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International transmission of financial shocks without financial integration

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HIGHLIGHTS

- We construct a dynamic model of Ricardian trade and financial frictions.
- We explore how a credit crunch in a country can be transmitted to another country.
- A credit crunch in a country decreases its extensive margin of exports.
- It also induces an internationally synchronized economic downturn.

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ABSTRACT

In a two-country model of Ricardian trade with a continuum of goods and financial frictions, it is shown that a credit crunch in a country can trigger a synchronized economic downturn even in the absence of international financial transactions.

1. Introduction

The globally synchronized economic downturn during the recent financial crisis drew more attention toward the importance of international interdependence. Recent theoretical studies emphasize the critical role of frictions in domestic financial markets for transmitting a financial shock from one country to another. Examples of such contributions using dynamic two-country models include Devereux and Yetman (2010), Devereux and Sutherland (2011), Kollmann et al. (2011), and Perri and Quadrini (2018). Their common finding is that under a higher level of financial integration, a country-specific shock leads to a more synchronized decline in economic activities. However, all these studies assume a single consumption/investment good economy, thereby ignoring the possible transmission channel through the intra-temporal trade of multiple goods. While there is little doubt that financial globalization played an important role in the international co-movement seen during the recent financial crisis, the fact remains that not only international financial transactions, but also international trade is the engine of globalization. On that basis, a financial shock in one country is also likely to spread through the latter channel of globalization.[1]

This study theoretically explores how financial shocks in one country propagate to its partner country through trade in goods alone. For this purpose, it incorporates financial frictions and international trade into a two-country model. To simply embed financial frictions, this study borrows the framework of Buera and

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[1] For instance, Lane and Milesi-Ferretti (2011) find that openness to trade had significant effects on the severity of affected countries' recessions. By employing firm-level micro data for 42 countries, Claessens et al. (2012) find that the 2007–2009 crisis had a larger negative impact on firms in countries more open to trade.

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Moll (2015), who examine how a financial shock, modeled as a tightening of borrowing constraints, affects aggregate efficiency in a closed economy. To describe the international production reallocation induced by financial shocks, we extend the Ricardian trade model with a continuum of goods developed by Dornbusch et al. (1977) to the framework of endogenous capital accumulation.[2] In the present model, the two countries trade a continuum of intermediate goods used for the domestic production of a single final good. The advantage of employing such a continuum-good Ricardian framework is that it allows us to explore how each country experiences changes in its extensive margins of exports and imports.

Within this framework, we examine the impacts of a permanent credit crunch in one country. In order to analytically obtain clear-cut results, we focus on the steady-state equilibrium and obtain the following two main results. First, the credit crunch in one country changes the trade patterns in the steady-state equilibrium so that this country experiences a decrease in its extensive margin of exports. Second, this reduces the investment, GDP, wage income, and aggregate income of the entrepreneurs in both countries. That is, international trade can work as the driver of a synchronized economic downturn.

Section 2 describes the setup of the model. Section 3 characterizes the equilibrium and examines the international transmission of the permanent credit crunch in one country. Section 4 concludes. Details of the derivations are given in the Online Appendix.

2. Model

Time is discrete and indexed by $t = 0, 1, 2, \ldots$ The world consists of two countries, home (denoted by H) and foreign (F), hereafter indexed by j. Since we focus on exploring how credit shocks in one country are transmitted to the other country through international trade in goods alone, we do not consider international financial transactions.

2.1. Firms

In each country, there is a single non-tradable final good used for domestic consumption and investment. The production function in country $j \in \{H, F\}$ is $Y_{j,t} = \left(\int_0^1 x_{j,t}(\omega)^{(\sigma-1)/\sigma} d\omega\right)^{\sigma/(\sigma-1)}$, where $Y_{j,t}$ is the output of the final good, $x_{j,t}(\omega)$ is demand for the intermediate good of variety $\omega \in [0, 1]$, and $\sigma > 1$ is the elasticity of substitution. All varieties are freely traded and thus there is no international price gap. Let $p_t(\omega)$ and $P_{j,t}$ respectively denote the prices of variety ω and the final good. Profit maximization leads $x_{j,t}(\omega) = \left(p_t(\omega)/P_{j,t}\right)^{-\sigma} Y_{j,t}$ and $P_{H,t} = P_{F,t} = \left(\int_0^1 p_t(\omega)^{1-\sigma} d\omega\right)^{1/(1-\sigma)}$. Hereafter, the final good is chosen as the numeraire.

