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ABSTRACT

This paper examines the effect of reduced transaction costs in the international trading of assets on the ability of governments to issue debt. We examine a model in which governments care about the welfare of their citizens, and thus are more inclined to default if a large proportion of their debt is held by foreigners. Reductions in transaction costs make it easier for domestic citizens to share risk by selling debt to foreigners. This may increase tendencies for governments to default, and thus raise their cost of credit and reduce welfare. We find that even in the absence of transaction costs, home bias in placement of government debt may persist, because in the presence of default risk the return on government debt is correlated with the tax burden required to pay the debt. Asset inequality may reduce this home bias, and by increasing foreign ownership, increase incentives for default. Finally, if foreign creditors are less risk averse than domestic creditors, there may be one equilibrium in which domestic creditors hold the asset and default risk is low, and another in which foreign creditors hold the asset and default risk is high.

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1 Introduction

This paper examines the effect of reduced transaction costs in the international trading of assets on the ability of governments to issue debt.

The simplest portfolio theories suggest that investors should fully diversify globally. In fact, however, assets are dispropotionately held domestically, perhaps due to asymmetries of information or transaction costs between domestic and foreign investors. There is, however, a widespread view that transaction costs are falling, due both to technological changes, such as 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). This trend prompts the hypothetical question: if transaction costs continue to fall, and capital markets become more fully integrated, what will happen to the ability of governments to issue debt, and to home bias?

Standard analysis suggests that enlarging the number of participants and reducing transaction costs in markets for sovereign debt should improve welfare for debtor nations: a larger pool of creditors facing lower transaction costs will bid up the price of a country's debt and improve its government's terms of credit. Thus, if U.S. investors find it easier to buy Japanese debt, this should make the Japanese better off.

This paper argues, however, that if a government faces different groups of potential creditors, and its ability to commit to repay its debt varies across those groups, then market exchanges of debt between the groups may make it more difficult for the government to commit to repay. Thus, reduction of transaction costs in asset markets may, paradoxically, reduce a government's ability to commit to repay its debt, worsen its terms of credit, and reduce its welfare. Our model also suggests that even in the absence of transaction costs, home bias may still persist, but that increased domestic inequality diminishes home bias and leads to greater foreign ownership of government debt. Finally, if the government's commitment to repay is weaker towards its more risk-tolerant creditors, we show that there may be multiple equilibria in the market for government debt.

To see all of this, suppose that a government which issues debt can later default, but that default is costly. For example, default might be through inflation if the debt is denominated in domestic currency. Suppose further that there are two classes of potential creditors: favored creditors, to whom the government does not like to default, and disfavored creditors, to whom the government is more willing to default. For example, the government might not like defaulting to domestic residents, but not mind defaulting to foreign residents; or it might not like defaulting to domestic residents from the majority ethnic group, but not mind defaulting to resident minorities.

We also assume 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: if the government announces, for instance, that it will not pay its debt obligations to foreign claimants, then foreign bondholders can just sell their bonds to domestic residents. 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. Hence, we take the probability of default or, in the case of nominal debt, target inflation, to be an increasing function of the amount of debt held by disfavored creditors.

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 accordingly the value of the asset to all creditors (e.g., by increasing the probability of default or by increasing target inflation). The reduction in asset value due to a sale of debt from an individual favored creditor to an individual disfavored creditor is miniscule, so individuals will not internalize this effect, and hence 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 their portfolio decisions, and the government will have to pay more for credit. The government would prefer to sell a smaller proportion of the asset to the disfavored group, to reduce the probability of costly default and improve its terms of credit, and it might therefore find it desirable to reduce the liquidity of the asset to prevent its sale to disfavored creditors. Governments do, for instance, issue debt denominated in domestic currency to make it more attractive to domestic creditors than foreign ones, and issue savings bonds which are nontransferable or difficult to transfer.

If domestic creditors are favored over foreign creditors, this model also suggests that domestic residents 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. Consequently, if all domestic agents are identical, we find that in our model, all debt is held by domestic residents. In the more realistic case in which domestic residents are heterogeneous, and the tax burden of individual domestic agents is not proportional to their holdings of government debt, optimal portfolio selection requires foreigners to hold some government debt. The ratio of assets to tax burden varies across individuals since assets tend to be more concentrated than income, and taxes tend to be levied primarily on income. Because the government's default decision is based on its amount of foreign indebtedness, our model suggests that, holding constant the tax schedule, greater asset inequality leads to greater foreign ownership of debt, and thus to inflationary default. This may be relevant to Latin America.

Finally, this paper shows that when creditors' willingness to bear risk increases in their wealth, there may be multiple equilibria. We present a model in which foreign creditors are disfavored and face some transaction cost in purchasing debt, but have greater wealth (and hence lower risk aversion) than domestic creditors. Because foreigners are more willing to bear risk than domestic creditors, and the government is more likely to default the greater is its foreign indebtedness, there may be multiple equilibria. In particular, there is a domestic ownership equilibrium, in which all debt is held domestically and the default risk and cost of credit are therefore low. There is also a foreign ownership equilibrium, in which foreign creditors hold some positive proportion of government debt and the default risk and cost of credit are correspondingly higher.

There is historical evidence that the repayment decisions of sovereign debtors are conditioned on the identity of their creditors. For instance, a large amount of domestic-currency-denominated foreign debt borne by a government is said to raise suspicions that the government will pursue inflationary policies. Thus, speculative attacks against the French franc in the 1920s have been blamed on expectations that the government would try to inflate away its foreign debt obligation from World War I.

