Multinational Entrepreneurs, Financial Constraints and Macroeconomic Fluctuations

Claudia Busl*

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Abstract

The global financial crisis has given rise to a growing number of studies exploring the consequences of financial integration and financial frictions for international business cycles. While empirical research refers to financial integration concerning portfolio investment as well as foreign direct investment, theoretically grounded studies mainly focus on the former. This paper explores how foreign direct investment by financially constrained entrepreneurs propagates different types of shocks across countries. I employ a two-country DSGE model in which national and multinational entrepreneurs choose their long-term investment in fixed assets employed in national production. Financial linkages between countries are twofold in this economy: First, due to the cross-country activity of multinational entrepreneurs asset prices between countries are closely linked. Second, entrepreneurs issue bonds in an international bond market, where these are combined into a bundle and sold to households.

Keywords: FDI, MNE, Financial Constraints, International Business Cycles

JEL classification: F21, F23, F41, F44

*Centre for European Economic Research (ZEW), POBox 103443, 68034 Mannheim, Germany, e-mail: busl@zew.de.
1 Introduction

The recent global financial crisis, which started in the US real estate market in 2007, triggered worldwide negative economic consequence up to national bankrucktency down to the present day. This reminds in an impressive way that we have to improve our understanding of the international propagation of economic shocks in order to better explain and to predict and prevent such an event. The ongoing process of globalisation with its increase in trade and financial integration has given rise to new transmission channels of macroeconomic fluctuations (see Kose et al., 2003). Empirical studies like Jansen and Stokman, 2004 find evidence for foreign direct investment (FDI) having a significant impact on business cycle co-movement after 1995. These findings are supported by statistics revealing the enormous growth and scale of multinationals’ activities.\footnote{The latest statistics are available in the World Investment Report by the UNCTAD (2011).}

Furthermore, research on the determinants of FDI decisions emphasizes the influence of financial restrictions. Antràs et al., 2009 demonstrate that multinational entrepreneur (MNE) activity and FDI arises endogenously under information asymmetry and week investor protection which is confirmed by US firm-level data. Buch et al., 2009, 2010 show in theory and empirically for German firms that financial frictions like collateral constraints affect the extensive as well as the intensive margin of FDI.

My contribution to this literature is to investigate, how the investment behaviour of financially contrained MNE influences the international business cycle. This paper explores the propagation of different types of shocks through FDI across countries. I employ a two-country DSGE model in which national and multinational entrepreneurs choose their long-term investment in fixed assets employed in national production. Financial linkages between countries are twofold in this economy: First, due to the cross-country activity of multinational entrepreneurs asset prices between countries are closely linked. Second, entrepreneurs issue bonds in an international bond market, where these are combined into a bundle and sold to households. Both types of entrepreneurs are subject to a collateral constraint which limits their leverage. Therefore, there exists a bi-directional link between bond and asset markets. If asset prices fall, borrowing has to be reduced to satisfy the leverage constraint. Lower credits force asset demand down which in turn puts asset prices under pressure.

In consequence, a negative shock to productivity is followed by a lower interest rate. The cross country investment of multinational entrepreneurs
leads to the transmission of macroeconomic fluctuations and to positive co-
movement in asset prices and output. Financial shocks respond in a qual-
itatively similar manner. In addition, I investigate the implications of the
size of the multinational relative to the national sector for macroeconomic
volatility and co-movement.

The global financial crisis has given rise to a growing number of stud-
ies exploring the consequences of financial integration and financial frictions
for international business cycles. While empirical research refers to financial
integration concerning portfolio investment as well as foreign direct invest-
ment, theoretically grounded studies mainly focus on the former. In this vein,
Devereux and Sutherland, 2011 investigate the consequences of financial in-
tegration in bond and asset markets in a model with leverage constraints.
Their results concerning the convergence of business cycles differ from what
Heathcote and Perri, 2002 find in a similar setting without leverage con-
straints underlining the importance of financial constraints. In contrast to
the portfolio investment choice those studies focus on, I consider multina-
tionals foreign direct investment decision, which are less volatile than other
financial flows. This is consistent with the OECD Benchmark Definition of
Foreign Direct Investment stressing the lasting interest behind such an in-
vestment which implies “a long-term relationship between the direct investor
and the enterprise and a significant degree of influence on the management of
the enterprise.” Therefore, I assume that entrepreneurs can only slowly ad-
just their investment. Thus, since investment reacts only sluggishly in response
to shocks, effects of those shocks are more persistent.

