A Ricardian Theory of Production, Trade and Finance - The Role of Credit Market Imperfection

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by

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Abstract

We build up a Ricardian trade model for a small open economy with imperfection in the market for credit which eventually affects the pattern of production and trade. Workers/entrepreneurs are endowed with different levels "capital" and need to borrow to produce the credit intensive good. Firms with strong internal cash flow will enter the credit intensive sector. Among those the weaker ones will like to deal in fragments and the richer ones will vertically integrate. Thus distribution of capital ownership determines the nature of production and trade. Those producing fragments may engage in external as well as internal trade. Two credit constrained nations may trade in fragments. The unconstrained richer firms will follow the standard Ricardian incentive to trade. Even if trade does not require credit, shortage of production credit will affect production and trade. Later we generalize our framework to determine prices and interest rate simultaneously. Even there is no role for trade credit, financial stringency will reduce volume of production and trade.

JEL classification: F1, G1

Keywords: Trade, Credit Market, Gains from Trade.

I. Introduction

The recent global financial crisis and its far-reaching repercussions on cross-border economic activity, has renewed interest in roles that credit markets play in international trade.[1] Among the most recent landmark contributions, Manova (2013) provides convincing evidence that credit constraints are an important determinant of global trade flows. Similar concerns are also present in Chor and Manova (2012). While availability of trade credit is an essential element that facilitates trading process, our understanding of basic trade models remains incomplete if we do not bring in the role of credit in production and trade in general. The main purpose of this paper is to introduce credit in the basic Ricardian model and that too when credit is not easily available. In this paper credit market problems affect production pattern and resulting pattern of trade, internal and external. Thus we do not talk specifically about trade credit, but credit in general and we take such a perspective in terms of the most basic model of trade, the Ricardian framework.

If a country, without having credit constraints, trades with another which is affected by the shortage of credit, it is likely that the credit constrained economy will specialize in fragments. In this case there is a comparative advantage story at work, the credit constrained economy has a comparative advantage in supplying fragments. The constrained economy also produces less of the credit intensive goods. We argue that firms which have adequate credit will exhibit very standard text book type Ricardian outcome. Paucity of credit will force a country to specialize mostly in non-credit intensive sector and those who are not so well endowed operating in the credit intensive sector will be better off producing fragments rather than the whole output.

Let us, at the outset, highlight the difference between our work and two other papers, by Matsuyama (2005) and Deardorff (2000), that have brought to the fore-front the issue of credit and finance in the context of trade and comparative advantage. Unlike Matsuyama (2005) our paper is not about corporate governance and contract enforcement and we deal with the Ricardian model and bank finance and do not talk about balance sheet of firms and determination of comparative advantage from that perspective. Instead we show how standard Ricardian outcomes are modified and altered when credit is expensive. Ours is fairly close to classical trade theoretic angle and what we feel should be the starting point for introducing credit in a proper trade model. Deardroff (2000) argues how during financial crisis fragmentation i.e. splitting up of production process in various traded segments, may create problems. On the contrary, in the paper the ability to trade in fragments actually helps to alleviate credit constraints. As such, our paper is different from both as we explicitly focus on credit market imperfection and fragmentation. [2]

Our paper also shows how trade promotes entrepreneurs and how trade actually helps the poor people more in relation to wealthier ones i.e. those endowed with higher initial amounts of capital or internal finance. We have to record our indebtedness to the classical economist David Ricardo who pioneered the wage fund theory of trade and growth and in the process emphasized the role of capital endowment in production and trade. Lineage wise this paper is also related to papers dealing with more 'classical' interpretation of the Ricardian theory of comparative advantage a' la Steedman (1979) and Findlay (1984) and to the literature on north-south trade [Findlay (1995)].