Related Literature

Drazen (1998) presents a political model of the allocation of debt among domestic and foreign creditors. His model rests on the premise that the government's decision to repudiate or renegotiate its debt depends on the identity of its claimants through the different political rights they enjoy and the punishments they can exact if the government fails to meet its obligations. Our model shares with his the sensitivity of the government's repayment decision to the identity of it claimants. Drazen's model, however, assumes that governments have control over whether debt is held domestically or abroad, so that his model is one of segmented markets in which the government acts as a discriminating monopsonist in placing its debt, and in which it can selectively repudiate one class of its obligations (i.e., domestic or foreign). This paper considers a non-segmented market for sovereign debt in which domestic and foreign creditors can trade government claims and in which, therefore, there is no possibility of selective default.

Although our model is described in terms of sovereign debt, the analysis may have implications for a broader range of situations. For instance, if foreign agents can insure domestic agents against fluctuations in GNP, this can reduce the government's incentive to increase income. Shiller (1995), in fact, estimates the value of a claim to a country's future GDP flows, and promotes the creation of such securities to insure against risk in national income. As Obstfeld and Rogoff (1996) point out, however, the desirability of such securities is undermined by the moral hazard this insurance would generate. Likewise, Calvo (forthcoming) offers a model which shows that it may be optimal, in terms of *ex ante* domestic welfare, not to have a market for insurance against national income risk. In Calvo's model, the government implements a reform (such as trade liberalization or an output-enhancing reform), but its commitment not to reverse the reform in the next period is not perfectly credible. Reform, moreover, is costly. In this case, the existence of a market for state-contingent contracts which can insure domestic agents against discontinuation of the reform can remove the government's incentive to carry out the reform. Domestic welfare would then be improved in the absence of such a market. Our paper differs from Calvo's in examining sovereign debt markets, rather than markets for insurance against discontinuation of reform.We also derive implications of secondary sovereign debt markets for home bias, consider the welfare consequences of different degrees of friction in international debt markets, and show the possibility of multiple equilibria in the placement of sovereign debt. In addition, while Calvo's model focuses on social welfare optimization in the presence of insurance provision by risk-neutral foreign agents, our model considers the welfare implications of individual utility optimization, where insurance results from the optimal portfolio decisions of individual risk-averse domestic and foreign agents.

The remainder of this paper is organized as follows. In Section 2 we present a partial equilibrium model of government debt and show that enlarging the pool of disfavored foreign creditors can worsen the government's terms of credit if its cost of default is sufficiently low. In Section 3, we show that reductions in the transaction costs associated with foreign placement and purchase of the government debt can also worsen the government's terms of credit. In Section 4, we extend the model to a general equilibrium setting in which the debt is repaid through taxes. We find that the partial equilibrium results continue to hold, and moreover, that reductions in transaction costs can worsen overall social welfare. We also find that home bias can persist even in the absence of transaction costs. Section 5 shows that the government's terms of credit may first improve, and then subsequently deteriorate, as transaction costs fall, so that there may be an optimal level of transaction costs. Section 5 also demonstrates that multiple equilibria may exist when disfavored creditors are less risk averse than favored creditors.

We should note that our model in Sections 2 through 4 is written in terms of domestic-currency-denominated debt, with default occuring through inflation. At the end of Section 2, we describe how the argument of these sections can be extended to debt denominated in foreign currency, and in Section 5 we present a model in which debt is real and default is through outright repudiation. In our remarks in Section 6, we describe a model of exchange-rate risk to motivate the denomination of debt in domestic currency, and to match the empirical observation that some governments seem at least as willing to inflate away domestically-denominated-debt as to default outright on debt denominated in foreign currency.

2 The Basic Model

Consider a two-period, partial equilibrium model in which the government issues debt to domestic creditors (who are favored) and foreign creditors (who are disfavored). In the first period, the government issues one unit of debt; each unit of debt pays 1 (in nominal terms) in the second period. Domestic and foreign creditors make 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 then can also trade among 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.

There is a continuum of identical domestic and foreign creditors (i.e., with identical wealth and preferences) of measure n_d and n_f, respectively ($n_d > 1$, $n_f > 1$). Both domestic 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 creditors. With CARA preferences there are no wealth effects, and so we normalize the wealth endowment of all creditors to 1. Let Γ_f and Γ_d denote the aggregate quantity of debt held by foreign and domestic 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.[1] 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 agents. Since the equilibrium concept here is a rational expectations equilibrium, if $\sigma^2 = 0$, creditors will correctly anticipate the government's 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.

Inflation generates a cost to domestic residents given by $\frac{k}{2}(\tau_e^2 + \sigma^2)$ ($k > 2$), as measured in certainty equivalent units. Note that this cost of inflation is increasing and convex in π_e, so that under this specification of inflation costs, domestic residents are averse to both high target inflation and to unexpected inflation. Recall that Γ_f denotes the amount of government debt held by foreigners. Then the government's inflation decision in period 2 (as a function

[1] Admittedly, the symmetric distribution of τ about its mean results in an asymmetric distribution of π. We stipulate 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 $\tau > 1$ is likewise small.

of foreign ownership of debt) is defined by

$$\tau_e = \frac{\Gamma_f}{k}. \tag{1}$$

For the moment, this rule is simply stipulated; in Section 4, where a domestic social welfare function is fully specified and the model is considered in a general equilibrium setting, the rule above will be derived as the solution to the government's optimization problem. To motivate the rule for the moment, however, we can note that in choosing to inflate, the government is trading off the cost of inflation $\frac{k}{2}(\tau_e^2 + \sigma^2)$ against the benefit of expected reduced real payments of $\tau_e \Gamma_f$ to foreigners in period 2. Then, τ_e as stipulated above maximizes the expected net benefit $\Gamma_f \tau_e - \frac{k}{2}(\tau_e^2 + \sigma^2)$.