There is a strand of literature combining the international trade literature
on multinationals and the international business cycle literature. In this
literature, corporate organisation choice regarding whether to access foreign
markets through export or FDI is driven by the individual productivity level
and differing cost structures for each type of market access. Market entry and
exit decisions as well as trade flows in reaction to economic shocks generate
business cycle spillovers between countries. However, these models prescind
from capital accumulation and financial markets and are therefore not able
to shed light on the impact of financial constraints on investment pattern
and international business cycles.

Inspired by the considerable part of large banks in the recent financial
crisis, business cycle models incorporating a multinational banking sector
were developed by Olivero, 2010, Ueda, 2010 and Enders et al., 2011. A
negative shock in one country, which reduces the net worth of the multina-

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tional bank, is spilled over to other countries through the bank’s cross-border activity. Financial frictions due to information asymmetries between banks and their lenders generate a sizeable amplification mechanism for financial shocks in these models. In contrast to those models, I focus on multinational entrepreneurs that are tied by leverage constraints on the credit market but face no frictions when investing in their projects. The latter is assumed since entrepreneurs have a better insight into the projects they invest and therefore face less information asymmetries than a bank does.

The paper is organized as follows. In the next section, I give a detailed description of the model. Section 3 analyses the impact of a productivity, a financial and a government shock on the investment behaviour of national and multinational entrepreneurs and how this influences the international business cycle. To isolate effects, three scenarios are compared: a world where all entrepreneurs operate domestically, one where all entrepreneurs invest at home and abroad and finally one where national and multinational entrepreneurs coexist. Section 4 concludes.

2 The Model

The model economy consists of two countries, home and foreign, both of whom are inhabited by savers and entrepreneurs. Entrepreneurs acquire shares in fixed assets which are employed in the production process and yield a risky return. I refer to these shares as equity claims or stakes in the production. Further discussion about how to interpret these assets can be found in Devereux and Yetman, 2010, who employ a similar setting. Savers also purchase fixed assets and use them in their home production. Two types of entrepreneurs exist in each country: national entrepreneurs which invest only in fixed assets of their home country and multinational entrepreneurs holding assets at home and abroad. This gives the MNE as opposed to the national entrepreneur the possibility to diversify its investment across countries and country-specific risks. The focus of my analysis is on the propagation of macroeconomic shocks through the investment decisions of multinational entrepreneurs and their interaction with their national counterparts, but not on market entry and exit or sector transition dynamics. Therefore, the relative size of the multinational sector is fixed exogenously.

There is an international credit market where entrepreneurs and savers can buy and sell debt securities. Since by assumption entrepreneurs are more impatient than savers, they will always be net borrowers. In addition, entrepreneurs face collateral constraints implying that their total leverage is bounded. All agents inelastically supply labour to the domestic final good.
production. This setting is chosen to concentrate on the investment behaviour of leverage constrained entrepreneurs and their interaction through financial markets.

In the next subsections, I describe the behaviour of agents in the home economy, if not stated otherwise. Foreign agents follow comparable pattern. Each country is inhabited by a infinitely living mass of agents normalized to unity. \( n_S \) of agents in country \( j \), \( j = \text{home, foreign} \) are savers, \( n_N \) belong to the group of purely domestically operating entrepreuners and the remaining \( n_M \) agents are multinational entrepreneurs with their headquarters in country \( j \).

### 2.1 Entrepreneurs

Both types of representative entrepreneurs, national (\( N \)) and multinational (\( M \)), maximize their expected life-time utility

\[
E_0 \sum_{t} \left( \beta^i \right)^t U \left( C_i^t \right),
\]

where \( \beta^i \) is the discount factor of entrepreneur \( i = N, M \). \( C_i^t \) is the consumption of the final good which is homogenous and freely traded across the world. The per-period utility function is given by \( U \left( C \right) = \left( \frac{C^{1-\sigma}}{1-\sigma} \right) \).