Our work draws from Jones and Marjit (2001) where fragmentation has been shown to help the young generation relative to the old who tend to own capital. Such a young-old asymmetry not only corroborates Jones and Marjit (2001) conjecture, but also lends credence to the theoretical model under consideration where we show that constrained entrepreneurs will opt for smaller size if they can. In Marjit (2008), relative capital endowments determine pattern of trade and occupational pattern simultaneously in a Heckscher-Ohlin setting, but the main focus was on wage distribution. While we produce a clear result where exactly similar countries gain from trade, a reinterpreted version in the context of the 'north-south' trade also yields an interesting result. The fact that a country faces credit market imperfection while the other does not, implies that the credit constrained economy will have a comparative advantage in producing fragments. Such a trade pattern echoes the earlier concern of trade between metropolis and colonies popularized through the literature on trade between centre and periphery. Two earlier attempts in modeling such a behavior without including capital are by Sanyal (1983) and Marjit (1987). The rest of the paper is organized as follows. Section 2 describes the model and presents the key results. Sections 3 and 4 look into further consequences of our results. In the final section, we draw our key conclusions.

Section 2 .1 Production and Trade in Final Good

Consider an economy producing two goods – x and y. x is produced with labor: 'a' units of labor produces one unit of x. Production of y requires one period to complete and workers have to be paid at the beginning, thus entrepreneurs require credit for the wage fund. One unit of labor produces one unit of y. The distribution is given in a continuum such that each worker is represented by $z \epsilon [0,1]$. Each worker is endowed with a wage fund $k(z)$ called 'capital'. In effect, we stylize a Ricardian small open economy, where workers are entrepreneurs, with commodity prices and interest rates determined in the rest of the world. However, the credit market is imperfect. If the workers so wish they can buy a bond which pays them r, a return as a lender determined in the rest of the world. Thus, so far as the lending or deposit rates goes, it is fixed at r. However, if they wish to borrow to augment their capital stock they must pay $R > r$.

In the standard literature on credit market imperfection such divergence is a common occurrence. Such a summary view of the imperfect credit market has been quite popular in theories of occupational distribution and poverty trap. One can easily bring in adverse selection or moral hazard type assumptions to create an endogenous wedge between R and r. But that is not necessary for the purpose in hand.

At this stage, we make an assumption that $k(z)$ is small enough for all z such that it falls short of the required wage fund to produce y. Since to each worker-entrepreneur the imputed cost of producing is $\frac{1}{a}$, the alternative wage rate, our assumption suggests that $k(z) < \frac{1}{a}\ \forall z$. Once they decide to borrow from the international market, the banks have to incur a loan processing cost, say, $\alpha > 1$ in addition to r, the lending rate. Thus $R = \alpha r > r$ As we shall see shortly given that $R > r$, internal source of financing such projects becomes crucial as predicted in the standard finance literature [Glenn Hubbard (1989)]. There are two aspects of the credit market imperfection problem.

1. **Specialized Intermediation**: Banks will charge an intermediation cost leading to a gap between the borrowing rate (R) and the lending or deposit rate (r). In the popular poverty trap literature, (R − r) > 0 is used as a sufficient condition to characterize credit market imperfection. One can borrow as much as one desires, at R > r, implying that no credit constraint is effectively binding.
2. **Information Issues**: The lender typically faces incomplete information regarding the type of the borrower, and decides the maximum amount of loan, internalizing any possibility of default. Such a maximum amount will be monotonically related with the endowment of the borrower. This defines the credit constraint [(Aghion, Banerjee, & Piketty, 1999)]

In our setup we assume that $[{}^{1}/_{a} - k(0)] \leq$ max loan granted to '0'th agent. Hence, we must stick to the intermediation cost only. But even we relax this assumption, our result will hold. We also assume competitive commodity markets where price has to be equal to average cost of production.

With this backdrop, we can now specify the incentive of a representative worker to be an entrepreneur and engage in producing y rather than x.

$$P + \frac{1}{a}(1+r) - \left[\frac{1}{a} - k(z)\right](1+R) \geq \left[\frac{1}{a} + k(z)\right](1+r) \tag{1}$$

where $P \equiv \frac{P_y}{P_x}$.

Note [1/a - k(z)] is nothing but the loan, L, taken from the bank and P has to be greater than L(1+R) plus k(z)(1+r), the cost of self-finance for production to be viable.

If the worker/entrepreneur interested in producing y wishes to produce more than one unit of y and demand loan accordingly, one can easily show that given k (z) she will choose the minimum amount and assuming away fragments of y at this stage , it will boil down to the production of a single unit. Hence, the argument is more robust than the assumption of a single unit being produced. In a sense the scale of production is endogenous since fixity of k(z) works as capacity restriction. We shall extend it further to include production of fragments later in the paper.