In this model, domestic creditors are favored in the sense that their welfare figures directly into the government's objective, and thus into its repayment decision. Foreign creditors are disfavored in the sense that the effect of default on foreign creditor welfare figures, at most, indirectly in the the government's repayment decision through that portion of k which represents the punishment capability of foreigners. This will become more apparent in the fully specified general equilibrium model below. For now, the asymmetry in the government's treatment of foreign and domestic creditors is captured by the fact that inflationary erosion of debt payments to foreign creditors is considered a benefit to the government, while the inflationary erosion of debt payments to domestic creditors is not.

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

$$q = (1 - p\gamma) + \gamma(1 - \tau), \tag{2}$$

the sum of the real return on the safe asset and the real return on government debt. By normality of τ, q is distributed normally with mean and variance

$$\mu_q = 1 - p\gamma + \gamma(1 - \tau_e) \tag{3}$$

$$\sigma_q^2 = \gamma^2 \sigma^2. \tag{4}$$

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 $\mu_q - \frac{r}{2}\sigma_q^2$, or

$$CE = 1 - p\gamma + \gamma(1 - \tau_e) - \frac{r}{2}\gamma^2\sigma^2. \tag{5}$$

Domestic and foreign creditors, then, choose their optimal portfolios (defined by γ) to maximize CE. All creditors are identical, and hence have identical choice of optimal γ, given by

$$\gamma(p, \tau_e) = \frac{1}{r\sigma^2}(1 - p - \tau_e). \tag{6}$$

In making their portfolio decisions, individual creditors take the portfolio decisions of the other creditors and the government's inflation decision τ_e as exogenous. We now impose the rational expectations requirement that the creditors' expected inflation equals the government's target inflation, so that $\tau_e = \frac{\Gamma_f}{k}$ in the creditors' portfolio decision:

$$\gamma(p) = \frac{1}{r\sigma^2}(1 - p - \frac{\Gamma_f}{k}). \tag{7}$$

Finally, aggregating individual demand schedules, we have that $\Gamma_f(p) = n_f\gamma(p)$ and $\Gamma_d(p) = n_d\gamma(p)$; solving for Γ_f and Γ_d, we obtain the creditors' aggregate demand schedules:

$$\Gamma_f(p) = \frac{n_f k(1-p)}{n_f + kr\sigma^2} \tag{8}$$

$$\Gamma_d(p) = \frac{n_d k(1-p)}{n_f + kr\sigma^2} \tag{9}$$

In equilibrium, $\Gamma_d(p) + \Gamma_f(p) = 1$, which yields the equilibrium market price of government debt:

$$p^* = 1 - \frac{n_f + kr\sigma^2}{k(n_f + n_d)}. \tag{10}$$

It is worth noting that under rational expectations, equilibrium asset allocations and price will be the same whether the government places it debt domestically and then trade occurs between domestic and foreign creditors, or 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, rational expectations guarantees that the placement price and secondary market price of debt will be identical.

Note that under our assumptions ($k \geq 2$; n_d,$n_f \geq 1$; σ^2 small), the equilibrium price p^* defined above is, indeed, bounded between 0 and 1.

From (10) we conclude that $\frac{dp^*}{dn_d} > 0$ and $\frac{dp^*}{dn_f} = \frac{-n_d+kr\sigma^2}{(n_d+n_f)^2k}$, so that $\frac{dp^*}{dn_f} < 0$ if and only if $k < \frac{n_d}{r\sigma^2}$. The first inequality is the standard effect of enlarging the market on the demand side: increasing the number of creditors reduces the quantity of debt held by each individual, and hence reduces each individual's exposure to risk, and so the equilibrium price of debt rises. The second inequality, however, demonstrates that under certain conditions, increasing the number of the disfavored, foreign creditors will drive down the price of the risky asset because foreign ownership of the asset rises in equilibrium, and hence so does expected inflation. The condition for this to occur is that the cost of inflation k is sufficiently low; if k is relatively high, then a high cost of inflation lends greater credibility to the government's commitment not to inflate away the value of the asset, and so the standard demand effect holds.

Furthermore, we note that if n_d is held constant, then as n_f increases, the amount of government debt held by an individual foreign creditor falls, and the amount of government debt held in aggregate by foreigners rises. Since foreign creditors individually hold less government debt as n_f rises, their exposure to risk falls as their number increases, and they behave as if they were less risk averse. Indeed, as n_f tends to infinity, the amount of risky asset held by each foreign creditor tends to zero, so that foreign creditors act essentially risk neutral, while the aggregate amount of government debt held by foreigners tends towards 1. In this case, the government's expected inflation decision is given by $\tau_e = \frac{1}{k}$. The equilibrium price of debt, as n_f tends to infinity, approaches $p^* = 1 - \frac{1}{k}$, which is the price that would be set by risk-neutral agents when the expected real return on debt is $1 - \tau_e = 1 - \frac{1}{k}$.

Thus, we can analyze the effect of reducing the risk aversion of foreign creditors in this model simply by considering the effect of increasing their numbers. In particular, as foreign creditors become less risk averse, the government's terms of credit improve only if the cost of inflation is sufficiently high.

In the exposition above, government debt is described as nominal debt (i.e., domestic-currency-denominated debt), and default is realized through inflation. However, the argument of this paper extends to real or foreign-currency-denominated debt as well. For instance, let 1 unit of debt represent the government's obligation to repay 1 in *real* terms in period 2. However, in period 2 the government can renegotiate the terms of its debt. In particular, it pays only a fraction $1 - \tau$ on each unit of debt in the second period. The government targets its degree of default optimally by choice of target τ_e, but its actual ability to renegotiate depends on various stochastic factors in the economy, and so realized τ is stochastic. Finally, the domestic government and economy bears a cost, parameterized by k as above, for its repudiation of debt. The model of this paper, and its results, then apply directly. Section 5 considers a model with real debt and explicit default.

