τ > 1 is likewise small.

for a given choice of portfolio $(\gamma, 1-p\gamma)$, where γ is the quantity of government debt held, and $1-p\gamma$ the quantity of safe asset. Then, for a creditor facing transaction costs equal to C, the sum of the real return on the safe asset and the real return (net of transaction costs) on government debt will be given by

$$q = (1-p\gamma) + \gamma(1-\tau) - C\gamma \,. \tag{1}$$

By the normality of τ, q is distributed normally with mean and variance

$$\mu_q = 1 - p\gamma + \gamma(1-\tau_e) - C\gamma \tag{2}$$

$$\sigma_q^2 = \gamma^2\sigma^2 . \tag{3}$$

Under normality of returns and CARA utility, the certainty equivalent of a unit of wealth invested in a portfolio $(\gamma, 1-p\gamma)$ is given by $\mu_q - \frac{r}{2}\sigma_q^2$. The maximization of this expression yields

$$\gamma_f(p, \tau_e) = \frac{1}{r\sigma^2}(1 - \tau_e - p - C) \,. \tag{4}$$

The domestic creditor's portfolio decision is the same as that of the the foreigner, except for the absence of transaction costs. The expression above therefore implies that

$$\gamma_d(p, \tau_e) = \left[\frac{1-\tau_e - p}{r.\sigma^2}\right]. \tag{5}$$

Equations (4) and (5) should be intuitive. The net expected return from holding the government bond is given by $1-\tau_e - p$ for domestic agents and $1-\tau_e - p - C$ for foreigners.

In order to have the model fully specified, we must model how the choices of D and τ_e are made in periods 1 and 2. We will first solve for the equilibrium in the second period given D, and then determine the choice of D by the government. We need now only to determine how the choice of τ_e is made at period 2. Inflation generates a cost to domestic agents given by $\frac{1}{2}k\left(\tau_e^2 + \sigma^2\right)$. Note that this cost is increasing and convex in τ_e. While choosing how much real wealth to erode with inflation τ_e, the government faces a trade-off between defaulting on the debt held by foreigners Γ_f and increasing this cost.

The marginal redistribution from foreign creditors to domestic citizens induced by a marginal increase in one unit of inflation is Γ_f. The marginal cost of this increase is given by $\tau_e.k$. This reasoning suggests that is reasonable to expect the choice of τ_e as given by $\tau_e = \Gamma_f / k$.

This idea can be formalized with an explicit objective function for the government in the following way. Let $v_1(p)$ and $\frac{1}{2}k_1\left(\tau_e^2 + \sigma^2\right)$ denote, in wealth equivalent units, the public good benefit and inflationary burden in the welfare of the capitalists, and $v_2(p)$ and $\frac{1}{2}k_2\left(\tau_e^2 + \sigma^2\right)$ the public good benefit and inflationary burden in the welfare of the workers. Note that the workers collectively face a real tax burden of $D(1-\tau)$, which is distributed normally with mean $D(1-\tau_e)$ and variance $D^2.\sigma^2$.

The welfare of the domestic creditors and workers are respectively defined by the certainty equivalents

$$CE_1 = v_1(p) - \frac{k_1}{2}\left(\tau_e^2 + \sigma^2\right) + n_d\left(\mu_d - \frac{r}{2}\sigma_d^2\right) \tag{6}$$

and

$$CE_2 = v_2(p) - \frac{k_2}{2}\left(\tau_e^2 + \sigma^2\right) - D(1-\tau_e) - \frac{r}{2}D^2.\sigma^2, \tag{7}$$

where μ_d and σ_d^2 are defined by (2) and (3) applied to domestic creditors.

Thus, *ex ante* domestic social welfare (with equal weights given to all agents[9]) is given by the total certainty equivalent

$$TCE = v(p) - \frac{k}{2}\left(\tau_e^2 + \sigma^2\right) + n_d\left(\mu_d - \frac{r}{2}\sigma_d^2\right) - D(1-\tau_e) - \frac{r}{2}D^2\sigma^2, \tag{8}$$

where $v = v_1 + v_2$, $k = k_1 + k_2$.

