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Default risk, sectoral reallocation, and persistent recessions[☆]

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ABSTRACT

Sovereign debt crises are associated with large and persistent declines in economic activity, disproportionately so for nontradable sectors. This paper documents this pattern using Spanish data and builds a two-sector, dynamic quantitative model of sovereign default with capital accumulation. Recessions are very persistent in the model and more pronounced for nontraded sectors because of default risk. An adverse domestic shock increases the likelihood of default, limits capital inflows, and thus restricts the ability of the economy to exploit investment opportunities. The economy responds by reducing investment and reallocating capital toward the traded sector to support debt service payments. The real exchange rate depreciates, a reflection of the scarcity of traded goods. We find that these mechanisms are quantitatively important for rationalizing the experience of Spain during the recent debt crisis.

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1. Introduction

During the recent sovereign debt crisis in Europe, many countries experienced a large and persistent decline in output. As previously documented for emerging markets crises, the decline in production was more pronounced in less traded sectors. Using industry-level data from Spain, we document large differential output performance across sectors, with less traded sectors experiencing much larger declines in output. We build a two-sector dynamic model of sovereign default risk, and capital accumulation that rationalizes both the large and persistent decline in aggregate output as well as the relatively sharper drop for nontradables during a sovereign debt crisis.

The main mechanism in our model that replicates the dynamics of sectoral and aggregate output during the crisis is the rise in sovereign default risk. Default risk amplifies and prolongs the recession, especially for the nontraded sector. Low aggregate shocks increase default risk and tighten international financial conditions by increasing interest rate spreads. In response to these shocks, investment is greatly reduced, not only because of the low productivity but also to smooth the decline in tradable consumption. Tradable production, however, decreases less than nontradable production because the economy reallocates inputs toward the traded sector to support external debt repayment at higher interest rate spreads. The decline in investment has persistent adverse effects on financial conditions, slowing the recovery. The real exchange rates depreciates as a reflection of the scarcity of traded goods.

Using two-digit sectoral data for Spain, we document sizable and robust differential performance across sectors during the debt crisis, correlated with *tradedness*. Using input-output tables, we define a continuous measure for tradedness as the ratio of exports to total output. The variation in tradedness across sectors is large, ranging from 0% to 50%, that is, anything from no exports to over half of the production being exported. We find that the output decline from the peak of 2007 to the trough of 2013 is larger for sectors that are less traded. Within manufacturing, the peak-to-trough decline is about 30% for sectors with zero tradedness and about 0% for those with

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50% tradedness. We also find that the comovement of annual growth rates with the sovereign bond spread, a measure of the severity of the debt crisis, varies with tradedness. We find that a 1% increase in the bond spread is associated with an average decline of 3% in the annual growth rate for sectors with zero tradedness and actually an increase in annual growth of about 1.5% for sectors with 50% tradedness.

We build a dynamic, small open economy model with capital accumulation and two sectors producing tradable and nontradable goods. International debt is unenforceable, and the economy can default on its debt. The interest rate on debt carries an interest rate spread that compensates for endogenous default risk. Consumption and investment are produced with a bundle of traded and nontraded goods, and the international debt is denominated in tradable goods. Aggregate capital accumulates over time as a result of investment decisions and is allocated across sectors such that the marginal product of capital is equalized. The economy is subject to aggregate productivity shocks that affect both sectors symmetrically.

In this framework, default risk restricts capital inflows and limits the ability of the economy to smooth consumption and effectively exploit productive domestic investment opportunities. The degree to which the country is indebted matters for investment and consumption as well as for the allocation of inputs across sectors. High indebtedness leads to declines in investment since tight financial conditions arising from default risk, which are more binding in high-debt states, lead the economy to shift resources away from investment and toward consumption. Consumption also falls despite this shift simply because more output is needed to service a larger debt level. In high-debt states, the allocation of inputs is also tilted toward the traded sector to support debt repayment.

We analyze the impulse response functions to declines in productivity that affect both sectors equally. A decline in aggregate productivity of 0.5% results in an increase in bond spreads of about 0.3% and a decline in aggregate output of about 0.7%. The decline in aggregate output is very persistent. By period 15 after impact, the shock has largely recovered, yet aggregate output continues to be about 0.4% below trend. The responses are markedly different across sectors. Nontraded production falls by more than 1% on impact, whereas traded production is almost unchanged. The decline in tradable consumption, however, is more than twice the decline in nontradable consumption, leading to a real exchange rate depreciation.