3 Transaction Costs

In this section, we consider the economy of Section 2 under varying transaction costs associated with trading debt internationally. We have in mind here asymmetric transaction costs which affect foreign creditors but not domestic ones. For instance, the secondary market for sovereign debt may be frictionless for trades among domestic creditors, yet may involve costs when foreign residents purchase government bonds from domestic creditors.

We let transactions costs on foreign ownership of government debt be indexed by $1 - \lambda$, so that foreign creditors earn only a fraction λ on every 1 unit of return on foreign debt. Domestic creditors continue to earn a nominal return of 1 on each unit of the risky asset.

For foreigners, real return on 1 unit of wealth invested as $(\gamma, 1 - p\gamma)$ is now given by

$$q = 1 - p\gamma + \lambda\gamma(1 - \tau) \tag{11}$$

and the certainty equivalent of 1 unit of wealth invested in the portfolio is

$$CE = 1 - p\gamma + \lambda\gamma(1 - \tau_e) - \frac{r}{2}\lambda^2\gamma^2\sigma^2. \tag{12}$$

Foreign creditors choose the portfolio γ_f which maximizes this certainty equivalent,

$$\gamma_f(p, \tau_e) = \frac{1}{\lambda r \sigma^2}(1 - \tau_e - \frac{p}{\lambda}). \tag{13}$$

Imposing the rational expectations condition $\tau_e = \frac{\Gamma_f}{k}$, and then aggregating, we obtain the aggregate foreign demand schedule

$$\Gamma_f(p) = \frac{n_f k(1 - \frac{p}{\lambda})}{\lambda r\sigma^2 k + n_f}. \tag{14}$$

Domestic creditors bear no transaction costs and therefore face the same portfolio decision problem as before (maximization of (5)). Hence, their portfolio choice is given by equation (6), $\gamma_d(p, \tau_e) = \frac{1}{r\sigma^2}(1 - p - \tau_e)$. Under rational expectations, the aggregate domestic demand schedule is

$$\Gamma_d(p) = \frac{n_d(\lambda r\sigma^2 k(1-p) + n_f p(\frac{1}{\lambda} - 1))}{r\sigma^2(\lambda r\sigma^2 k + n_f)}. \tag{15}$$

In equilibrium, $\Gamma_d(p) + \Gamma_f(p) = 1$, so that when an interior solution exists, the equilibrium price is

$$p^* = \frac{\lambda r\sigma^2(\lambda n_d k + n_f k - n_f - \lambda k r\sigma^2)}{-n_d n_f + \lambda n_d n_f + \lambda^2 n_d k r\sigma^2 + n_f k r\sigma^2}. \tag{16}$$

For $\lambda = 1$ (i.e., the case of no transaction costs), by the results of Section 2, an interior solution always exists. As λ changes, p^* changes continuously, so an interior solution will always exist for sufficiently low transaction costs (i.e., for λ sufficiently close to 1). If transaction costs are high enough, foreigners will hold no debt.

The main result of this section in contained in the following proposition:

Proposition 1 $\frac{dp^*}{d\lambda} < 0$ *if and only if* $k < \frac{n_d}{r\sigma^2}$.

The proposition follows directly from differentiation of (16):

$$\frac{dp^*}{d\lambda} = \frac{N}{(-df + \lambda df + \lambda^2 dkr\sigma^2 + fkr\sigma^2)^2}, \tag{17}$$

where $N = df^2 r\sigma^2 + k(-2\lambda d^2 fr\sigma^2 + \lambda^2 d^2 fr\sigma^2 - df^2 r\sigma^2 + 2\lambda dfr^2\sigma^4) + k^2(2\lambda dfr^2\sigma^4 - \lambda^2 dfr^2\sigma^4 + f^2 r^2\sigma^4 - 2\lambda fr^3\sigma^6)$. So $\text{sign}(\frac{dp^*}{d\lambda}) = \text{sign}(N)$. Note that N is convex and quadratic in k, with roots at $k_1 = \frac{n_d}{r\sigma^2}$ and $k_2 = n_f/(2\lambda n_d - \lambda^2 n_d + n_f - 2\lambda r\sigma^2)$. Finally, $k_1 > 2$ and $k_2 < 2$ together imply that

$$\begin{aligned} \frac{dp^*}{d\lambda} &< 0 \text{ for } k \in [2, \frac{n_d}{r\sigma^2}) \\ \frac{dp^*}{d\lambda} &> 0 \text{ for } k \in (\frac{n_d}{r\sigma^2}, \infty). \end{aligned}$$

□

Ordinarily, we would expect that as transaction costs fall, so that foreign creditors earn a higher return on government debt, they would bid up the price at which the government can place its debt. The proposition above demonstrates that only if the cost of inflation k is sufficiently high, so that the government can crediby commit to a low target inflation even as larger quantities of debt are held by foreigners, will reduction of transaction costs improve the government's terms of credit by increasing the foreign supply of credit. On the other hand, if k is low, then reduced transaction costs, by increasing foreign holdings of debt and thereby encouraging inflation, worsen the government's terms of credit; in such a case, reducing the liquidity of this asset market will actually raise the price at which the government can place its bonds.