At the beginning of period 2, the government makes its target inflation decision to maximize *TCE* taking *p* and γ as given.[10] This is equivalent to maximizing

$$-\frac{k}{2}\left(\tau_e^2 + \sigma^2\right) + \Gamma_d(1-\tau_e) - D(1-\tau_e), \tag{9}$$

and yields $\tau_e = \Gamma_f / k$ as a solution.

Given the government's inflation decision, we can derive the equilibrium outcomes, for a given choice of D, from the condition $\Gamma_d(p) + \Gamma_f(p) = D$.

This leads to the following equilibrium demands for debt:

[9] The results which follow also hold for arbitrary welfare weights; see further discussion in Appendix B.
[10] It is now clear that domestic creditors are favored *only* in the sense that their welfare, and not the welfare of foreigners, figures directly into the government's objective.

$$\Gamma^*_d = \pi_d.D + \pi_d.\left(\frac{n_f.C}{r.\sigma^2}\right), \tag{10}$$

and

$$\Gamma^*_f = \pi_f.D - \pi_d.\left(\frac{n_f.C}{r.\sigma^2}\right), \tag{11}$$

where $\pi_d = \frac{n_d}{n_d + n_f}$ and $\pi_f = \frac{n_f}{n_d + n_f}$.

This is the interior equilibrium of the model. The equilibrium will be interior if, at the price were foreigners are starting to demand a positive amount of debt, the domestic demand is smaller than D. This can be expressed as

$$\frac{C}{r.\sigma^2} < D. \tag{12}$$

We will assume that this condition holds true. If this were not the case, our comparative static results would not be interesting, since transaction costs would not matter for any equilibrium outcome.

From the same conditions used above to calculate the equilibrium demands and given the government's decision rule $\tau_e = \Gamma_f / k$, we can obtain the equilibrium price for this equilibrium:

$$p^* = \left(1 - \frac{\Gamma^*_f}{k}\right) - \frac{r\sigma^2}{n_f + n_d}.D - C.\pi_f. \tag{13}$$

3. Changes in Transaction Costs

3.1. Comparative Statics

From the expression above, the two effects of reducing transaction costs C should be clear. The direct positive effect is a consequence of the fact that decreases in C lead to increases in the foreign demand for the debt, what enables higher prices to place all the debt in the market. However, there is also a negative indirect effect. When C falls, the foreign ownership of the debt Γ^*_f will increase, what leads to a higher temptation for the government to inflate and a lower price.

When the cost from inflation is sufficiently low, the second effect will be more important and reductions in transaction costs will worsen the terms of trade. To see this, note that the above expression for p leads to

$$\frac{\partial p^*}{\partial C} = \left(\frac{\partial \Gamma^*_f}{\partial C} \right) . \frac{1}{k} - \pi_f = \pi_f . \frac{n_d}{r\sigma^2 k} - \pi_f \qquad (14)$$

This expression will be positive only if

$$k < \frac{n_d}{r\sigma^2}.$$

The above result can be summarized in the following proposition.

Proposition 1 *A reduction in transaction costs reduces the price of D units of government debt if and only if the cost of inflation is sufficiently low (*$\frac{dp^*}{dC} > 0$ *if and only if* $k < \frac{n_d}{r\sigma^2}$*).*

Proof: See above text.

Proposition 1 above establishes that when the cost of inflation *k* is low, and so the government's commitment not to default is not credible, reduction in transaction costs will reduce the price of D units of debt. However, further analysis is required to determine the welfare consequences of reduced transaction costs.

When transaction costs C change, there is an effect both on the price of debt, equilibrium inflation, and the allocation of debt between domestic and foreign creditors. The marginal effect of changing inflation for social welfare is zero, since the government determines inflation at a level that maximizes social welfare, i.e. at a point where this effect is equal to zero.

The change in the allocation of the debt has two effects. On one hand, it is cheaper for the government to raise funds domestically, since there are commitment problems of repayment to outside creditors. On the other hand, this exposes more domestic citizens to the debt risk. In our model, those two effects cancel out.

Finally, the change in the price of debt has an effect on the amount of public goods that the government is able to finance. A lower price for the debt reduces the ability of the government to finance public goods given a fixed amount of nominal debt. This is the only important effect here. More precisely, we have that (see Appendix A for a discussion of details):

$$\frac{\partial TCE^*}{\partial C} = \left(v'(p^* D)D - \Gamma_d^*\right)\frac{\partial p^*}{\partial C}, \tag{15}$$

where all quantities are equilibrium quantities (given the choice of D).