Both entrepreneurs receive income from labour and from their current asset holdings. Labour supply is constant and normalized to unity. Each period entrepreneurs have to repay the loans obtained the period before and, afterwards, decide on the new debt they want to incur. Furthermore, they choose consumption and fixed asset position by investing in new equity stakes. The budget constraint of national entrepreneurs in the home country can be expressed as

\[
C_t^N + q_{1t} x_{1t}^N - B_{t+1}^N \leq W_{1t} + R_{K1} k_{1t}^N + (1 + r_t) B_{t}^N \tag{2}
\]

and for multinational entrepreneurs as

\[
C_t^M + q_{1t} x_{1t}^M + q_{2t} x_{2t}^M - B_{t+1}^M \leq W_{1t} + R_{K1} k_{1t}^M + R_{K2} k_{2t}^M + (1 + r_t) B_{t}^M \tag{3}
\]

\( x_{1t}^N, x_{1t}^M \) and \( x_{2t}^M \) represent the adjustment of equity stakes made by entrepreneurs in the home country to change their participation in domestic and foreign production firms, named production firm 1 at home and 2 abroad. \( k_{1t}^N, k_{1t}^M \) and \( k_{2t}^M \), on the other hand, are the equity stakes held by these entrepreneurs at the begin of the period which yield \( R_{K1} \) and \( R_{K2} \), respectively. \( q_{1t} \) and \( q_{2t} \) are the prices of the fixed asset in the two countries in
units of the final good. For their labour supply entrepreneurs at home receive wage income \( W^t \). \( B^N_t \) (\( B^M_t \)) is the quantity of bonds issued by the national (multinational) entrepreneur last period. He has to repay this debt in \( t \) plus an interest rate \( r_t \) and incurs new debt \( B^N_{t+1} \) (\( B^M_{t+1} \)). Like in Kiyotaki and Moore, 1997, lenders demand collateral for this debt, since they have no other instrument to force repayment from entrepreneurs. This results in the following leverage constraint for national entrepreneurs

\[
B^N_{t+1} \leq \kappa^N_t q_{1t} k^N_{1,t+1} \tag{4}
\]

and

\[
B^M_{t+1} \leq \kappa^M_t (q_{1t} k^M_{1,t+1} + q_{2t} k^M_{2,t+1}) \tag{5}
\]

for MNEs. These constraints imply that new debt incurred by the entrepreneurs cannot exceed a percentage \( \kappa^i_t < 1 \) of of their asset holdings valued at current prices.

As mentioned in the introduction, foreign direct investment (as well as national investment) is characterized by the lasting interest of the investor as opposed to the short-term diversification aspect of portfolio investment. In the model, I assume that investment in equity stakes of production is subject to investment adjustment cost, as proposed by Christiano et al. (2005). Therefore, asset holdings \( k^i_{jt} \) of entrepreneur \( i \) in production firm \( j \) evolve according to

\[
k^i_{jt+1} = (1 - \delta) k^i_{jt} + x^i_{jt} \left[ 1 - S \left( \frac{x^i_{jt}}{x^i_{jt-1}} \right) \right], \tag{6}
\]

where the function \( S \) has to fulfill the following properties: \( S(1) = S'(1) = 0 \) and \( S''(1) > 0 \). Fixed assets are exposed to depreciation at rate \( \delta \).

National (Multinational) entrepreneurs in the home country choose their consumption, their total borrowing and their investment and thus their asset holdings in order to maximize their expected utility given their budget constraint (2) ((3)), their collateral constraint (4) ((5)) and the law of motion for fixed assets (6). This yields the following first-order conditions for both types of entrepreneurs

\[
\lambda^i_t = U'(C^i_t) \tag{7}
\]

\[
\lambda^i_t = E_{t|t} \beta \lambda^i_{t+1}(1 + r_{t+1}) + \mu^i_t \tag{8}
\]
\[ \lambda_i^t q_{it} = \phi_i^t \left[ 1 - S \left( \frac{x_{1t}^i}{x_{1, t-1}^i} \right) - \frac{x_{1t}^i}{x_{1, t-1}^i} S' \left( \frac{x_{1t}^i}{x_{1, t-1}^i} \right) \right] + E_t \beta_{i+1} \left( \frac{x_{1,t+1}^i}{x_{1t}^i} \right)^2 S' \left( \frac{x_{1,t+1}^i}{x_{1t}^i} \right) \] (9)