4 A General Equilibrium Model

The economy of Section 2 left open the disposition of the money raised by the government in the first period, and the source of funds to repay its debt obligation in the second. We now consider the model in the following general equilibrium setting, where the economy is closed by a levy of taxes to repay the government's debt obligation: The government wishes to raise money in the first period in order to invest in some public good which generates utility for domestic residents in the second period. The government can only credibly commit to repay 1 unit on its bond obligations in the second period, so it can only issue (and will issue) 1 unit of debt at the market price p per unit. We have in mind here that the government has two default technologies available to it: outright default and inflation. If the government's debt obligation exceeds 1 unit, it cannot credibly commit not to default outright, and so it is limited to issuing 1 unit of debt.[2] The public good enters into the domestic residents' utility function as an increasing function v of the amount of investment made; i.e., the public good generates utility $v(p)$ in certainty equivalent units. In the second period, the government levies taxes (of nominal value 1) to pay off the debt.

The domestic population is divided into two groups. Heterogeneity among the domestic population is necessary because, as we shall see below, if all do-

[2] Admittedly, under this rationale, the government's debt limit should be 1 in *real* terms. However, for tractability, we assume that the government is limited to issuing a fixed amount of debt in nominal terms.

mestic residents have the same proportion of bondholdings to tax burden, then for all domestic residents, inflationary erosion of asset value will be perfectly offset by the inflationary reduction in tax burden, and all government debt will be held domestically as a safe asset. We therefore assume heterogeneity among the domestic population in the ratio of bondholdings to tax burden. For simplicity, we designate two groups, whom we label rich and poor. Domestic wealth is owned by the rich, and only the rich act as domestic creditors. The poor do not invest in government bonds. In particular, the poor are have some fixed endowment, immune to inflation, in the second period. For instance, this endowment might be agricultural output or wage income. We normalize the poor's wealth to 0. We can do this because all agents have CARA utility, so there are no level effects from translating wealth endowments to a new origin. We assume that the poor do not act as creditors, because (for instance) the transaction costs are too high, or because they face informational, liquidity, or capital market constraints. In the second period, the government divides the tax burden between the two groups, levying a tax of h (in nominal terms) on the rich and $1-h$ on the poor.

Specifically, then, let $v_1(p)$ and $\frac{1}{2}k_1(\tau_e^2+\sigma^2)$ denote, in wealth equivalent units, the public good benefit and inflationary burden in the utility of the rich, and $v_2(p)$ and $\frac{1}{2}k_2(\tau_e^2+\sigma^2)$ the public good benefit and inflationary burden in the utility of the poor. Recall that the poor face a real tax burden of $(1-h)(1-\tau)$, which is distributed normally with mean $(1-h)(1-\tau_e)$ and variance $(1-h)^2\sigma^2$.

For a portfolio defined by investment in γ units of debt, let q denote the normally distributed return, net of taxes:

$$q = 1 - p\gamma + \gamma(1-\tau) - \frac{h}{n_d}(1-\tau). \tag{18}$$

Then, the utility of the rich is defined by the certainty equivalent

$$CE_1 = v_1(p) - \frac{k_1}{2}(\tau_e^2+\sigma^2) + n_d(\mu_q - \frac{r}{2}\sigma_q^2), \tag{19}$$

and the utility of the poor by the certainty equivalent

$$CE_2 = v_2(p) - \frac{k_2}{2}(\tau_e^2+\sigma^2) - (1-h)(1-\tau_e) - \frac{r}{2}(1-h)^2\sigma^2, \tag{20}$$

where the mean and variance of the net return on a portfolio $(\gamma, 1 - p\gamma)$ are given by

$$\mu_q = 1 - p\gamma + (\gamma - \frac{h}{n_d})(1 - \tau_e) \tag{21}$$

$$\sigma_q^2 = (\gamma - \frac{h}{n_d})^2 \sigma^2. \tag{22}$$

Thus, *ex ante* domestic social welfare is given by the total certainty equivalent

$$TCE = v(p) - \frac{k}{2}(\tau_e^2 + \sigma^2) + n_d(\mu_q - \frac{r}{2}\sigma_q^2) - (1-h)(1-\tau_e) - \frac{r}{2}(1-h)^2\sigma^2 \ , \tag{23}$$

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. Because p and γ are determined in period 1, and h, n_d, and σ^2 are exogenously fixed, maximizing TCE with respect to τ_e is equivalent to maximizing

$$-\frac{k}{2}(\tau_e^2 + \sigma^2) + n_d(\gamma_d - \frac{h}{n_d})(1 - \tau_e) - (1-h)(1-\tau_e). \tag{24}$$

Recalling that $n_f\gamma_f + n_d\gamma_d \equiv \Gamma_f + \Gamma_d = 1$, we conclude that (24) is maximized at $\tau_e = \Gamma_f/k$, which is precisely the government inflation decision (1) stipulated in Section 2. Hence, τ is normally distributed around τ_e with variance σ^2, where the government's target inflation decision is given by $\tau_e = \Gamma_f/k$.