As long as the government only raises money to invest in a public good if that investment is worthwhile, we have that $v'(p^* D) - \Gamma_d^* / D > 0$. For the public project to be worthwhile, the marginal benefit from investment of an additional unit of wealth, $v'(p^*)$, must exceed 1, the marginal benefit from an additional unit of wealth. Since $\Gamma_d^* \leq D$, we have therefore established the following result:

Proposition 2 *Given a choice of D, assuming that the public good is worthwhile, a reduction in transaction costs is welfare-enhancing if and only if the government's commitment not to inflate is sufficiently credible; i.e., if and only if the cost of inflation k exceeds* $n_d / r\sigma^2$.

Proof. See Appendix A.

Although we have only solved the model for a given choice of D, the result from Proposition 2 can be extended to the final equilibrium of the model. To see this, note that given C, there will be an optimal choice by the government of how much nominal debt to issue D*(C). Since the government chooses D* to maximize the TCE, the envelope theorem implies that

$$\frac{dTCE(C, D^*(C))}{dC} = \frac{\partial TCE((C, D^*(C))}{\partial C}. \tag{16}$$

More precisely, since the fact that the government maximizes social welfare implies that

$$\frac{\partial TCE((C, D^*(C))}{\partial D} = 0, \tag{17}$$

what matters for the overall impact of marginal changes in C is only the direct effect.

Finally, note that in equilibrium it will be always worthwhile to invest in the public good. The reason is simple. The only potential benefit from issuing more debt is investing more in the public good. More debt always increases the cost of inflation and the overall exposure of domestic agents to risk. Only when those social costs are compensated by the investment in the public good will the government raise more debt. Therefore in equilibrium the marginal return from investing in the public good should be positive. These two facts allow us to formulate Proposition 3:

Proposition 3 *A reduction in transaction costs is welfare-enhancing in equilibrium if and only if the government's commitment not to inflate is sufficiently credible; i.e., if and only if the cost of inflation k exceeds* $n_d / r\sigma^2$.
Proof: See above text.

The equilibrium impact of changes in transaction costs on the price of debt will depend on the response of D* to those changes. However, what matters for the government is its ability to finance the public good by issuing debt, and the price of debt conditional on D better captures this ability.

4. Taxing Domestic Creditors and Home Bias

The model from Section 3 left open the issue of how future taxes impact domestic creditors' portfolio choice by assuming that taxes are levied only on workers. In this section we extend the previous model to a general equilibrium setting where taxes are levied on all domestic citizens, including domestic creditors. We discuss how all the results from the last section can be extended to this setting. In an international finance context, we also find that home bias can persist even in the absence of transaction costs.
Suppose we have the same model as in Section 3. Assume now that, in the second period, the government divides the tax burden between the two groups, levying a fraction of taxes given by *h* (exogenously determined) on capitalists and 1-*h* on workers. As in Section 3, we will assume that workers cannot act as creditors. In the context of our model's set up, we need to have a group of domestic agents that cannot act as creditors in order to have foreign agents acting as creditors in equilibrium. This point should become clearer after the discussion of the results.

While foreign individual portfolio decisions remain the same, domestic individual portfolio decisions now will take into account the effect of taxes. The individual demand for debt of domestic creditors will now become (see Appendix A for details):

$$\gamma_d(p,\tau_e)=\frac{hD}{n_d}+\left[\frac{1-\tau_e-p}{r.\sigma^2}\right]. \tag{18}$$

In the absence of expected returns, domestic creditors now have an additional motive to hold debt, because this enables them to insure themselves against future taxes. More precisely, in the absence of non-zero expected returns from holding the risky debt, each domestic agent would hold as much debt as he or she is exposed to taxes (hD/n_d in equation (21)), achieving full insurance. If all domestic agents were potential creditors, all debt would be placed domestically.

This leads to the following interior equilibrium:

$$\Gamma^*_d=\pi_d D+\pi_d.\left(\frac{n_f.C}{r.\sigma^2}\right)+(1-\pi_d).hD, \tag{19}$$

$$\Gamma^*_f=\pi_f D-\pi_d.\left(\frac{n_f.C}{r.\sigma^2}\right)-(1-\pi_d).hD, \tag{20}$$

$$p^*=\left(1-\frac{\Gamma^*_f}{k}\right)-\frac{(1-h)}{n_f+n_d}.Dr\sigma^2-C.\pi_f,$$

where $\pi_d=\frac{n_d}{n_d+n_f}$ and $\pi_f=\frac{n_f}{n_d+n_f}$.