(1) can be rewritten as

$$P + k(z)(R - r) \geq \frac{1}{a}(1+R) \tag{2}$$

In the absence of any imperfections in the credit market, $r = R$. Hence, (2) boils down to

$$P \geq \frac{1}{a}(1+r) \tag{3}$$

Internal financing becomes irrelevant as $k(z)$ vanishes from the scene with $r = R$. (3) also suggests that whether the economy will specialize in $x \; or \; y$ depend on whether the return from entrepreneurship $\left[P - \frac{1}{a}(1+r)\right]$ is positive. Complete specialization will be the likely outcome if P> $\frac{1}{a}(1+r)$, replicating the fundamental and well known Ricardian proposition. In a way what we show is that the text book Ricardian model is a special case of this general framework with explicit role of finance or credit.

Let us now rank $k(z)$ such that $k'(z) > 0$ for $z \epsilon [0,1]$ with $P + k(1)(R-r) > \frac{1}{a}(1+R)$ and $P + k(0)(R-r) < \frac{1}{a}(1+R)$ and define $\tilde{z}$ such that

$$P + k(\tilde{z})(R-r) = \frac{1}{a}(1+R) \tag{4}$$

It is obvious from (3) and (4) that since $r < R$, any incentive to produce y is greater with a distorted credit market. However the net incentive, if any, to engage in production of y will be greater in an undistorted credit market, since the following holds

$\left[P - \frac{1}{a}(1+r)\right] - \left[P + k(z)(R-r) - \frac{1}{a}(1+R)\right] = \left[\frac{1}{a} - k(z)\right](R-r) > 0 \; as \; k(z) \leq \frac{1}{a} \; for \; z \leq \tilde{z}$.

Since $k'(z) > 0$, $\forall \; z \geq \tilde{z}$ workers will become entrepreneurs in y and for the rest, x seems to be more profitable. Thus even if (3) holds with strict inequality, (4) may discourage all $z < \tilde{z}$ to become entrepreneurs in y, thus causing deviation from the first best allocation. Therefore, $(1-\tilde{z})$ will be the amount of y that will be produced and $\frac{\tilde{z}}{a}$ will be the amount of x produced.

Therefore, we have the first proposition.

Proposition 1

With a perfect credit market and P >(1/a)(1+r), all firms should specialize in producing x , the standard Ricardian equilibrium. If the credit market is imperfect in the sense described above and given the distribution of capital or internal finance, the set of poorest firms will be forced to specialize in x and the rest in y. Thus between two exactly similar countries if one does not face the credit constraint and the other does, the constrained economy will produce and export less of y, denoting a deviation from the first best allocation.

Proof – See the discussion above.

Section 2.2 Fragments

Suppose y can be produced in fragments i.e. by splitting up the production process, `a la Jones and Kierzkowski (2001), so that if one firm produces λ fraction of the value, the other will produce (1- λ) fraction, exchange and mix them to produce one unit of y. The fraction is technologically given and we do not allow for optimal degree of fragmentation. We just allow the possibility that any firm operating in this small economy can produce a fragment and sell. It can sell to another firm within the country or outside the country. In the former case it is internal trade and for the latter, it is international trade. Let us then rewrite the incentive constraint (1)

$$\lambda P - \left[\frac{\lambda}{a} - k(z)\right](1+R) + \frac{1}{a}(1+r) \geq \frac{1}{a}(1+r) + k(z)(1+r) \tag{5}$$

The entrepreneur gets λ fraction of the net value employing λ fraction of worker who can work (1- λ) fraction in x and get $\frac{1}{a}(1+r)$ in total and (5) can be rewritten as

$$P + \frac{k(z)}{\lambda}(R-r) \geq \frac{1}{a}(1+R) \tag{6}$$

Note that the LHS of (6) is greater than the LHS in (2), implying greater incentive to produce y. Also note that if R=r i.e. if the firm is rich enough, it does not gain by producing fragments since it does not need to save on the borrowing cost as it has enough internal finance. But this is important for a poorer firm. Figure 1 depicts $\tilde{z}$ in two different cases with $\tilde{z}_2$ (in (6)) being less than $\tilde{z}_1$ (in (2)).