\[ \phi_i^t = E_t \beta_i^t \left( \lambda_{t+1}^i R_{1K,t+1} + (1 - \delta) \phi_{i,t+1}^i \right) + \mu_i^t \kappa_i^t q_{it} \] (10)

and for domestic multinationals additionally

\[ \phi_i^M = E_t \beta_i^M \left( \lambda_{t+1}^M R_{2K,t+1} + (1 - \delta) \phi_{i,t+1}^M \right) + \mu_i^M \kappa_i^M q_{it}. \] (11)

I named the multiplier on the budget constraint, the collateral constraint and on the law of motion for fixed assets \( \lambda_i^t \), \( \mu_i^t \) and \( \phi_i^t \), respectively. Since entrepreneurs are assumed to be less patient than saver, \( \mu_i^t > 0 \) will always hold. This implies that the marginal utility of an extra unit of credit is always positive, in consequence the collateral constraint is always binding.

### 2.2 Savers

Savers maximize their life-time utility

\[ E_0 \sum_t \left( \beta^S \right)^t U \left( C_t^S \right), \] (12)

where \( C_t^S \) is consumption of final goods and \( \beta^S \) is intertemporal discount factor of savors. For the discount factors holds \( \beta^S > \beta^t \) for \( i = N, M \), which implies that savers are more patient than entrepreneurs. This assumption ensures that entrepreneurs never have enough resources to finance their investments on their own and in consequence are net borrowers, whereas savers are net lenders.

Savers get income from labour supplied to the final good production and from their home production. Additionally, they receive interest on the credit bundles they bought last period. With this resources they consum, adjust their fixed asset holdings and disburse new loans. Thus, they face the following budget constraint

\[ C_t^S + q_{1t} x_{1t}^S + D_{t+1} + G_t^S \leq W_{1t} + G(k_{1t}^S) + (1 + r_t) D_t, \] (13)

where \( x_{1t}^S \) is investment in new assets at home at price \( q_{1t} \). Adjustment of fixed assets is simply given by the change in asset holdings.
\[ k^{S}_{1,t+1} = x^{S}_{t} + k^{S}_{1t}. \]  

(14)

\(W_t\) is wage income on savers’ labour supply and \(G(k^{S}_{1t})\) is the production function of home activity, which produces income in terms of final goods. \(D_t\) are debt securities bought by savers last period, which entitle to an interest rate \(r_t\) and \(D_{t+1}\) are new loans granted in \(t\). Moreover, savers are exposed to a government spending shock \(G^S_t\). This demand shock is introduced to explore whether such a shocks triggers different effects than a supply shock. References for opposing outcomes of supply and demand shocks on the convergence of business cycles are found by Morgan et al. (2004). In addition, Buch et al. (2005) provide evidence for divergent impacts of these shocks on the volatility of cycles.

Savers maximize their expected utility over consumption, their debt and fixed asset holdings subject to the budget constraint (13) giving the following conditions

\[
\lambda^S_t = E_t \beta^S \lambda^S_{t+1} \left( q_{1t+1} + G'(k^{S}_{1,t+1}) \right) / q_{tt} 
\]

(15)

\[
\lambda^S_t = E_t \beta^S \lambda^S_{t+1} (1 + r_{t+1}), \tag{16}
\]

where \(\lambda^S_t\) is the Lagrange multiplier of the budget constraint.

### 2.3 Production

Each country has one representative production unit, which is called firm 1 in the home country and firm 2 in the foreign country. The production units maximize their profits given the following production technology

\[ Y_t = A_t L^{-\alpha_E}(K_t)^{\alpha_E} \]

(17)

where \(L_t = n_S + n_N + n_M = 1\) is the total labour supply of domestic agents. \(K_t = n_N k^N_{1t} + n_M (k^M_{1t} + k^{M*}_{1t})\) are fixed assets of firm 1 in the home country consisting of fixed assets hold by domestic nationals \(k^N_{1t}\) and domestic multinationals \(k^M_{1t}\) as well as of assets from foreign multinationals \(k^{M*}_{1t}\). The first-order conditions arising for firm 1 in the home country are given by

\[ W_t = (1 - \alpha_E) A_t K^\alpha_E \]

