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Assessing new perspectives on country risk[1]

We examine in a unified framework three recent perspectives on country risk: debt intolerance, original sin, and currency mismatches. We find statistical evidence supporting aspects of all three, though the strength of that support varies considerably across hypotheses and a number of open questions remain. Our evidence is consistent with the view that good domestic macroeconomic and structural policies hold the key to addressing country risk.

JEL classification: F30, G15.

In recent years, new perspectives on country risk have gained prominence under the rubrics of "debt intolerance", "original sin" and "currency mismatches". Debt intolerance posits that the debt/country risk trade-offs are worse for countries with a history of economic mismanagement. Original sin argues that countries less able to borrow in their own currency should be intrinsically riskier. Currency mismatches maintain that countries whose net worth is more sensitive to exchange rate depreciations should suffer higher costs in the event of a crisis.

These views are distinct, though not mutually exclusive. At the same time, their implications have only begun to be tested systematically. This special feature takes a further step in that direction on the basis of a widely used measure of country risk, namely sovereign ratings by the major rating agencies.

We improve on extant tests of new perspectives on country risk in two ways. First, we employ a better "benchmark" model of ratings determinants: thus we are able to control better for the other factors that affect country risk so as to identify the additional contribution of debt intolerance, original sin and currency mismatches to credit quality. Second, we employ better data, which allows us to extend and improve measures of original sin and currency mismatches. In particular, we draw further on the banking, securities and derivatives statistics of the Bank for International Settlements (BIS).

To anticipate our results, we find support for the hypothesis that debt intolerance, original sin and currency mismatches are all relevant in explaining

[1] The views expressed in this article are those of the authors and do not necessarily reflect those of the BIS. We would like to thank Arturo Macias and Jhuvesh Sobrun for invaluable research assistance.

country risk, even after controlling for a wide array of other factors. By and large, variables identified with the corresponding perspectives are statistically significant predictors in ratings regressions. At the same time, the economic significance of these variables is in some cases more modest than suggested by previous research, and is less than that of a few of the more standard economic and structural variables. We also see our statistical results as supporting the view that sound *domestic* macroeconomic and structural policies hold the key to addressing country risk.

In the first section, we briefly discuss the selected perspectives on country risk. In the second, we lay out the framework used for testing the various hypotheses and contrast it with previous work. In the third, we present and discuss the empirical results. In the concluding section, we note some caveats and recommend areas for further research.

Three views of country risk

Debt intolerance

Debt intolerance stresses the impact of a history of economic mismanagement on debt capacity

"Debt intolerance", as introduced by Reinhart, Rogoff and Savastano (2003, hereafter RRS), refers to the inability of many emerging market economies to handle "overall debt levels that would seem quite manageable by the standards of the advanced industrial economies". RRS argue that the root cause of this reduced debt bearing capacity is a history of economic mismanagement. They pay particular attention to past episodes of very high inflation and actual defaults.

Why should history matter? A number of channels are possible. One is the inevitable inertia of institutions. It takes time to reform in a fundamental way. Under this interpretation, inflation history and past defaults should best be seen as symptoms of deeper institutional failings. Another is the fact that past crises may by themselves have long-lasting, debilitating effects on institutions. RRS note that they can weaken the financial system and undermine tax-raising capacity and long-term growth. Long memories on the part of investors, unwilling to concede the benefit of the doubt, could reinforce these objective channels: once bitten, twice shy. Finally, the high and highly sensitive borrowing costs associated with these various factors can, in turn, exacerbate vulnerabilities. RRS observe that, not surprisingly, because of inertia in these various weaknesses, countries that default tend to do so repeatedly, ie are "serial defaulters". They stress, however, that, over time, good policy should be able to overcome these shortcomings.

Original sin

Original sin stresses a country's inability to borrow abroad in its own currency

The term "original sin", by evoking the echoes of an event buried in the distant past, can superficially sound like "debt intolerance" to the uninitiated. In fact, it points to a different condition. The concept has evolved over time. The one we focus on here is "the inability of a country to borrow abroad in its own currency"

and, by extension, to hedge vis-à-vis non-residents[2, 3] (Eichengreen, Hausmann and Panizza (2003a, hereafter EHP)). Proponents of original sin argue that this condition heightens a country's vulnerability because it implies that exchange rate depreciations make it harder to service external debts. In turn, this reduces the willingness of non-residents to finance countries ex ante, makes that financing more sensitive to adverse economic conditions ex post, and limits policymakers' room for manoeuvre.

What can cause original sin? If original sin was caused by the same set of factors as debt intolerance, it would be just an additional symptom of past and current domestic institutional shortcomings. For instance, it is natural to think that a history of inflation and default could make foreign investors reluctant to hold debt, especially long-term debt, denominated in the currency of the borrower. In this case, the condition would reflect not so much an "original sin" as a "sin of a lifetime" (McCauley and Ho (2003)). Proponents, however, argue that original sin reflects primarily intrinsic characteristics of global financial markets and is, as such, largely beyond a country's own control or, at a minimum, that it would take considerably longer to address than other domestic structural shortcomings. In particular, EHP conjecture that, in the presence of transaction costs, diversification of global portfolios would not go beyond those few currencies that provide the highest diversification benefits, which they identify with those from the largest economies. Similarly, Flandreau and Sussman (2003) argue that original sin reflects a "secondary market liquidity premium" associated with all currencies but those of the largest economies. Historically, they stress, escaping original sin has required countries to emerge as leading economic powers.