Provision of the public good and levy of taxes affects only domestic creditors, so the foreign portfolio decision remains unchanged:

$$\Gamma_f(p; \lambda) = \frac{n_f k(1 - \frac{p}{\lambda})}{\lambda r \sigma^2 k + n_f} \tag{25}$$

However, domestic creditors' portfolio decision must now take into account the effect of taxes when maximizing their certainty equivalent CE_1. Domestic creditors take p and τ_e as given, so their problem reduces to

$$\gamma_d(p, \tau_e) = \text{argmax}_\gamma\, 1 - p\gamma + (\gamma - \frac{h}{n_d})(1 - \tau_e) - \frac{r}{2}(\gamma - \frac{h}{n_d})^2\sigma^2, \tag{26}$$

which gives

$$\gamma_d(p, \tau_e) = \frac{(1 - \tau_e + \frac{h}{n_d} r\sigma^2 - p)}{r\sigma^2} \ . \tag{27}$$

Recalling that $\tau_e = \Gamma_f / k$ in equilibrium, from (25) and (27) we have that the domestic creditors' aggregate demand schedule is given by

$$\Gamma_d(p; \lambda, h) = \frac{n_d[\lambda r\sigma^2 k(1 + \frac{h}{n_d} r\sigma^2 - p) + n_f \frac{h}{n_d} r\sigma^2 + n_f p(\frac{1}{\lambda} - 1)]}{r\sigma^2(\lambda r\sigma^2 k + n_f)}. \tag{28}$$

In equilibrium, $\Gamma_d(p) + \Gamma_f(p) = 1$, so that when an interior equilibrium exists, the equilibrium price is given by

$$p^* = \frac{\lambda r\sigma^2(\lambda n_d k + n_f k - \lambda k r\sigma^2 - n_f + n_f h + \lambda h k r\sigma^2)}{-n_d n_f + \lambda n_d n_f + \lambda^2 n_d k r\sigma^2 + n_f k r\sigma^2}. \tag{29}$$

As in Section 3, an interior equilibrium exists whenever transaction costs are sufficiently low (i.e., λ close to 1). In addition, the main result of Section 3 continues to hold in this general equilibrium setting:

Proposition 2 $\frac{dp^*}{d\lambda} < 0$ *if and only if* $k < \frac{n_d}{r\sigma^2}$.

The proof follows as before.

We note here the implications of (28) and (29) for home bias in this model. When $\lambda = 1$, the equilibrium price and quantity of debt held by domestic residents are given by

$$p^* = \frac{n_d k + n_f k + n_f(h - 1) + k r\sigma^2(h - 1)}{n_d k + n_f k} \tag{30}$$

and

$$\Gamma_d^* = \frac{n_d + h n_f}{n_d + n_f} \ . \tag{31}$$

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 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. The model exhibits this home bias because real return on debt and real tax burden are exactly negatively correlated, so that inflationary erosion of the tax burden acts as a hedge against inflationary erosion of asset value. Note that when $h = 1$, so that the government's repayment of debt is entirely financed by taxes, all debt is held by domestic residents no matter what the level of transaction costs (i.e., whatever the value of λ). For $\lambda = 1$, this arises as the interior equibrium; for $\lambda < 1$, there is no interior equilibrium, and this arises as a corner solution.

Proposition 2 above establishes that when the cost of inflation k is low, so that the government's commitment not to default it not credible, reduction in transaction costs will worsen the government's terms of credit, and thereby tend to reduce welfare. Inflation, however, also has a welfare-improving effect through its reduction of real debt payments to foreigners, and hence of the real tax burden required to finance those payments.[3] Thus, when k is low, further analysis is required to determine the welfare consequences of reduced transaction costs.

Recall that social welfare is defined by the total certainty equivalent (23):

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

where q is the return on each domestic creditor's portfolio.

We are interested in the effect of increasing λ on equilibrium welfare, as given by $TCE^* \equiv TCE(p^*)$. Calculating $dTCE^*/d\lambda$ by summing the effects of increased λ on equilibrium TCE through its various constituent terms, we get that

$$\frac{dTCE^*}{d\lambda} = (v'(p^*) - 1 + \Gamma_f^*)\frac{dp^*}{d\lambda}. \tag{32}$$

We can assume that $v'(p^*) - 1 + \Gamma_f^* > 0$ if we assume that, *ex ante*, the government only raises money to invest in the public good if that investment is worthwhile. For the public project to be worthwhile, the marginal benefit from investment of an additional unit of wealth, $v'(p^*)$, must exceed 1, the

[3]Inflationary erosion of domestic debt does not affect social welfare since this simply represents a transfer from domestic creditors to domestic taxpayers.

marginal benefit from an additional unit of wealth. Since $\Gamma_f^* \geq 0$, we have therefore established the following result:

Proposition 3 *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 $n_d/r\sigma^2$.*

Equation (32) is obtained by considering the effect on increased λ on each constituent term of TCE^*. The effect of reduced transaction costs on the social benefit from the public good (v) will depend on whether reduced transaction costs increase or decrease the amount of money (p^*) that the government is able to raise for expenditure on the good:

$$\frac{d}{d\lambda}v(p^*) = v'\frac{dp^*}{d\lambda}, \tag{33}$$

so that from Proposition 2 it follows that

$$\frac{d}{d\lambda}v(p^*) > 0 \text{ if and only if } k > \frac{n_d}{r\sigma^2}. \tag{34}$$

The effect of λ on the government's inflation decision is given by

$$\frac{d\tau_e^*}{d\lambda} = (\frac{n_d}{-n_d + kr\sigma^2})\frac{dp^*}{d\lambda}. \tag{35}$$

Since $dp^*/d\lambda > 0$ if and only if $k > n_d/r\sigma^2$, equation (35) implies that $\frac{d\tau_e^*}{d\lambda} > 0$. Recalling that $\tau_e^* = \frac{\Gamma_f}{k}$, we conclude that a reduction in transaction costs $1-\lambda$ shifts the placement of government debt towards greater foreign ownership and consequently produces a higher target inflation.

Then, since

$$\frac{d}{d\lambda}[-\frac{k}{2}(\tau_e^{*2} + \sigma^2)] = -k\tau_e^*\frac{d\tau_e^*}{d\lambda} < 0) \tag{36}$$

a rise in λ contributes negatively to welfare through its effect on the social cost of inflation (36).