(18)

\[ R_{Kt} = \alpha_E A_t K^{\alpha_E-1}. \]

(19)
2.4 Equilibrium

Global equilibrium requires market clearing in the fixed asset markets, the global debt market and the final good market. Furthermore, firms labour and fixed asset demand must equalize the supply offered by all agents. For the asset markets at home and abroad equilibrium is defined as

\[ n_S k_{1,t+1} + n_N k_{1,t+1} + n_M (k_{1,t+1} + k_{1,t+1}^*) = 1 \]  
\[ (20) \]

\[ n_S k_{2,t+1} + n_N k_{2,t+1} + n_M (k_{2,t+1} + k_{2,t+1}) = 1, \]  
\[ (21) \]

where total supply of fixed assets is normalized to unity.

Market clearing in the global credit market is obtained by

\[ n_S (D_{t+1} + D_{t+1}) = n_N (B_{t+1}^N + B_{t+1}^N) + n_M (B_{t+1}^M + B_{t+1}^M). \]  
\[ (22) \]

Finally, equilibrium in final goods market is given by

\[ n_S (C_{t} + C_{t}^*) + n_N (C_{t}^N + C_{t}^N) \\
+ n_M (C_{t}^M + C_{t}^M) + n_S (G_{t}^S + G_{t}^S) = A_t k_{1,t} + n_M (k_{1,t} + k_{1,t}^*)]^{\alpha_E} \\
+ A_t^* k_{2,t} + n_M (k_{2,t} + k_{2,t})]^{\alpha_E} \\
+ n_S [G(k_{1,t}) + G(k_{2,t})] \]  
\[ (23) \]

For the first two scenarios analysed in section 3 equilibrium is characterized by the equations given above. More specific, the equilibrium of the first scenario with \( n_M = 0 \), that is an economy without multinational entrepreneurs, is fully described by equation (2), (4), (6) - (10), (13) - (16) and (18) - (22). The second setting is given by conditions (3), (5) - (11), (13) - (16) and (18) - (22). If \( n_N, n_M > 0 \), i.e. nationals and multinationals coexist, the described equilibrium does not determine the distribution of equity stakes between nationals and multinationals. This is because assets of national and multinational entrepreneurs are regarded as perfect substitutes in the production. The division of funds between the two country-specific fixed assets is not affect by this problem, since investment alternatives, namely equity shares in the domestic and in the foreign production, differ with respect to the underlying production technology. Allocation of assets is directly mapped into allocation of credits, which can be seen by combining domestic and foreign counterparts of equation (4) and (5). Collateral constraints provide a direct link between asset and credit markets. Besides, without further assumptions savers do not distinguish between bonds issued by national and multinational entrepreneurs. In consequence, the credit market does not provide an allocation for credits, and thus for assets, either.
In this version of the model, I assume for simplicity that the relative quantity of credit issued to national entrepreneurs is fixed to 
\[ \frac{n_N (B_{t+1}^N + B_{t+1}^{NS})}{n_M (B_{t+1}^M + B_{t+1}^{MS})} = \frac{\omega}{1-\omega} \]
with \( \omega \in (0, 1) \). Thus, for \( \omega < 0.5 \) there is a bias in loan granting towards multinationals. A preference of lenders for multinationals can be justified for several reasons: Multinational have a diversified portfolio of investments which makes them less prone to default. Moreover, empirical studies uniformly attest MNEs to be on average larger and more productive than other firms,\(^4\) which again comes in favour of the credit standing of MNEs.

Further evolution of this model should make the allocation of credits less arbitrary. A financial intermediary will be introduced who bundles bonds through an Armington-aggregator and sells the bundles to savers. This moves the decision of funds division between MNEs and nationals from the savers to the financial intermediary which is supposed to be able to take differences between borrowers into account.

### 2.5 Calibration

Calibration is mostly taken from Devereux and Sutherland 2011, who study a similar setting. Parameter values are summarized in table 1. In each country live \( n_S = 0.5 \) savers so that there are as many savers as entrepreneurs. The share of national and multinational entrepreneurs, \( n_N \) and \( n_M \), are adapted according to the considered scenario. The same is true for the coefficient of loan granting bias towards multinationals \( \omega \), which pins the relative quantity of bond and asset holdings of entrepreneurs down. The leverage parameter \( \kappa \) is set to 0.75, which is equivalent to a leverage ratio \( \frac{1}{1-\kappa} \) of 4.