As should be clear from the expressions above, future tax payments increase the demand of domestic agents and redirects the allocation of debt from foreign creditors towards domestic creditors. However, this change does not impact the way foreign

creditors' demand for debt as well as debt prices respond to changes in transaction costs. Therefore, all previous results are also valid here. This can be summarized as follows.

Proposition 4 *In the model where all domestic citizens are taxed, reductions in transaction costs reduce the equilibrium price paid for D units of government debt if and only if the cost of inflation is sufficiently low ($k < \frac{n_d}{r\sigma^2}$). Moreover, a reduction in transaction costs leads in equilibrium to a reduction in domestic social welfare if and only if this same condition holds true.*

Proof. See Appendix A.

If we interpret the safe asset as a diversified portfolio of domestic and foreign assets, this model also has implications for home bias. When C = 0, the equilibrium quantity of debt held by domestic citizens is given by

$$\Gamma^*_d = \pi_d.D + (1-\pi_d).hD \tag{21}$$

Hence, when h = 0, the proportion of debt held by domestic creditors precisely equals their share of world wealth, as we would expect (domestic and foreign creditors have identical preferences and face the same portfolio decision, so their ownership share of any asset will equal their fraction of the total population). However, as the tax burden h on domestic creditors increases, greater home bias is exhibited; indeed, when the government's repayment of debt is entirely financed by taxes on domestic creditors (h = 1), all debt is held by domestic creditors, no matter what the level of transaction costs (i.e., whatever the value of C). The reason is simple: the absence of domestic returns would be enough to clear the market with domestic agents (due to their insurance motives) and foreign creditors require some compensation (due to transaction costs) to hold domestic debt.

More generally, if debt repayments are financed with taxes levied on the same period of repayment, domestic agents can always insure themselves against these future tax shocks to their real income by holding government debt. If a domestic agent will face a nominal tax burden of t at the time of debt repayment, holding t units of nominal debt will provide the agent with full insurance. Since the aggregate nominal tax burden faced by all agents in the economy will be D, if all domestic agents can act as creditors, the government faces a domestic demand for debt given by D even in the absence of any expected real return on debt.

Therefore, as long as all domestic agents are risk averse and can act as creditors, all debt will always be placed domestically in equilibrium in our model. In a more realistic setting, in which taxes are not all levied in the period of repayment or domestic agents face uncertainty about their future tax burden, agents would only partially insure themselves against future tax payments by holding debt and some debt would be held by foreign creditors in equilibrium.

We are not arguing that this is currently the main source of home bias, but simply that even if the transaction costs and information asymmetries that account for home bias disappeared, home bias would persist.

5. Extensions

5.1. Multiple Equilibria

In this section, we analyze how the ability of a disfavored group to purchase government debt can lead to multiple equilibria. More precisely, we show that when the

assumption of CARA preferences is dropped, and agents' risk aversion is allowed to vary with their wealth, there may be multiple equilibria in the market for government debt.

We continue to consider a two-period model in which the government issues risky debt at market price p to domestic and foreign creditors in the first period. For simplicity, we will assume that the government can credibly issue only one unit of debt. Debt is *real* here, and pays out 1 in real terms in the second period; the government may also choose to default, in which case it repudiates its debt entirely and creditors earn zero return.

Risk-averse favored and disfavored creditors make portfolio decisions in the first period between the risky debt and a safe asset which pays 1 with certainty in the second period. The two groups of creditors could represent either the domestic and foreign creditors in our international finance example or soldiers and speculators in our revolutionary war debt example.

There are two important distinctions between those two groups of creditors. First, as before, disfavored creditors face transaction costs C on each unit of debt they hold. Second, disfavored creditors are less risk averse than favored creditors. This may occur, for instance, if we assume that agents' willingness to bear risk increases with their wealth, and that disfavored creditors have greater wealth than domestic creditors.

This last assumption is central and leads us to the multiple equilibria result. Since foreigners are willing to bear more risk than domestic creditors, and since greater foreign ownership makes the government debt more risky, there may be multiple equilibria in the market for government debt.