Next,

$$\frac{d}{d\lambda}[-(1-h)(1-\tau_e)] = (1-h)\frac{d\tau_e^*}{d\lambda} > 0, \tag{37}$$

so that reduced transaction costs affect welfare positively through the tax benefit of inflation that accrues to the poor (37).

Finally, a rise in λ affects the return on government bonds (via equilibrium price and target inflation) and thereby affects the portfolio decision of domestic creditors and the utility they gain from their investment:

$$\frac{d}{d\lambda}[d\mu_q^* - \frac{dr}{2}\sigma_q^{2*}] = (\gamma_d^* - h)(-\frac{d\tau_e^*}{d\lambda}) - \gamma_d^*\frac{dp^*}{d\lambda}. \quad (38)$$

Since $\gamma_d^* > h$ and $\frac{d\tau_e^*}{d\lambda} > 0$, if $\frac{dp^*}{d\lambda} > 0$ (i.e., if $k > n_d/r\sigma^2$), then decreasing transaction costs have an unambiguously negative effect on the utility to the rich from their portfolio. This is not surprising: when $\frac{dp^*}{d\lambda} > 0$, falling transaction costs both increase the price of debt and increase target inflation, so that the real return on government debt falls. However, if $\frac{dp^*}{d\lambda} < 0$ (i.e., $k < n_d/r\sigma^2$), then the sign of (38) is ambiguous.

5 General Default Costs and Multiple Equilibria

In this section, we generalize the equilibrium and comparative statics results of Sections 2, 3, and 4 by allowing for a more general specification of preferences and default costs. In the main results of Sections 3 and 4, we showed that the price of debt and welfare may fall monotonically as transaction costs fall, if the government's commitment to repay is not sufficiently credible. This monotonicity (conditional on the cost k of inflation) arises from linearity of the government's inflation decision in the aggregate foreign ownership of its debt. In this section, we first show that, more generally, the government's terms of credit may initially improve as transaction costs fall, and then deteriorate as transaction costs fall further. In this case, there will be an optimal level of transaction costs. Second, 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 one unit of debt, at market price p, to domestic and foreign creditors in the first period. However, debt is *real* now, 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 0 return.

Risk-averse domestic and foreign creditors make a portfolio decision in the first period between the risky debt and a safe asset which pays 1 with certainty in the second period. Foreign creditors face transaction costs $1-\lambda$ and earn only a fraction λ on each unit of return.

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. The net benefit from default is the cost of servicing debt held by foreigners (Γ_f) less the cost of default k. Hence, the government defaults if and only if $\Gamma_f - k \geq 0$.

First we show that the equilibrium price of government debt may be nonmonotonic in the level of transaction costs. We take the number of foreign creditors to be large, so that they act effectively risk-neutral.

Then, suppose that k is distributed as follows. With probability $\phi_{min} < 1$, $k = 0$; with probability $1 - \phi_{min}$, k is distributed uniformly on $[A, Z]$, where $0 < A < 1$ and $Z > 1$. This implies a probability of default $\phi(\Gamma_f)$ as a function of foreign ownership:

$$\begin{array}{rcll} \phi(\Gamma_f) & = & \phi_{min} & \text{for } \Gamma_f < A \\ \phi(\Gamma_f) & = & \phi_{min} + \frac{\Gamma_f - A}{Z-A}(1-\phi_{min}) < 1 & \text{for } A \leq \Gamma_f \leq 1 \end{array} \tag{39}$$

Defining $\theta \equiv \frac{1-\phi_{min}}{Z-A}$, we can rewrite (39):

$$\phi(\Gamma_f) = \phi_{min} + (\Gamma_f - A)\theta \text{ for } A \leq \Gamma_f \leq 1. \tag{40}$$

First, we show that if transaction costs are very high (in particular, if $\lambda = 0$), then lowering transaction costs (i.e., raising λ) can increase the equilibrium price of debt.

At $\lambda = 0$, foreigners will hold no debt, so $\Gamma_f^* = 0$ and $\Gamma_d^* = 1$. The probability of default will be ϕ_{min}, and the equilibrium price of debt will be $P(1) = \Gamma_d^{-1}(1 \mid \phi = \phi_{min})$.

Now consider the price $P(1-A) = \Gamma_d^{-1}(1 - A \mid \phi = \phi_{min})$ at which domestic creditors will hold $\Gamma_d = 1 - A$ if the probability of default is ϕ_{min}. We have that $P(1-A) > P(1)$ for downward-sloping demand function Γ_d. Furthermore, $P(1-A) < 1 - \phi_{min}$ since domestic creditors are risk-averse.

For transaction costs $1-\lambda$ and default probability ϕ_{min}, risk-neutral foreign creditors will hold any amount of government debt as long as $p \leq \lambda(1-\phi_{min})$. In particular, at $\lambda = \frac{P(1-A)}{1-\phi_{min}} < 1$, foreign creditors will hold any amount of debt if $p \leq P(1-A)$. Therefore, for $\lambda = \frac{P(1-A)}{1-\phi_{min}}$, $\Gamma_d^* = 1-A$, $\Gamma_f^* = A$, $\phi^* = \phi_{min}$, $p^* = P(1-A)$ define an equilibrium. Hence, lowering transaction costs from $\lambda = 0$ to $\lambda = \frac{P(1-A)}{1-\phi_{min}}$ improves the government's terms of credit.

Next, we show that if transaction costs are zero (i.e., $\lambda = 1$), a rise in transaction costs can also increase the price at which the government is able to place its debt. At $\lambda = 1$, risk-neutral foreigners will hold all debt at its actuarially fair price, and risk-averse domestic creditors will hold no debt. Since $\Gamma_f^* = 1$, the probability of default is given by $\phi = \phi_{min} + (1-A)\theta$, and the price of debt will be be its expected payoff, $p^* = 1-\phi = 1-\phi_{min}-(1-A)\theta$.