All agents have the same coefficient of relative risk aversion and intertemporal elasticity of substitution \( \sigma = 2 \), which is a standard value in business cycle literature. Following Devereux and Sutherland (2011), the discount factor of savers is set to 0.96 and that of entrepreneurs, which is assumed not to differ between nationals and multinationals, is set to 0.94.

The final goods sector produces employing a Cobb-Douglas production technology with a share of fixed assets in production equal to \( \alpha_E = 0.36 \), which is the standard measure of capital share in US GDP. Home production uses \( G(k^S) = (k^S)^{\alpha_S} \) with \( \alpha_S = 0.1 \) as production technology. This means that fixed assets are of greater importance for the final good sector. Fixed assets are assumed to depreciate at rate of 0.025 per quarter.

\(^4\)For an overview on this literature see Markusen 2004. New evidence on US data provide e.g. Bernard et al. 2009.
<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$n_S, n_N, n_M$</td>
<td>Population share of savers, nationals and MNE 0.5, see scenarios</td>
</tr>
<tr>
<td>$\sigma$</td>
<td>Coefficient intertemporal elasticity of substitution 2</td>
</tr>
<tr>
<td>$\beta^S, \beta^N, \beta^M$</td>
<td>Discount factor 0.96, 0.94, 0.94</td>
</tr>
<tr>
<td>$\omega$</td>
<td>Coefficient of loan granting bias towards MNE see section (3.3)</td>
</tr>
<tr>
<td>$\delta$</td>
<td>Depreciation rate of fixed assets 0.025</td>
</tr>
<tr>
<td>$\alpha_E$</td>
<td>Capital share of final good production 0.36</td>
</tr>
<tr>
<td>$\alpha_S$</td>
<td>Capital share of home production 0.1</td>
</tr>
<tr>
<td>$\bar{\kappa}$</td>
<td>Leverage parameter 0.75</td>
</tr>
<tr>
<td>$\rho_A$</td>
<td>Persistence of productivity shock 0.9</td>
</tr>
<tr>
<td>$\rho_\kappa$</td>
<td>Persistence of financial shock 0.9</td>
</tr>
<tr>
<td>$\rho_G$</td>
<td>Persistence of government spending shock</td>
</tr>
</tbody>
</table>

Table 1: Calibration

I discuss three types of shocks in the next section. The first source of fluctuations is a shock to production technology in the final goods production, which is standard driver of business cycles in the RBC literature. The shock follows a stochastic process given by

$$\log (A_t) = \rho_A \log (A_{t-1}) + v_t$$

with $\rho_A = 0.9$ being the persistence of the shock, an expected value of the innovation $E_{t-1}(v_t) = 0$ and variance $\sigma^2_v = 0.005^2$.

Moreover, I introduce a “financial” shock directly hitting the collateral constraint through a change in the maximum leverage ratio. This shock can be interpreted as a sudden change in credit market conditions requiring lenders to reduce the riskiness of their debt holdings which is achieved by higher collateral constraints. Thus, a negative financial shock tightens the collateral constraint reducing loans granted and the acquisition of new equity shares. National and multinational entrepreneurs are supposed to be subject to the same leverage restriction implying $\kappa_t = \kappa^N_t = \kappa^M_t$. The stochastic process for the leverage coefficient is written as

$$\log (\kappa_t) = (1 - \rho_\kappa) \log (\bar{\kappa}) + \rho_\kappa \log (\kappa_{t-1}) + \epsilon_t,$$

where $\rho_\kappa = 0.9$, $E_{t-1}(\epsilon_t) = 0$ and $\sigma^2_\epsilon = 0.011^2$.

In addition, I consider a government spending shock on the budget constraint of savers to see, whether effects of a demand shock differ from supply shocks which was suggested in literature.

$$\log (G^S_t) = \rho_G \log (G^S_{t-1}) + \nu_{jt}$$
Productivity, financial and government spending shocks are uncorrelated. In the foreign economy, all shocks are driven by the same process, respectively and are not correlated with shocks in the home country.