The impulse response functions are driven by the path of productivity and the endogenous amplification from financial frictions that arise from default risk. These financial frictions are themselves embedded in the level of interest rate spreads as well as the sensitivity of the bond price function to borrowing and capital. To decompose these impulse responses into these forces, we compare them against two parameterizations of a standard two-sector reference model without default risk. In the first reference model, *no-default-frictionless*, financial markets are nearly frictionless and interest rate fluctuations are essentially null. In the second reference model, *no-default-spread*, interest rate spreads fluctuate exogenously with productivity, with low productivity leading to high interest rate spreads, yet these rates do not respond to borrowing or capital choices. The impulse responses in these reference models are quite different from those in the benchmark default model. In both models, the decline in aggregate output is more muted, and output recovers rapidly after the shock. In terms of the sectoral responses, in the no-default-frictionless model, traded production declines more than nontraded production in contrast to the benchmark model. In the no-default-spread model, however, traded production declines less than nontraded production as in the benchmark.

The larger traded production decline in the no-default-frictionless model arises because here the economy can borrow more at low interest rates to smooth consumption when it experiences low shocks. Well-functioning financial markets in this reference model leads the economy to use international borrowing for smoothing traded consumption, allowing reallocation toward nontraded production to smooth nontraded consumption. This model also features a real exchange rate appreciation in contrast with the depreciation of the benchmark default model.

We conduct an event analysis and compare our model implications directly to Spanish data. We focus on the peak-to-trough performance from 2007 to 2013. We feed in the sequence of shocks such that the model replicates the 9.6% decline in aggregate output observed in Spain. We then compare the implications of the model against the data for interest rate spreads, sectoral output, and real exchange rates. We find that the model predicts an increase in spreads of 3%, close to the 2.7% value observed in the data. The model predicts declines of 10% and 6.8% for nontraded and traded sectors, respectively, very close to the data counterparts of 10% and 6.4%. The model also predicts, as in the data, a real exchange rate depreciation. The magnitude of the average depreciation of 2.4% in the model is, however, higher than the 1.1% observed in the data.

We also perform the event analysis in the two no-default reference models. As in the impulse responses, the decline in GDP in these reference models is more muted, with GDP reclining about 18% less than in the benchmark model. The sectoral responses differ across the reference models. The no-default-frictionless model predicts a 2.7% larger contraction of tradable production relative to nontraded production, while the no-default-spread model predicts a 3.6% larger contraction of nontradable production which is comparable to the benchmark. This comparison suggests that the amplification in aggregate GDP in the benchmark model with default risk arises largely from the sensitivity of the bond price function to borrowing and capital, while the differential sectoral effects arise from the higher level of interest rate spreads.

We also use our model to forecast the persistence of the recession for Spain. We extend the event such that the shocks in the model after 2013 recover following their Markov chains. We find that our model predicts a very slow recovery. By 2040, our model predicts that aggregate output will have closed only half of the gap from trend.

Finally, we consider the predictions of our model for financial shocks, introduced directly as exogenous interest rate spreads fluctuations, in rationalizing the Spanish crisis. We find that financial shocks can rationalize a large portion of the differential sectoral effects in Spain during the crisis. In the context of our model, however, financial shocks alone are unable to generate much movements in default risk and have very minor effects on aggregate output.

1.1. Literature

Our paper is closely related to the literature studying the boom-bust cycle and sectoral differential responses — for example, Schneider and Tornell (2004), Kehoe and Ruhl (2009), Pratap and Urrutia (2012), and de Ferra (2016). First, in terms of empirical findings, it has been documented that during crises, real exchange rates depreciate and nontradable sectors suffer a bigger decline than tradable sectors; see Schneider and Tornell (2004) for a review. Schneider and Tornell present these stylized facts with an event study for the boom-bust cycles of 11 countries from 1980 to 1999. Kehoe and Ruhl (2009) and Pratap and Urrutia (2012) confirm these stylized facts for Mexico's 1994 crisis, and the recent paper de Ferra (2016) reports similar results for Italy's 2012 crisis. Our empirical contribution confirms these findings for Spain with disaggregated data, using a continuous measure for tradability.

In terms of theory, both Kehoe and Ruhl (2009) and Pratap and Urrutia (2012) focus on the effect of sudden stops on aggregate total factor productivity and exchange rate depreciations. Kehoe and Ruhl model sudden stops as an unexpected halt in foreign capital flows.

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