Currency mismatches

Currency mismatches have often been confused with original sin, for good reason. A currency mismatch may be defined – as, for instance, most recently by Goldstein and Turner (2004, hereafter GT) – as "the sensitivity of net worth or of the present value of net income to changes in the exchange rate". If currency mismatches take the form of *net debt* positions in foreign currency, they can make countries vulnerable because large depreciations would make it harder for net borrowers to service foreign currency liabilities. Thus, currency mismatches are not intended to predict crisis; rather, they are seen as increasing the cost of a crisis in the event of a sudden large depreciation of the currency (ie they are a sort of "stress test").[4] At least since the Asian crisis, the

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[2] If foreigners are unwilling to hold claims in domestic currency, they should also be unwilling to be counterparts in hedging transactions with residents; see also Slavov (2003).

[3] An earlier version of the hypothesis covered the inability to borrow domestically long-term in domestic currency (Eichengreen and Hausmann (1999)). The considerable progress made by many emerging market countries in this area, however, has made it less interesting to test this version.

[4] For much the same reasons, one might also expect the vulnerability associated with the mismatches to be related to other structural factors of the economy.

potentially disruptive consequences of such balance sheet configurations have been widely recognised (eg Krugman (1999), FSF (2000)).

Since, according to original sin, it is primarily through net debt positions in foreign currency that the inability to borrow in domestic currency is expected to increase country risk, it is tempting to conclude that the two views are equivalent. In fact, there are at least two important differences between the two concepts. First, proponents of the currency mismatch hypothesis stress that there need be only a weak correlation between currency mismatches and the apparent inability to borrow abroad in domestic currency. Residents may accumulate assets, hedge or have (net) revenues denominated in foreign currency.[5] Second, the observation of limited borrowing in domestic currency may reflect unexploited possibilities due to distorted incentives for residents (eg the implicit guarantees associated with fixed, but ultimately unsustainable, exchange rate regimes) rather than unwillingness on the part of non-residents to provide such funding. Finally, and partly as a corollary, good domestic policies can largely overcome any residual inability to borrow or hedge and limit its unwelcome consequences. Flexible exchange rates and investments in the development of domestic currency bond markets and, more generally, of strong domestic institutions are cases in point. Many countries have followed this type of advice in recent years, strongly encouraged by the international community (eg FSF (2000), G7 (2003)).

Currency mismatches can have a low correlation with original sin measures

Testing views of country risk: the framework

The previous analysis suggests a straightforward way of testing the various views of country risk. First, choose a reliable measure of country risk. Then, see to what extent the various proxies of debt intolerance, original sin and currency mismatches help explain variations in that measure once a full set of possible determinants is included in the benchmark model of country risk. This will avoid the risk of finding spurious relationships between the proxies and the measure of country risk.

Extant work has so far fallen somewhat short of this description. For one, the measures of country risk have not been uniform, having included Institutional Investor ratings (RRS), S&P ratings (EHP) and actual crises (GT). In addition, the set of variables capturing other underlying determinants of country risk has been quite limited. For instance, RRS just include measures of historical mismanagement (high inflation and past defaults) together with debt, while EHP consider only a number of debt ratios, terms of trade and real

Past work has used a limited set of control variables

[5] Conceptually, there are two distinct sets of mismatches: (a) those involving a potential wealth transfer from residents to non-residents; and (b) those involving wealth transfers among residents. GT stress the importance of both, while at the same time recognising that some offsetting among residents can take place if public authorities draw on foreign exchange reserves to cushion adverse shocks. By contrast, EHP focus exclusively on the transfer vis-à-vis non-residents. In their empirical proxy for currency mismatches, GT have difficulties separating neatly the two sets of mismatches, given the data limitations.

exchange rate volatility.[6] Likewise, except for an initial attempt in EHP, the three basic hypotheses are not fully explored together.

In what follows, we seek to remedy these shortcomings. In the process, we also pay particular attention to the distinction between those factors that are amenable to domestic policy and those that are not.

The measure of country risk: credit ratings

Agency credit ratings are stable measures of country risk

As a measure of country risk, we rely on agency credit ratings. We do so for a number of reasons. First, although by their nature agency ratings are not necessarily the most accurate measures of the time variation in country risk, they provide a good benchmark with which to assess its cross-sectional distribution. In fact, two of the country risk hypotheses proposed – debt intolerance and original sin – relate more to this cross-sectional dimension, as time variation in the corresponding metrics is expected to be quite limited. Second, for current purposes, credit ratings are preferable to market spreads. Credit spreads are very volatile (influenced by extraneous factors such as time-varying appetite for risk) and available for too short a period. Third, credit ratings are still actively used by market participants as benchmarks for country risk assessments. Finally, using ratings facilitates comparisons with EHP and RRS as well as with previous work that has used ratings rather than ex post measures of risk, such as incidence of crises.[7] Of course, the disadvantage of using an ex ante measure of risk as opposed to an ex post one, such as crises themselves, is that the tests inevitably rely on the accuracy of the corresponding risk assessments (see below).

Among measures of ratings, for current purposes sovereign credit ratings of the major credit rating agencies are arguably superior to the country ratings published by Institutional Investor.[8] Institutional Investor ratings aggregate the

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[6] The methodologies also vary. In particular, RRS and EHP rely on formal econometric analysis. By contrast, partly because of lack of data, GT simply observe that, in a sample of large emerging market countries, those suffering financial crises have tended to have large negative values of a metric of currency mismatches in the run-up to and during the crises themselves.