3 The Effect of Multinationals on the International Business Cycles

In this section, I investigate the effect of productivity and government spending shocks on the investment behaviour of entrepreneurs and on the co-movement of international business cycles. To explore the role of multinational entrepreneurs in detail, three scenarios are compared. In the first setting called “national model”, $n_M$ is set to zero (and $n_N = 0.5$), which implicates that only national entrepreneurs and savers live in both economies. The second scenario labelled “multinational model” considers the opposite: a world where all entrepreneurs operate in both countries, that is $n_M = 0.5$ and $n_N = 0$. Comparing the first two scenarios, the mechanism activated by the cross-boarder activities of multinationals becomes transparent.

The last setting called “intermediate model” is an intermediate case where both types of entrepreneurs coexist. Within this scenario the importance of the size of the multinational sector relative to the national sector for the transmission mechanisms is discussed.

3.1 National Entrepreneurs and Investment Flows

To see how transmission of business cycle fluctuations changes in the model economy by introducing multinationals with the possibility of cross-boarder investing, a setting with national entrepreneurs only will be analysed as reference model. In this model the only connection between economies goes through the interest rate of the international credit market.

Figure 1 on page 17 displays impulse response functions to a one percentage negative shock to the productivity of final goods production in the home country. The figure contains responses of output, consumption\(^5\), prices of fixed assets, borrowing of entrepreneurs, asset holdings and investment of entrepreneurs and gross interest rate on lending together with the finance premium, as defined in Mendoza (2010).

The negative productivity shock reduces at home wages of both, savers and entrepreneurs, and return on equity shares hold by entrepreneurs. In

\(^5\)Note, that total consumption is computed as $C_t = n_S C^S_t + n_N C^N_t + n_M C^M_t - n_S G(k_t^S)$.
consequence, prices of fixed assets at home fall and investment in new equity stakes drops. This triggers at the same time a fall in credit supply and demand. But due to the collateral constraint, which tightens with dropping assets prices, the demand for loans of entrepreneurs decreases more, so that there is a excess supply for loans resulting in a fall of the interest rate. Foreign entrepreneurs profit from the favourable situation on the credit market and, consequently, increase borrowing and investment, which in turn leads to higher asset prices. Their leverage constraint expands promoting further investment. The (slight) rise in foreign output and the lower interest rate encourage foreign consumption. Thus, the central result from this model, a negative cross-country correlation of output and consumption, does not differ from what Devereux and Sutherland (2011) find in their model with portfolio investment choice. For equity stakes this conclusion is valid as well.

In contrast to a model without costly adjustment of investment, investment and fixed asset holdings show, as was to be expected, a much more persistent response to the shock paired with a decreased size of the response. This is also true for bond holdings and asset prices in both countries.

Figure 2 on page 18 illustrates the effects of a one percentage negative shock to the leverage constraint for entrepreneurs in the home country. The basic mechanism caused by this shock are very similar to what we observe in the case of a productivity. A fall in credit demand due to the tightened collateral constraint results in a drop of the interest rate and demand for fixed assets. Domestic asset prices fall and aggravate the leverage constraint further. Response of consumption exhibits again a strong negative correlation, whereas output does so only for the first 6 periods.

A shock enlarging government spending and hitting the budget constraint of savers only, as can be seen from Figure 3 on page 19, yields identical responses of foreign and domestic agents. This happens because of the direct connection of agents budget constraints through the final good market. In immediate response to the shock, total consumption and savers demand for fixed assets and debt securities is reduced. The former triggers a small fall in asset prices tightening the collateral constraint of entrepreneurs. In the following demand for loans drops and the investment rate rises. The extra demand from government is satisfied by an increase in investment in equity shares, moving fixed assets from home production to final goods production.
3.2 Multinational Entrepreneurs as Transmitter of Macroeconomic Fluctuations

3.3 The Interplay of Heterogenous Entrepreneurs and the International Business Cycle

4 Conclusion
References


Figure 1: Effects of a productivity shock in a world where all entrepreneurs operate domestically
Figure 2: Effects of a financial shock in a world where all entrepreneurs operate domestically
Figure 3: Effects of a government spending shock in a world where all entrepreneurs operate domestically