Each variety of intermediate good is produced from non-tradable capital and labor. Let $X_{j,t}(\omega)$ denote the output of variety ω in country j. Each variety is produced according to

$$X_{j,t}(\omega) = \frac{1}{\psi_j(\omega)}\left(\frac{K_{j,t}(\omega)}{\alpha}\right)^{\alpha}\left(\frac{L_{j,t}(\omega)}{1-\alpha}\right)^{1-\alpha}, \ \alpha \in (0, 1),$$

where $K_{j,t}(\omega)$ and $L_{j,t}(\omega)$ are demand for capital and labor, respectively. $\psi_j(\omega) > 0$ is the country-specific productivity parameter for variety ω. Let $q_{j,t}$ and $w_{j,t}$ denote the rental price of capital and wage rate in country j, respectively. The unit cost function in country j is given by $mc_{j,t} \equiv \psi_j(\omega) q_{j,t}^{\alpha} w_{j,t}^{1-\alpha}$. Perfect competition results in $p_t(\omega) = \min_j\{mc_{j,t}(\omega)\}$. Following Dornbusch et al. (1977), the varieties are indexed so that $d(\psi_F(\omega)/\psi_H(\omega))/d\omega < 0$: all other things being equal, the home (foreign) country has a comparative advantage in low-indexed (high-indexed) goods. Let ω_t^c denote the cutoff variety of exports in each country, implicitly determined from $mc_{H,t}(\omega) = mc_{F,t}(\omega)$. Under the assumed technology distribution, any variety no more (less) than ω_t^c is produced in the home (foreign) country. Let $\Omega_{H,t} \equiv [0, \omega_t^c]$ and $\Omega_{F,t} \equiv [\omega_t^c, 1]$ stand for the sets of the varieties produced in the home and foreign countries, respectively.

2.2. Entrepreneurs and workers

In each country, there exists a unit measure of entrepreneurs, indexed by $i \in [0, 1]$. The entrepreneurs' behavior is similar to Buera and Moll (2015), Section 2): in our model, they engage in investment projects to produce capital and rent it to domestic intermediate good firms. An entrepreneur's utility function is given by $E_t\left[\sum_{\tau=t}^{\infty}\beta_j^{\tau-t}\log c_{j,\tau}^i\right]$, where $c_{j,t}^i$ is consumption and $\beta_j \in (0, 1)$ is the discount factor. The budget constraint is $q_{j,t}k_{j,t}^i - (1 + r_{j,t})d_{j,t-1}^i + d_{j,t}^i = c_{j,t}^i + z_{j,t}^i$, where $k_{j,t}^i$ is his/her capital, $z_{j,t}^i$ is investment, $d_{j,t}^i$ is the end-of-period stock of the one-period bonds (i.e., his/her debt), and $r_{j,t}$ is the interest rate. Capital fully depreciates in one period.[3] Entrepreneurs differ in their efficiency of investment technologies:

$$k_{j,t+1}^i = \theta_{j,t}^i z_{j,t}^i.$$

At the end of each period, each entrepreneur draws a productivity from the time-invariant distribution, $G_j(\theta) \equiv \text{Prob}\left(\theta_{j,t}^i \le \theta \mid j\right)$. Thus, $\theta_{j,t}^i$ is i.i.d. across agents as well as over periods. There is no aggregate uncertainty. Each entrepreneur faces the following credit constraint:

$$d_{j,t}^i \le \pi_j z_{j,t}^i,$$

where $\pi_j \in [0, 1]$. That is, at most a proportion π_j of investment can be externally financed.

Let $a_{j,t}^i \equiv z_{j,t}^i - d_{j,t}^i$ and $\lambda_j \equiv \pi_j/(1-\pi_j) \in [0, \infty)$ respectively denote his/her own funds for investment and the leverage ratio. As in Buera and Moll (2015), we assume that each entrepreneur can decide $a_{j,t}^i$, $z_{j,t}^i$, and $d_{j,t}^i$ after observing his/her investment efficiency $\theta_{j,t}^i$. Thus, we can formulate the optimization problem in the same manner as Buera and Moll (2015) and we can replicate their derivations. From the log period utility specification, we can obtain entrepreneur i's decisions as

$$a_{j,t}^i = \beta_j\left[q_{j,t}k_{j,t}^i - (1 + r_{j,t})d_{j,t-1}^i\right],$$

$$(z_{j,t}^i, d_{j,t}^i) = \begin{cases} \left(0, \ -a_{j,t}^i\right) & \text{if } \theta_{j,t}^i < \theta_{j,t}^c \\ & \equiv (1 + r_{j,t+1})/q_{j,t+1}, \\ \left((1+\lambda_j)a_{j,t}^i, \ \lambda_j a_{j,t}^i\right) & \text{if } \theta_{j,t}^i \ge \theta_{j,t}^c, \end{cases}$$

the derivations of which are given in Online Appendix. In the second equation, $\theta_{j,t}^c$ is the cutoff productivity of investment. This result means that if their productivity is lower than the cutoff in a period, entrepreneurs do not actively invest in this period but instead lend all financial funds to other active entrepreneurs.

Let $A_{j,t} = \int_0^1 a_{j,t}^i di$ denote the aggregate wealth in country j. In Online Appendix, we derive the aggregate investment $Z_{j,t}$, aggregate capital $K_{j,t+1}$, and aggregate wealth in the next period

[2] See Eaton and Kortum (2012) for reviews of recent developments in Ricardian trade theory.

[3] In Online Appendix, we consider the case that capital depreciates only partially and the remaining capital is liquidated before the new investment. We show that the main results in this study, summarized in Propositions 1–3, are also obtained in this case.