[7] For example, see Cantor and Packer (1996), Ferri et al (1999), Jüttner and McCarthy (2003), Reisen (2003) and Moody's (2003b, 2004). In part because the rating of sovereign debt was a relatively late blooming area of the credit ratings industry, the use of the sovereign ratings of the major credit rating agencies to estimate country risk regressions dates back only to the mid-1990s. The original formulation of Cantor and Packer found that an OLS specification using only eight explanatory variables explained more than 90% of the cross-sectional variance in agency credit ratings for 49 countries. In particular, they found that per capita income, inflation, external debt, economic development, and default history were particularly strong predictors of foreign currency ratings.

[8] Clearly, since we are using sovereign credit ratings as a proxy for country risk, we are relying on a definition of country risk that focuses on the likelihood that the sovereign borrower will meet all of its debt obligations. The rating agencies also assign a general country ceiling that generally indicates the highest rating that is possible for all entities in that country; in practice, this ceiling is usually equivalent to the sovereign rating. Individual ratings that pierce the ceiling are possible, though unusual with the exception of structured finance (see Moody's (2001)). Country risk is often used more generally to refer to the likelihood of events changing business profits and asset valuations in a country. For an example of this sort of discussion of country risk, and evidence that it is priced in emerging market equity markets, see Erb et al (1996).

responses of major banks grading countries from 0 to 100 without specifying the underlying criteria. By contrast, the major agencies frequently publish lists of criteria that they considered when arriving at ratings. In addition, the agencies regularly review the correspondence of their ratings with default rates (eg Moody's (2003a)). And unlike the anonymous respondents to the survey, agencies stake their reputation on the accuracy of ratings assignments.

We rely on the average rating of Moody's and Standard & Poor's, rather than using a single rating, as in EHP. Research on the pricing of debt obligations suggests that bonds tend to be priced at the average of ratings when the ratings are split (Cantor et al (1997)).

Finally, we focus on foreign currency rather than local currency sovereign ratings. Local currency ratings are a relatively recent development and are not as widely available.[9] Table 1 lists the average rating through the estimation period for the countries included in the analysis.[10]

The benchmark model of country risk and the specific tests of debt intolerance, original sin and currency mismatches

A proper benchmark model of country ratings should consider a whole gamut of variables traditionally deemed relevant. The rating agencies themselves frequently provide guidance on the wide array of quantitative and qualitative factors they consider (eg Moody's (2004), Standard & Poor's (2004)). In Table 2, we list the more than 30 explanatory variables assessed in the regression analysis. For the most part, these variables reflect macroeconomic factors, including inflation and growth, the external debt burden, proxies for liquidity and the fiscal situation. In addition, they include measures that seek to capture deeper institutional factors, such as the corruption and political risk indices (eg Kaufmann et al (2003)). Generally, the expected relationship between these variables and country risk is straightforward and does not require elaboration. By contrast, a few words are called for when considering the specific hypotheses under examination.

We proxy for economic mismanagement using inflation and default history

Any test of the debt intolerance hypothesis should involve a test of the relevance of a history of mismanagement. Following RRS, we proxy this history through the percentage of years that a country has had inflation over 40% and through its default record. A strict interpretation of the hypothesis is that the impact of debt on county risk should be amplified by a bad default or inflation record *even after controlling for any independent impact of these variables on risk*. After all, the importance of a default history for ratings was already well established, conceptually and empirically, before the emergence of the debt intolerance hypothesis (Eaton (1996), Cantor and Packer (1996)). To test this strong version of the debt intolerance view, we follow RRS and include interactive variables which multiply our debt measures by the default and inflation record *in addition to* these two variables themselves.

[9] For a review of local currency sovereign ratings, see Kisselev and Packer (2004).

[10] In the regression analysis, ratings are recoded numerically with AAA (Aaa) equal to 17, AA+ (Aa1) equal to 16, and so on down to CCC+ (Caa1) equal to 1.

Foreign currency sovereign credit ratings

Average, 1996–2003

Country	Rating	Country	Rating	Country	Rating
Argentina	BB	Hong Kong SAR	A	Philippines	BB+
Australia	AA+	Hungary	BBB	Poland	BBB
Austria	AAA	Iceland	A+	Portugal	AA
Belgium	AA+	India	BB	Russia	BB–
Brazil	B+	Indonesia	BB	Singapore	AAA
Bulgaria	BB–	Ireland	AA+	Slovenia	A
Canada	AA+	Israel	A–	South Africa	BBB–
Chile	A–	Italy	AA	Spain	AA+
China	BBB	Japan	AA	Sweden	AA+
Colombia	BB+	Korea	A–	Switzerland	AAA
Croatia	BBB–	Lithuania	BBB	Taiwan, China	AA
Cyprus	A+	Malaysia	BBB+	Thailand	BBB
Czech Rep	A–	Mexico	BB+	Turkey	B
Denmark	AAA	Netherlands	AAA	United Kingdom	AAA
Finland	AA+	New Zealand	AA+	United States	AAA
France	AAA	Norway	AAA	Venezuela	B
Germany	AAA	Pakistan	B		
Greece	A–	Peru	BB–		

Note: Average of end-year mean foreign currency ratings of Moody's and Standard & Poor's. Ratings shown correspond to the notation used by Standard & Poor's. Ratings of countries less than CCC not included in sample. Not all countries have ratings for all years.

Sources: Moody's Investors Service; Standard & Poor's. Table 1

Should external or public sector debt be the relevant concept? In principle, external debt seems to be the most appropriate variable, as the main interest in debt intolerance is with external defaults. At the same time, in increasingly globalised markets, with large cross-border investments, the distinction between internal and external defaults is becoming harder to draw in practice. RRS themselves consider both variables, depending on the countries under examination. In what follows, we include the two separately for all countries, as EHP do.