In order to capture that idea we assume that disfavored creditors possess wealth to the degree that they act effectively risk neutral and we model the government default

decision in a simple way. The government faces a cost of default k which is stochastic, and is realized only at the beginning of the second period, after creditors have made their portfolio decisions but before the government makes its decision whether to default or repay.

Following the notation used before, denote the demand for debt by favored and disfavored creditors respectively by Γ_d and Γ_f. The net benefit from default is the cost of servicing debt held by disfavored creditors (Γ_f) less the cost of default k. Hence, the government defaults if and only if $\Gamma_f - k \geq 0$.

For the distribution of k, we assume that with probability $\phi_{\max} < 1$, $k \in [0, F]$, where F is some constant less than 1. With probability $1 - \phi_{\max}$, there is a very high cost of default; in particular, k > 1. This generates a period one probability of default $\phi(\Gamma_f)$ as a function of foreign ownership, where ϕ is just the cumulative distribution function of k. Under our assumptions, $\phi(0) = 0$, $\phi'(\Gamma_f) \geq 0$ and $\phi(\Gamma_f) = \phi_{\max} < 1$ for $\Gamma_f \in [F, 1]$.

We are not being very specific about the incidence of taxes between favored and disfavored creditors. However, this is not crucial here: only conditions on the equilibrium demand for debt of favored and disfavored creditors matter.

This model can have at least two equilibria if domestic agents are sufficiently risk averse. First, there is an equilibrium in which all debt is held by favored creditors. $\Gamma_f = 0$ implies that the probability of default ϕ is zero, and that the government debt is therefore a safe asset. Since domestic creditors face no transaction costs, they will bid the price of debt up to its real return: $p^* = 1$.

At this price, domestic creditors are indifferent between government debt and the other asset (both of which are safe, offer the same return, and trade at the same price), but because of transaction costs, foreign creditors will hold no debt at this price. Hence, $\Gamma^*_f = 0$, $\Gamma^*_d = 1$, $p^* = 1$ is always an equilibrium.

Now suppose that favored creditors are sufficiently risk averse that if $p = 1 - \phi_{\max} - C$, and the probability of default is $\phi_{\max}$, then domestic creditors will demand $\Gamma_d(p, \phi_{\max}) = D < 1 - F$. In this case, there is a second equilibrium where disfavored creditors will hold a positive amount of debt and there will be a positive probability of default in equilibrium.

Suppose $\Gamma_f = 1 - D$; then $\Gamma_f > F$, so the probability of default is $\phi_{\max}$. Risk neutral disfavored creditors will set the price of the debt at their expected return on debt, $p = 1 - \phi_{\max} - C$. At this price and risk of default, domestic creditors will want to hold $\Gamma_d(p, \phi_{\max}) = D$. This implies that $\Gamma^*_f = 1 - D$, $\Gamma^*_d = D$ is also an equilibrium allocation, with $p^* = 1 - \phi_{\max} - C$.

5.2. Foreign vs. Domestic Currency Denominated Debt

Empirically, some countries seem as reluctant to default on debt denominated in foreign currency as on debt denominated in domestic currency, even though foreign-currency-denominated debt is more likely to be held by foreigners.[11] We could extend our model to match this fact, without assuming that governments are more concerned for

[11] However, recent events do suggest that countries are not unwilling to default on (or renegotiate) liabilities to foreign creditors, including ones denominated in foreign currency. In 1998, Russia defaulted on ruble-denominated debt as well as on foreign currency denominated debt. In 1999, Ecuador became the first country to default on its dollar-denominated Brady bonds.

foreigners' welfare than for that of domestic citizens. Below, we first sketch such as extension, and then argue that in such a model, reductions in transaction costs may reduce the ability of nations to issue domestic currency denominated debt.

In order to understand why countries seem more willing to inflate away domestically denominated debt than to repudiate foreign-currency-denominated debt, it seems reasonable to follow Cole and Kehoe (1996) in assuming that an explicit violation of a contractual obligation (such as outright repudiation of debt) creates some cost due to generalized loss of reputation, including reputation in other areas, such as protection of foreign direct investment. Default of domestic currency denominated debt need not be outright, but can be realized through inflation. Investors in domestic currency denominated debt know that they are accepting a risk of inflation, so inflation does not entail as great a loss of generalized reputation as explicit repudiation of debt. Thus, a government may be willing to use inflation to reduce the value of its indebtedness where it would be unwilling to default outright on it obligations.