Since θ monotonically increases towards $\frac{1-\phi_{min}}{1-A}$ as Z approaches 1 from above, p^* can be made arbitrarily small in magnitude for Z sufficiently close to 1. In particular, as long as Z is not too large, we have that p^* is smaller than $P(1-A)$, the price of debt when $\lambda = \frac{P(1-A)}{1-\phi_{min}}$. This implies that, for Z not too large, the government's terms of credit improve when transaction costs rise from $\lambda = 1$ to when $\lambda = \frac{P(1-A)}{1-\phi_{min}} < 1$.

These two results together show that although falling transaction costs may initially improve the price at which a government can place its debt, reductions in transaction costs beyond a certain point can still be detrimental to its terms of credit.

Next, we show that in this more general model, there may be multiple equilibria in the market for government debt. In the model of Sections 2, 3, and 4, we used identical CARA preferences for analytical convenience, but at the expense of realism. We now consider what happens when foreign creditors are less risk averse than domestic creditors. This may occur, for instance, if we assume that agents' willingness to bear risk increases in their wealth, and that foreigners have greater wealth than domestic creditors. Since foreigners are willing to bear more risk than domestic creditors, and since greater foreign ownership makes government debt more risky, there may be multiple equilibria in the market for government debt.

We assume that foreign creditors have sufficient wealth that they act effectively risk-neutral. It is then straightforward to construct an example with multiple equilibria. 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 $\Gamma_f \in [F, 1]$.

This model can have at least two equilibria if domestic agents are sufficiently risk averse. First, there is a domestic ownership equilibrium, where all debt is held domestically. $\Gamma_f = 0$ implies that the probability of default ϕ is zero, and that 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 domestic agents are sufficiently risk averse that if $p = \lambda(1 - \phi_{\max})$, 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, foreign ownership equilibrium. Suppose $\Gamma_f = 1 - D$; then, $\Gamma_f > F$, so the probability of default is $\phi_{\max}$. Risk-neutral foreign creditors will set the price of government debt at their expected return on debt, $p = \lambda(1-\phi_{\max})$. 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 $p^* = \lambda(1 - \phi_{\max})$.

This model, in which the disfavored creditors are also less risk averse, need not be restricted to international financial markets, but may also be relevant within a country, when a government has multiple classes of domestic creditors. In the early years of the United States, for example, one of the most important political debates concerned disposition of the American Revolutionary War debt. Much of the initial domestic debt had been issued to a broad class of small creditors, including Revolutionary War soldiers, patriots, and "citizen-farmers." However, as the war progressed and debt-service payments became increasingly erratic and uncertain, many small creditors sold the bonds they held to wealthy speculators, who were better positioned to bear risk, at substantial discounts. Consequently, when Congress debated the national debt in the early 1790s, many believed that speculators were opportunists not particularly commited to the national cause; moreover, they were viewed as neither a popular nor important political constituency. Accordingly, there was strong and explicit political support for repudiating the debt held by speculators. In this case, the distinction between favored and disfavored creditors resides in the distinction between a broad class of small creditors, who were less tolerant of risk, and a small class of wealthy speculators, who were better able to bear risk. As it turned out, in this historical episode, Congress decided not to default, and the government fully repaid all of its debt obligations (Stabile, 1998).

6 Extensions

Our model describes domestic creditors as favored. 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. We could extend our model to match this fact, without assuming that governments are more concerned for foreigners' welfare than for that of domestic residents. Below, we first sketch such an 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 on 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 (and, hence, as great a cost) as explcit repudiation of debt. Then, a government may be willing to use inflation to reduce the value of its indebtedness where it would be unwilling to default outright on its obligations.

Governments may nonetheless wish to issue domestic-currency-denominated debt 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 good 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).

Moreover, foreign buyers will also find purchasing domestic-currency-denominated debt preferable to purchasing debt denominated in the currency of the rest of the world. If the debt is denominated in foreign currency, then in the state in which foreigners highly value the domestic country's exports, because domestic currency is relatively valuable, foreigners will be repaid with only a small quantity of those exports. In the state in which foreign taste for the domestic good is unfavorable, because domestic currency is relatively worthless, foreigners will receive a large quantity of the good. Given that the rest of the world is risk neutral, it prefers to receive a constant quantity of the domestic good than to receive a quantity that covaries negatively with its taste for the good. (The ideal contract might provide foreigners with an amount of the good which covaries positively with their taste for the good, and hence the price of the good, but this contract might be difficult to write if governments could manipulate the price of the good, or if the good is difficult to describe *ex ante*.) 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), denomination in domestic currency poses a tradeoff between protection from exchange-rate risk and a temptation to inflate.

Our previous analysis 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.

7 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 the price of government debt will fall with the reduction in transaction costs. Our exposition of the model used nominal debt with inflationary default, but the argument holds with real debt and other default or renegotiation mechanisms as well. Indeed, in a generalized model of real debt with default through repudiation, we show that if disfavored creditors are less risk averse than favored creditors, there may be multiple equilibria in the market for government debt.

Our more general model also shows that the price of government debt may be nonmonotonic in the level of transaction costs. Even if we believe the transaction costs in international financial markets have been falling for some time, due to technological and policy changes, and that these reduced costs have not hurt sovereign debtors, the nonmonotonicity result implies that further reductions in costs need not be so innocuous.

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 incentives 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, then some amount of illiquidity in this asset can be optimal. In particular, governments may be tempted to expropriate the value of firms that have a large amount of foreign ownership. 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.

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