Testing for the specific contribution of original sin and currency mismatches raises trickier issues. They relate to measurement and interpretation. We next consider these in turn.

Serious measurement problems arise with respect to both hypotheses. The reason is that statistics on the foreign exchange configuration of both on- and off-balance sheet exposures are extremely limited. For example, EHP use a range of measures of original sin based exclusively on the share of foreign exchange debt in subsets of on-balance sheet liabilities, drawing on BIS statistics (see the box on page 56). They exclude, in particular, all derivatives positions and hence hedging possibilities. The problems are even more severe for measures of currency mismatches, which necessarily call for more information about the nature and distribution of currency risk. GT develop some admittedly crude estimates, but are conscious of their shortcomings.

Explanatory variables

Categories	Variables	Unit	Source
Macroeconomic	Log per capita GDP[1]	$	
	Log inflation[1]	%	
	Real GDP growth (year on year)[1]	%	IIF, IMF, IFS,
	Investment/GDP	%	DRI, EIU
	Saving/GDP	%	
	Current account/GDP	%	
Debt burden	Net debt/GDP	%	
	External debt/exports[1]	%	
	Short-term external debt/FX reserves	%	IIF, IMF, IFS,
	Short-term external debt/total external debt	%	DRI, EIU
	Short-term external debt/GDP	%	
	FX reserves/imports	%	
Government finance	Public debt/GDP[1]	%	IIF, IMF, IFS,
	Fiscal balance/GDP	%	DRI, EIU
Political, socio-economic variables	Corruption[1, 2]	1–10 scale	TI
	Political risk[1, 2]	1–100 scale	ICRG
	Central bank independence	0–1 scale	CS
History	Dummy = 0 if no default in past 25 years	0,1 indicator	S&P
	Years since foreign currency default[1]	Years	S&P
	Percentage time over 40% inflation in past 25 years[1]	%	IFS
Size	Log real GDP	$ (constant)	IFS
	Log real GDP (PPP terms)[1]	$	WB
Financial development	Domestic credit to private sector/GDP	%	IFS
	Market capitalisation of stock market/GDP	%	DS, JPM
	Credit plus stock market capitalisation/GDP	%	DS, JPM
	FX derivatives turnover/GDP	%	BIS
	FX spot and derivatives turnover/GDP[1]	%	BIS
Original sin and mismatch variables	OSIN2, OSIN3 (see text for definitions)[1]		
	MISMATCH (see text for definition)[1]	%	BIS
	AECM (see text for definition)		

[1] Variable used in the final specification. [2] To facilitate interpretation of the regression coefficients, the indices of corruption and political risk from TI and ICRG, in which higher values correspond to lower corruption and lower political risk, have been multiplied by minus one.

Sources: BIS = Bank for International Settlements; CS = Cukierman et al (2002) and Syklos (2003); DRI = Data Resources Institute; DS = Datastream; EIU = Economic Intelligence Unit; ICRG = *International Country Risk Guide*; IFS = *International Financial Statistics* (IMF); IIF = Institute for International Finance; IMF = International Monetary Fund; JPM = JPMorgan Chase; S&P = Standard & Poor's; TI = Transparency International; WB = World Bank. Table 2

We improve on previous tests in two respects here. For one, we add explicitly various proxies for hedging possibilities based on the BIS foreign exchange and derivatives statistics. In particular, we assess the relevance of currency swaps and forwards as well as of the size of the overall FX market. We conjecture that they could matter on their own and/or modify the relevance of on-balance sheet proxies of original sin. In addition, we simply extend the GT measure of currency mismatches well beyond their sample of countries, from 22 to 52. As an additional check, we also follow EHP in creating a proxy

We use proxies for hedging possibilities from BIS data

measure for currency mismatches which can be derived for a much broader sample of countries, if required (see box).

One question of interpretation concerns the *channel* through which original sin is expected to work. Arguably, if original sin did not induce net debt positions in foreign currency (in this sense, "currency mismatches"), it would have limited impact on country risk. The exception, stressed by EHP, would be through any indirect costs incurred by the country in order to limit, hedge or offset currency exposures (lower returns on investments, any capital controls, etc). Thus, a finding that original sin mattered even in the presence of a proxy for currency mismatches would call for an empirical analysis of the link between original sin and those omitted costs. It might also point to the possibility of mismeasurement in the currency mismatch variable. In this article, however, we will not pursue these issues further.

A second set of questions of interpretation concerns the potential *causes* of original sin.

How far is original sin affected by a history of mismanagement?

First, it is worth considering how far original sin is explained, respectively, by country size or by proxies for a history of mismanagement and other institutional characteristics. This matters because of the different policy implications. Likewise, it is useful to explore how far original sin retains independent explanatory power for country risk once the influences of those policy-related factors on original sin are taken into account. This can be done by evaluating separately the impact on country risk of the part of original sin "explained" by the various factors and that of its residual unexplained component.[11]

Country size may have an independent impact on country risk

Second, the role of size merits particular attention, since neither of the two explanations provided to explain the link between country size and original sin seems fully satisfactory. For one, large countries may indeed be more diversified, but this does not imply that these diversification benefits are transferred to the respective currencies. Currency diversification depends on correlations *across* currencies as an asset class, and there is little reason to expect these correlations to be more than weakly related to diversification of income streams *within* given countries. Moreover, investors eagerly diversify across stock markets in emerging market countries on an unhedged basis. Likewise, borrowing heavily in a few currencies to exploit the liquidity of the respective underlying securities markets does not imply that hedging the corresponding exposures is impossible. Indeed, borrowing on a hedged basis is a very common strategy to reduce all-in borrowing costs. Thus, separate evidence of limited hedging possibilities is required to establish the relevance of original sin. Both of these arguments suggest that it may be worth considering country size as a potential determinant of country risk *in its own right*. Besides capturing diversification opportunities, a larger size could make a country less vulnerable to abrupt but small adjustments in global investors' portfolios and, in some cases, more likely to receive external support from the international community in the event of a crisis.