Despite its time inconsistency problem, a government may nonetheless wish to issue domestic currency denominated debt; this is well documented in the literature (Bohn, 1990b; Bohn, 1994; Freeman and Tabellini, 1998; Persson et al., 1987). For example, governments may issue nominal liabilities to shield themselves from the exchange rate risk associated with debt denominated in foreign currency. Consider the following model. Suppose that the domestic country does not value any goods from abroad in the second period. The only reason it exports in period 2 is to pay off its debt from period 1. The rest of the world is large enough that it acts as if it were risk neutral. The taste in the rest of the world for the good produced by the domestic country is

random, so that the price in foreign currency at which the domestic economy can export its good in period 2 is also random. The price of the domestic good in domestic currency is always 1.

If foreign taste for the domestic good turns out to be favorable in period 2, then the good will have a high price in foreign currency, and domestic currency will be valuable. If foreign taste turns out to be unfavorable, then the good will have a low price in foreign currency, and domestic currency will be worth little. If debt is denominated in foreign currency, then the amount of goods that the country has to produce to pay off its debt will vary with foreign taste for the good. Risk to the domestic economy is minimized by denominating the debt in domestic currency, since domestic currency denomination implies that a constant amount of production from the domestic economy will be needed to pay off the debt to the rest of the world (namely, one unit of output per unit of debt).

In these circumstances, a government that could credibly commit to repay would prefer to issue domestic currency denominated debt than foreign currency denominated debt. Where credibility is imperfect (as in our model), countries face a tradeoff between denomination in domestic currency in order to protect themselves from exchange rate risk and denomination in foreign currency in order to reduce the temptation to inflate.

Applying our previous analysis to this richer situation suggests that if transaction costs in domestic currency denominated debt are high—for example, because costs of changing currency are great—then countries will be able to issue domestic currency denominated debt. However, reductions in transaction costs lower the welfare associated with issuing debt denominated in domestic currency. They do not alter the welfare associated with issuing foreign currency denominated debt. Thus, in this situation, our

model implies that reductions in transaction costs could lead to a switch from denomination of debt in domestic currency to denomination in foreign currency. These reductions in transaction costs could thus reduce welfare by reducing countries' ability to insure exchange rate risk, without increasing their ability to commit to repay debts.

6. Conclusion

Standard analysis would suggest that a reduction of transaction costs facing foreign investors should improve sovereign debtors' terms of credit. Our model demonstrates, however, that when a government cannot selectively default on debts to only some of its bondholders, and when its willingness to default varies with the distribution of its obligations among various claimants, then reduced transaction costs can actually worsen the government's terms of credit and social welfare. In particular, a reduction in transaction costs has two opposing effects on the government's terms of credit. On the one hand, disfavored creditors facing lower transaction costs will tend to bid up the price of government debt. On the other hand, because the aggregate amount of debt held by disfavored creditors increases, the government's desire to default will be higher. *Ex ante*, rational creditors will demand a premium for this additional default risk. In the context we examine, if the cost of default is sufficiently low, the latter effect will predominate, and both the price of government debt and social welfare will fall with the reduction in transaction costs.

These results suggest that some amount of friction in international financial markets can be good for sovereign debtors. In particular, they suggest a reason why governments would want to reduce the liquidity of their debt instruments or to segment the markets in which they place their debt. In fact, governments do issue debt that is

differentially targeted to domestic or foreign creditors. For instance, many countries issue savings bonds which are nontransferable or difficult to transfer. Domestic currency denominated debt may likewise be more attractive to domestic investors than foreign ones.

This model was presented in terms of sovereign debt, but the analysis may have implications for foreign investment, or other situations in which an agent has some control over an asset's value and the agent's incentive to affect the asset's value varies with the identity of the claimants of that value. For instance, a government privatizing a firm may later desire to expropriate some of the value of the privatized firm through taxation. If the government's desire to expropriate value depends on the distribution of shares and the identity of shareholders (for example, the government may be tempted to expropriate the value of firms that have a large amount of foreign ownership), then some amount of illiquidity in this asset can be optimal. Indeed, this model suggests a rationale for the observed phenomenon of different classes of shares issued by some firms: some that can only be held domestically, and some that can be traded internationally.