[11] This is done by including in the main regression only the residual of an auxiliary regression of original sin on the relevant explanatory variables, alongside those variables.

Measures of original sin and currency mismatch

We follow Eichengreen et al (2003b) in creating multiple measures of original sin using the international banking and securities data of the BIS. All the measures seek to quantify the ratio of debt issued in foreign currencies relative to the total outstanding. They differ, however, in terms of the aggregates considered and the assumptions made. Three measures are considered:

(1) OSIN1 = (1 – securities issued by country *i* in national currency *i* / securities issued by country *i*)

(2) OSIN2 = Max (securities and loans issued by country *i* in five major currencies / all securities and loans issued by country *i*, OSIN3)

(3) OSIN3 = Max (1 – (securities in currency *i* / securities issued by country *i*), 0)

As a "true" measure of original sin, each metric has its flaws owing to data limitations. For instance, while OSIN2 includes bank debt, OSIN1 and OSIN3 only cover securities. OSIN3 differs from OSIN1 because all debt issued in a country's currency is counted as local currency issuance regardless of the nationality of the issuer. This generally results in lower values for OSIN3 than OSIN1.[①] The strong point of OSIN2 is that it utilises not only the securities data, but also the international banking data of the BIS. However, because the banking data are not reported in all currencies, measures must implicitly rely on the assumption that all liabilities not denominated in the five major currencies are denominated in the local currency. Thus, to the extent that there are foreign currency liabilities in currencies other than the dollar, euro, yen, pound sterling and Swiss franc, they are counted as local currency denominated, which would tend to understate original sin.

For currency mismatches, we use the aggregate effective mismatch measures created by GT, in both their original and modified versions. GT calculate the original aggregate effective currency mismatches (AECM) proxy as follows. First, they calculate net foreign currency assets (NFCA) as the sum of the net foreign assets at central banks and banks plus the foreign currency (net) assets of non-banks held with BIS banks minus the international debt securities outstanding denominated in foreign currency. Then the foreign currency share of total debt (FC%TD) is calculated where the denominator is cross-border liabilities of non-banks and banks (to BIS banks) plus domestic credit to private entities plus international and domestic debt securities. AECM then equals NFCA times FC%TD divided by exports if net foreign currency assets are less than zero, and NFCA*FC%TD divided by imports if net foreign currency assets are greater than zero.[②] We also try an EHP measure of mismatches that multiplies original sin (in the results below, we use OSIN2) by (reserves – debt) / exports. They justify the measure as the one which is closest to GT's AECM based on the available data.

[①] For example, South Africa, which boasts significant issuance in its local currency by international organisations, has a much lower value of OSIN3 than OSIN1. EHP favour OSIN3 over OSIN1 since they posit that a country's ability to issue in its own currency should increase with the local currency issuance of non-nationals because of increased swaps and hedging possibilities. However, since the existence of underlying local currency bond obligations is not a necessary condition for parties to enter into currency swaps, it is not obvious that this more expansive measure of local currency activity should improve predictive ability. [②] The original version assumes that domestic credit and domestic bonds are all in domestic currency, but adjustments are made on a case by case basis to arrive at a modified AECM. See the authors' work for a discussion of some of the inevitable approximations and assumptions needed to calculate the proxy.

Original sin may be a consequence of a high country risk

Finally, it is worth considering the possibility that original sin may not be the cause, but rather the *consequence,* of country risk. In other words, countries may be unable to borrow in foreign currency *because* they are

perceived to be too risky, for whatever reason. This is consistent with the observation that international organisations, such as the World Bank, can in fact borrow in emerging market currencies.[12] It also squares with the fact that non-residents would tend to hedge only with highly creditworthy counterparties, normally market-making institutions. If such reverse causation was present, any explanatory power for country risk of the unexplained component of original sin as described above could be regarded as spurious, or at least viewed with some suspicion.[13]

Empirical results[14]

Our sample comprises 52 countries for which we have collected annual data from 1996 to 2003. We use panel data to exploit the information contained in the time variation and cross-sectional variation in the data. As a preliminary step, we report a correlation matrix of ratings and selected explanatory variables (Table 3). Country credit ratings are strongly correlated with a number of our explanatory variables, notably with per capita GDP (rho = 0.86), the corruption and political risk indices (–0.85 and –0.87, respectively), as well as years since default and inflation history (0.69 and –0.62). The original sin measures are also strongly correlated with country credit ratings. By contrast, the currency mismatch measures appear to have relatively little correlation with ratings, though the table does show that countries with higher measures of original sin tend to have negative mismatch.

The benchmark model: what matters?

Ratings are most sensitive to per capita GDP, political risk, and corruption

The benchmark model of ratings, which excludes the variables related directly to the debt intolerance, original sin and currency mismatch hypotheses, performs rather well (Table 4, regression 1). Measures of development (per capita GDP) and macroeconomic performance (inflation and GDP growth) have the expected sign and are statistically significant at standard confidence levels.[15] The qualitative variables proxying for political risk and corruption are

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[12] Eichengreen et al (2003c) actually use this observation to back up their claim of imperfections in global financial markets. They note that the fact that international financial institutions are able to hedge at a profit reflects underlying pent-up hedging demand by the residents of the country of the currency of issue. But the alternative explanation seems at least equally plausible.