Similarly, this model can be applied to the potential tradeoff noted in the corporate finance literature between liquidity and control: increasing the liquidity of share in a firm offers the benefits of a more liquid market, but may tend to disperse ownership and make monitoring more difficult (Coffee, 1991; Bhide, 1993; Admati et al., 1994). For instance, consider a privately held firm with significant ownership by employees which then lists on a stock exchange. Listing on the exchange reduces transaction costs in the market for the firm's shares. This encourages the employees to sell their shares for portfolio diversification reasons. However, once the shares have been

sold, and ownership is diversified, no individual has an incentive to monitor the managers, and so the managers' incentive to maximize shareholder value may be reduced. This scenario is analogous to the model of sovereign debt we explore in this paper, and similar results apply.[12]

In fact, the corporate finance example suggests another application of this model to sovereign debt, different from the one explored in this paper. A sovereign debtor facing a financial crisis may find it easier to renegotiate the terms of its debt if that debt is held by a small number of creditors (e.g., a few large banks) than if the debt is held by a diffuse set of small bondholders. A failure to renegotiate, in turn, is more likely to precipitate a crisis, and hence default. Lower transaction costs, to the extent that they increase dispersion of bond ownership, again generate a tradeoff between risk sharing and increased risk of default. In this case, the identity of creditors matters not because it affects the debtor's incentives to affect the value of the debt, but because it constrains the debtor's ability to do so. The results of our model still apply.

[12] We owe this example to Mathias Dewatripont.

Appendix A

Proof of Propositions 2 and 4. We will focus on proposition 4 and show results for the model where both capitalists and workers are taxed. Since the model in Section 3 is a particular case of the model in Section 4 where h=0, the proof of proposition 2 will follow immediately from the steps below. In what follows, all quantities are equilibrium quantities; asterisks are dropped for notational clarity. The first thing to notice is that Equations (18), (19) and (20) can be derived following the exact same steps as in the model from Section 2. Following those steps one can write now the certainty equivalents from the domestic agents as

$$CE_1 = v_1(p) - \frac{k_1}{2}\left(\tau_e^2 + \sigma^2\right) + n_d\left(\mu_d - \frac{r}{2}\sigma_d^2\right) \tag{22}$$

and

$$CE_2 = v_2(p) - \frac{k_2}{2}\left(\tau_e^2 + \sigma^2\right) - (1-h)D(1-\tau_e) - \frac{r}{2}(1-h)^2 D^2.\sigma^2, \tag{23}$$

where

$$\mu_d = 1 - p\gamma_d + \left(\gamma_d - \frac{hD}{n_d}\right)(1-\tau_e) \tag{24}$$

and

$$\sigma_d^2 = \left(\gamma_d - \frac{hD}{n_d}\right)^2 \sigma^2. \tag{25}$$

The social welfare is defined by the total certainty equivalent and can be written as:

$$TCE = \left[v(pD) + n_d - p.\Gamma_d - \Gamma_f.(1-\tau_e)\right] - \frac{k}{2}\left(\tau_e^2 + \sigma^2\right)$$

$$- n_d\left(\gamma_d - \frac{hD}{n_d}\right)^2.\frac{r\sigma^2}{2} - D^2.(1-h)^2.\frac{r\sigma^2}{2}. \tag{26}$$

We can calculate the effect from changes in C (keeping D constant) in the TCE using this expression:

$$\frac{\partial}{\partial C}TCE = \left[v'(pD)D - \Gamma_d\right]\frac{\partial p}{\partial C} + \frac{\partial \Gamma_d}{\partial C}\left(\left[p - .(1-\tau_e)\right] - r\sigma^2.\left[\gamma_d - \frac{h}{n_d}\right]\right)$$

$$+ \left[k.\tau_e - \Gamma_f\right]\frac{\partial \tau_e}{\partial C} \tag{27}$$

The expression above is very intuitive. The first term represents the direct effect from the change in the terms of trade in the total amount financed of public goods (fixed the amount of debt held by the foreign and domestic creditors and the level of inflation). The second term reflects the effect from the change in the equilibrium quantities of debt held by both domestic and foreign creditors. Given that the total quantity of debt is fixed, this is just a change in the composition of the debt between domestic and foreign creditors.