[13] This is an instance of "simultaneity" bias. In principle, original sin could be instrumented with some other variable. However, we had difficulties thinking of variables that could be useful instruments while at the same time not being expected to have an independent influence on country risk. Further work could try to address this issue.

[14] For a further elaboration on a full set of results, see Borio and Packer (forthcoming). To check whether the fact that ratings are capped at AAA for highly rated countries might be affecting the results, we also estimated a censored tobit model. This, however, did not materially influence the findings. In addition, the key regressions were tested also with an additive dummy for the group of industrial countries. The dummy was not statistically significant and the results were not affected.

[15] We also tried foreign exchange reserves, normalised by imports, but this variable did not perform well.

Correlation matrix of selected variables					
	Variable				
	Foreign currency rating	OSIN2	OSIN3	AECM	MISMATCH
Log per capita GDP	0.861	–0.536	–0.516	–0.177	–0.233
Log inflation	–0.609	0.307	0.335	0.061	0.001
GDP growth	0.024	0.146	0.172	–0.159	0.006
Corruption perceptions index	–0.849	0.387	0.405	0.217	0.266
Political risk score	–0.866	0.501	0.532	0.218	0.191
Years since foreign currency default	0.685	–0.433	–0.408	–0.148	–0.040
Frequency of high inflation periods	–0.616	0.385	0.429	–0.089	–0.147
Foreign currency rating		–0.617	–0.620	–0.108	–0.049
OSIN2			0.854	–0.065	–0.276
OSIN3				–0.115	–0.328
AECM					0.732

Sources: IMF; World Bank; Transparency International; *International Country Risk Guide*; EIU; Datastream; Standard & Poor's. Table 3

also highly statistically significant, as are the historical variables of time since default and inflation history. In terms of economic significance, ratings appear to be most sensitive to per capita GDP, followed by political risk and corruption. Holding other variables constant, an "improvement" in the explanatory variable from the 25th to the 75th percentile results in an improvement in the average credit rating of 2.9, 1.7 and 1.4 notches for per capita GDP, political risk, and corruption, respectively. Similar improvements in the inflation history and default variables add 1 and 0.6 notches to the forecast credit rating.

Debt intolerance

Varying support for debt intolerance

The findings concerning debt intolerance depend on the precise interpretation of the hypothesis (Table 4, regressions 2–3). On the one hand, the previous results clearly show that a history of economic mismanagement does affect credit standing *generally*. Likewise, and importantly, public and external debt do matter more for emerging market countries than for industrial countries: in this sense, emerging market countries find it harder to sustain high levels of debt.[16] Correspondingly, debt variables are statistically significant and have the right sign only for emerging market countries, as indicated by the

[16] Moreover, this result indicates that there are other factors, not included in the regression, that would have to explain this difference.

coefficient on the interactive dummy for this group of countries.[17, 18] On the other hand, the strong version of the hypothesis is not generally supported by the data. Specifically, the dummies interacting debt with history do not systematically add explanatory power to the regression.[19] In other words, a history of mismanagement does not appear to make country risk more sensitive to debt *per se.*

Original sin and currency mismatches

Proxies for original sin are found to contribute to explaining country risk ratings, even after controlling for the above factors (Table 4, regression 5). The best performing proxy is the one that considers the composition of bank debt and securities together (OSIN2).[20] Taken at face value, the estimates indicate that holding other variables constant, a country going from having all to none of its external debt denominated in foreign currency would have its rating upgraded by slightly less than one whole letter grade (three notches). This is less than the five notches sometimes found in previous work (EHP, Eichengreen et al (2003b)).

Importance of original sin is reduced by inclusion of size ...

At the same time, the inclusion of country size in the regression results in a further decline in the importance of original sin (Table 4, regression 6). The corresponding coefficient falls to two notches. Country size, measured in the best fitting model by GDP in purchasing power parity terms, is modestly significant in an economic sense: an increase from the 25th to the 75th sample percentiles in size, holding other variables constant, would increase the rating by around one third of a rating notch.

Currency mismatches, too, appear to have explanatory power in addition to the previous variables. This is true regardless of whether they are measured by the GT metric or the EHP proxy (Table 4, regressions 7–8). For instance, the results suggest that an improvement from the 25th to the 75th percentile in the currency mismatch proxies leads to improvements in country ratings of 0.1 and 0.5 notches, respectively.

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[17] Of course, more generally *even if the sensitivity of ratings to debt was similar to that of industrial countries* (similar coefficient in the regression), emerging market countries would exhibit a *lower* debt capacity. This reflects the fact that they tend to have a lower per capita income, a worse history of economic mismanagement and greater structural domestic weaknesses. In this general sense, they would also be "intolerant to debt".

[18] Although in some of the next regressions these interactive group dummies for government and external debt may be individually statistically insignificant, they are always jointly significant.

[19] These results also hold if two completely separate regressions are estimated for industrial and emerging market countries, thereby not forcing all differences between the two to operate through the interactive dummies.

[20] The substitution of either OSIN1 or OSIN3 for OSIN2 reduced the explanatory power of the overall model and the size of the coefficients on the corresponding variables, although they remained statistically significant. At the same time, the overall pattern of the results did not change. In the remainder of the paper, we limit our analysis to the OSIN2 metric.

Foreign currency sovereign ratings regressions

Explanatory variable	Specification								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log per capita GDP	1.49* (10.35)	1.40* (9.74)	1.25* (8.63)	1.29* (9.31)	1.33* (9.59)	1.31* (9.54)	1.45* (10.41)	1.45* (10.53)	1.31* (9.56)
Log inflation	–0.48* (5.31)	–0.49* (5.64)	–0.52* (5.38)	–0.50* (6.02)	–0.47* (5.66)	–0.45* (5.48)	–0.42* (5.06)	–0.42* (5.14)	–0.44* (5.32)
GDP growth	0.06* (2.01)	0.07* (2.33)	0.08* (2.46)	0.09* (3.01)	0.08* (2.83)	0.09* (3.10)	0.08* (2.95)	0.08* (2.98)	0.10* (3.14)
Corruption perceptions index	–0.31* (4.85)	–0.34* (5.33)	–0.36* (5.84)	–0.44* (6.79)	–0.45* (7.14)	–0.45* (7.35)	–0.46* (7.46)	–0.44* (7.11)	–0.47* (7.38)
Political risk score	–0.10* (7.92)	–0.07* (4.59)	–0.07* (4.45)	–0.06* (4.07)	–0.06* (4.49)	–0.07* (4.86)	–0.07* (4.91)	–0.07* (4.92)	–0.08* (5.90)
Years since foreign currency default	0.05* (4.66)	0.03* (3.22)	0.01 (0.70)	0.03* (3.17)	0.03* (2.97)	0.04* (3.36)	0.03* (3.10)	0.04* (3.36)	0.04* (3.54)
Frequency of high-inflation periods	–5.76* (11.82)	–4.81* 7.49)	–7.70* (5.18)	–4.33* (7.20)	–4.31* (7.32)	–4.11* (6.96)	–4.44* (7.36)	–4.25* (6.99)	–4.48* (7.58)
Public debt/GDP		0.005 (1.68)	0.006 (1.62)	–0.004 (1.03)	–0.004 (1.07)	–0.002 (0.54)	–0.000 (0.05)	0.000 (0.26)	–0.002 (0.61)
External debt/exports		0.001* (4.00)	0.002* (4.27)	0.000 (1.16)	–0.000 (0.11)	0.000 (0.90)	0.001* (2.07)	0.000 (0.43)	0.000 (1.11)
Public debt/GDP (developing countries)		–0.012* (3.04)	–0.050* (2.52)	–0.002 (0.55)	–0.003 (0.75)	–0.006 (1.30)	–0.009 (1.88)	–0.010* (2.40)	–0.006 (1.42)
External debt/exports (developing countries)		–0.004* (2.48)	–0.003 (0.48)	–0.003* (2.26)	–0.003 (1.91)	–0.003 (1.93)	–0.002 (1.07)	–0.000 (0.34)	–0.003 (1.89)
PubDebt/GDP* years since default			0.001 (1.83)						
ExtDebt/GDP* years since default			–0.000 (0.22)						
PubDebt/GDP* high inf			0.051 (1.79)						
ExtDebt/GDP* high inf			–0.000 (0.02)						
OSIN2				–2.43* (6.10)	–1.98* (5.24)	–1.64* (4.25)	–0.72 (1.62)	–1.11* (2.52)	–1.66* (4.36)
Size (log GDP)_					0.18* (3.58)	0.17* (3.61)	0.16* (3.39)	0.10* (2.05)	0.18* (3.68)
AECM						0.01* (2.85)			0.01* (3.01)
MISMATCH							0.57* (5.20)	0.70* (6.80))	
MISMATCH* {(FX spot and derivatives)/GDP}								–0.07* (5.70)	
Adjusted R-squared	0.922	0.941	0.943	0.948	0.950	0.951	0.953	0.954	0.951

Note: The dependent variable is defined as the average credit rating of Moody's and Standard & Poor's (which takes the numerical form as described on page 52). Year dummy variables are included in the regressions but the coefficients are not reported. Absolute T-statistic in parentheses, based on White heteroskedasticity-consistent standard errors. * = significant at least at the 5% level. Regression 9 is estimated with the same variables as regression 6, except for the substitution of the forecast error from regression 4 in Table 5 for OSIN2. The interactive debt variables in regression 3 are calculated for developing countries only, and are zero otherwise. AECM and MISMATCH are defined so that positive values are associated with net asset positions in foreign currency.

Sources: IMF; World Bank; Transparency International; *International Country Risk Guide*; EIU; Datastream; Standard & Poor's.

Table 4

... and currency mismatches

In addition, the inclusion of the proxies for currency mismatches also takes away part of the explanatory power from the original sin variables. In fact, when the EHP mismatch measure is included, the coefficient on OSIN2 falls to less than one notch and is no longer significant at the standard confidence levels.[21]

Hedging may influence the impact of mismatch proxies

Measures of hedging possibilities do not alter this picture much. For instance, interacting original sin with total FX and derivatives transactions in a currency (standardised by GDP) does appear to reduce the influence of original sin, but the finding is not statistically significant (not shown). At the same time, the proxy for hedging opportunities seems to complement the effect of one mismatch variable, as reported in regression 8 of Table 4. These results suggest that measures of off-balance sheet hedging should be refined further.