On one hand, an increase in the amount of debt held by foreigners increases the cost of financing the public good, from a domestic social point of view, since foreigners need to be

compensated for the inflationary default. On the other hand, an increase in the importance of foreign creditors reduces the exposure of domestic citizens to the risk associated with domestic debt. From the demand for debt of domestic agents, one can immediately see than in our model those two effects cancel out in the second term in equation (27).
Finally, there is the effect from the change in the level of inflation. Given that the government is choosing the level of inflation to maximize social welfare, the marginal effect from changes in inflation is zero. Recalling that $\tau_e = \frac{\Gamma_f}{k}$, it follows that the third term in equation (27) is equal to zero. Those last two observations imply that the last two terms in equation (27) are zero, which leads us to equation (15). This equation was here derived in the general case. Given this equation, one can simply replicate the same arguments described in Section 2 to get the results in Proposition 4.

Appendix B

The total certainty equivalent defined by (8), and hence the results of Section 2 and 3, assume equal welfare weights for rich and poor.[13] More generally, we can define the total certainty equivalent for an arbitrary welfare weight $\alpha \in [0,+\infty)$ on the utility of the poor:

$$TCE = v(p) - \frac{k}{2}(\tau_e^2 + \sigma^2) + n_d(\mu_q - \frac{r}{2}\sigma_q^2) - \alpha(1-h)D(1-\tau_e) - \alpha\frac{r}{2}(1-h)^2 D^2\sigma^2, \quad (28)$$

where $v = v_1 + \alpha v_2$ and $k = k_1 + \alpha k_2$.

The first thing to notice is that since the equilibrium allocation of the debt between domestic and foreign creditors does not depend on the expected level of inflation, the equilibrium allocation of the debt will remain the same (given by equations (17) and (18)).

However, now the government's inflation decision will be different. A simple way to see how this decision changes is to notice that the TCE can be written in terms of the previous TCE (TCE_0) as

$$TCE = TCE_0 + (1-\alpha)(1-h)D(1-\tau_e) + (1-\alpha)\frac{r}{2}(1-h)^2 D^2\sigma.^2 \quad (29)$$

The only change in the government decision comes from the fact that inflation redistributes income from the rich to the poor and the government now weights those groups differently. The new government's inflation decision is given by

$$\tau_e = \Gamma_f / k + \frac{(1-\alpha)}{k}.(1-h).D. \quad (30)$$

Following the same steps as before we will also obtain that the equilibrium price of the debt is given by

$$p = (1-\tau_e) - \frac{(1-h)}{n_f + n_d}.Dr\sigma^2 - C.\pi_f. \quad (31)$$

[13] Since *v* and *k* can reflect different weights on rich and poor, the only assumption, in fact, is that the social planner gives equal weight to a unit of taxes (inflation-risk adjusted) whether levied on the rich or poor.

Since $\partial \tau_e / \partial C$ is the same as before, we also have that $\partial p / \partial C$ does not change, and Proposition 1 remains unchanged. There is still the issue of what happens now to domestic social welfare. We have that the change in social welfare is now given by

$$\frac{\partial}{\partial C} TCE = \left[v'(pD)D - \Gamma_d\right]\frac{\partial p}{\partial C} + \frac{\partial \Gamma_d}{\partial C}\left([p - .(1-\tau_e)] - r\sigma^2 .\left[\gamma_q - \frac{hD}{n_d}\right]\right)$$

$$+ \left[k.\tau_e - \Gamma_f - (1-\alpha).(1-h)D\right]\frac{\partial \tau_e}{\partial C}. \quad (32)$$

We have the same expression as before, except for one term. The change in inflation now has an additional effect on social welfare, given by the fact that inflation redistributes income among the different domestic groups. However, the same reasoning described before also applies here. The government is already choosing the level of inflation to maximize social welfare (incorporating this new effect), and therefore the marginal effect on social welfare should be null.

As before, we have that

$$\frac{\partial TCE^*}{\partial C} = \left(v'(p^* D)D - \Gamma_d^*\right)\frac{\partial p^*}{\partial C}. \quad (33)$$

Once more, Propositions 3 and 4 follow from this equation and the arguments in Section 2.

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