Structural weakness matters more than country size

What about the determinants of original sin? Interestingly, there is evidence that both history of mismanagement and other proxies for structural weaknesses (the political risk index) have an explanatory power that exceeds that of size itself (Table 5). On their own, the two sets of more policy-related variables account for over 20% of the sample variation in OSIN2 and, together, for around one third.[22] By contrast, size explains some 13%. This result is consistent with the view that original sin may be significantly affected by bad

Original sin regressions

Explanatory variable	Specification					
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	2.44* (17.13)	1.09* (24.69)	2.17* (15.61)	1.93* (18.81)	1.35* (19.88)	2.72* (19.24)
Corruption perceptions index	–0.02* (2.45)		–0.03* (3.56)			–0.01 (1.22)
Political risk score	0.03* (9.45)		0.02* (9.01)	0.02* (10.32)		0.02* (8.71)
Years since foreign currency default		–0.01* (6.86)	–0.00 (1.29)	–0.00 (0.93)		–0.00 (0.60)
Frequency of high-inflation periods		0.68* (6.27)	0.62* (5.30)	0.61* (5.35)		0.43* (5.01)
Size (log GDP)_					–0.09* (6.98)	–0.10* (10.56)
Adjusted R-squared	0.267	0.220	0.336	0.313	0.131	0.494

Note: Estimated by tobit (censored normal) regressions. Absolute z-statistic in parentheses, based on Huber-White standard errors and covariance. * = significant at the 5% level.

Sources: IMF; World Bank; Transparency International; *International Country Risk Guide*; EIU; Datastream; Standard & Poor's. Table 5

[21] We did not test more finely for the possibility that the influence of currency mismatches could be dependent on other characteristics of the country concerned (eg the credibility of a pegged exchange rate regime). This is left to further work.

[22] The corruption index, however, has the wrong sign (regressions 1 and 3). This is why regression 4 and subsequent analysis will exclude it.

past domestic policies and, as a corollary, that sound policies can help overcome it.[23]

Based on these purely statistical results, what is the explanatory power of original sin for country risk that is truly independent of the previous policy-related variables? As noted, this can be tested by including the unexplained residual of an auxiliary regression of OSIN2 on the variables of interest in the original regression for country risk alongside these variables. By implication, the coefficients on high-inflation history, political risk and corruption increase markedly. Meanwhile, the coefficient on original sin implies that a move from the 25% to the 75% percentile in the forecast error now yields less than a 0.2 notch impact on the country credit rating, versus a much larger impact in the original specification.[24]

Conclusion

On the basis of their ability to explain sovereign ratings, in this article we have found evidence supporting a number of perspectives on country risk that have recently come to prominence – debt intolerance, original sin and currency mismatches. At the same time, a number of qualifications on the strength of that support and open questions remain.

First, traditional economic and structural determinants still account for the lion's share in variation in country risk as measured by sovereign credit ratings. These include, in particular, per capita GDP, measures of corruption and political risk, and proxies for a history of economic mismanagement.

Second, there is evidence for debt intolerance, although it depends on the precise interpretation of the hypothesis. Debt does matter more for the ratings of emerging market countries than for their industrial counterparts. And, as noted, a history of mismanagement, approximated by past defaults and episodes of very high inflation, does affect ratings considerably. Overall, emerging market countries do exhibit a lower debt capacity. But a history of mismanagement does not appear to influence systematically the sensitivity of country risk measures to debt levels.

Third, proxies for original sin appear to matter for country risk, although their relevance emerges as noticeably smaller than in previous econometric research. Moreover, there is evidence that the ability to obtain foreign funding in domestic currency is significantly affected by a history of mismanagement and by socio-economic structural weaknesses, as proxied by past episodes of high inflation and political risk, rather than by country size alone. This purely statistical finding is consistent with the view that original sin can be influenced by good domestic policies. It is also consistent with the progress made by

[23] This qualifies the results by EHP and Eichengreen et al (2003b), which do not test for the relationship between original sin and the proxies for economic mismanagement and structural weaknesses employed here. At the same time, their "size" variable is also defined differently, so that the results are not fully comparable at this stage.

[24] The actual size of the coefficient changes only marginally, but since the variation in the independent variable is much smaller (the residual of the auxiliary regression rather than OSIN2 itself), so is the relevance of this variable in explaining the variation in country risk.

individual countries in developing domestic bond markets and hedging opportunities, through a mixture of sound macroeconomic and structural policies.

Fourth, explicit proxies for currency mismatches do matter and they tend to reduce the explanatory power of original sin proxies. At the same time, variables designed to capture hedging possibilities play only a marginal role. These results leave a puzzle unanswered. If, as noted, the main influence of original sin on countries' vulnerabilities operates through balance sheet mismatches, why do proxies for original sin often remain relevant even once measures of mismatches are included in the analysis? A number of possible explanations could be suggested (see eg EHP). However, we suspect that the difficulties faced in measuring mismatches correctly owing to data limitations can play a significant role.

These results suggest that a number of issues deserve further attention. These include, in particular, the range of factors that affect the residual apparent differences in country risk assessments as between the loosely grouped industrial and emerging market countries and the determinants of the extent of foreign financing in domestic currency. In the absence of the development of better statistics on foreign exchange exposures, however, the answers to some of these questions may remain elusive.

A further important caveat to our analysis is that it applies only to risk assessments rather than to ex post measures of risk, such as crises. Variables that help to explain credit ratings need not be good ex ante predictors of crises. In fact, to some extent, financial crises are more likely to occur when market monitors such as rating agencies underweight or mismeasure factors that turn out to be important ex post. For instance, it is possible that rating agencies may have misjudged the importance of currency mismatches and/or had inadequate estimates of currency mismatches prior to financial crises during the sample period.[25] But these issues, too, are better left to future research.

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[25] For a recent analysis based on ex post measures, see Manasse et al (2003).

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