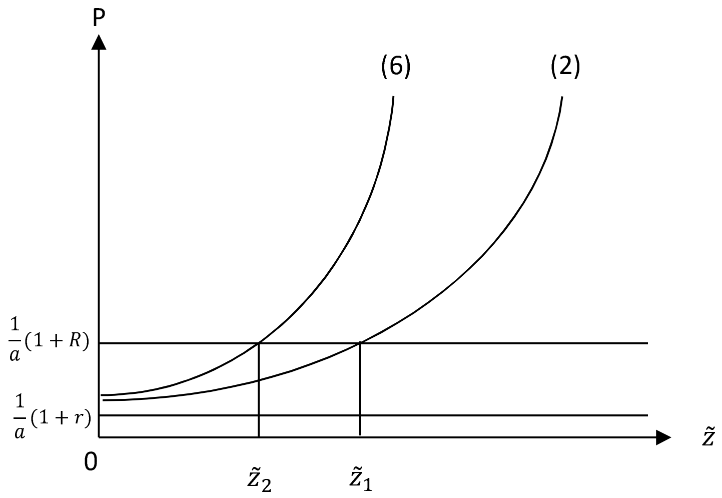

Figure 1

As $\lambda < 1$, LHS in (6) is greater than RHS in (6) for $\tilde{z} = \tilde{z}_1$, implying a drop in $\tilde{z}$ to $\tilde{z}_2$. We have drawn Figure 1 to indicate that $P > \frac{1}{a}(1+r)$ implies that if there is no distortion in the credit market, the economy would have specialized in y. If we allow trade in fragments $\tilde{z}$ drops and we have $\lambda\big((1-\tilde{z}(\lambda)\big)$ working hours being spent on y. Another important point is that the trading nations, both suffering from credit market imperfection, will trade without any reference to comparative advantage. It is possible that the closed economy can engage in internal trade when agents produce fragments of y. But whenever another country appears in the horizon, there will be inter-country trade provided technological considerations do not prohibit further fragmentation. The point we are trying to make is that, since $R > r$, there are latent diseconomies of scale and fragmentation allows higher income. Will fragmentation allow greater production of y or more working hours spent on y as is desired by the first best allocation? The following proposition answers this question.

Proposition 2. **Trade in Fragments allows a movement towards first best allocation from autarky**_i.e._($\lambda = 1$) _iff $\tilde{z} > \frac{1}{1+\frac{1}{\varepsilon}}$ where $\epsilon \equiv \frac{k'(\tilde{z})}{k(\tilde{z})}\tilde{z}$

Proof: If $P > \frac{1}{a}(1+r)$, only y will be produced and we define it as the first best allocation where

$\tilde{z} = 0$, All working hours are devoted to production of y.

Given that $k(\tilde{z}) = \frac{\lambda\left[\frac{1}{a}(1+R)-P\right]}{(R-r)}$ (from (6)),

$$\frac{d\left[\lambda\left(1-\tilde{z}(\lambda)\right)\right]}{d\lambda} = 1 - \tilde{z}\left(1+\frac{1}{\varepsilon}\right) \quad (7)$$

where $\varepsilon = \frac{k\prime(\tilde{z})}{k(\tilde{z})}\tilde{z} > 0$ denotes the elasticity of distribution of capital or wage fund stock with respect to $\tilde{z}$. Therefore, (7) will imply

$$\frac{d[\lambda(1-\tilde{z}(\lambda)]}{d\lambda} < 0 \text{ iff } \tilde{z} > \frac{1}{1+\frac{1}{\varepsilon}} \quad (8)$$

If, initially (with $\lambda = 1$), $\tilde{z} > \frac{1}{1+\frac{1}{\varepsilon}}$ and we allow trade in fragments $\tilde{z}$ drops and given given (8) L_y i.e. total allocation of labour in y increases and we move towards the first best. (QED)

Proposition 1 clearly states that for $\tilde{z}$ lower than $1+\frac{1}{\varepsilon}$, trade in fragments will induce more people to be entrepreneurs but total allocation of labour for production of y will actually fall. As more people come into sector y, the existing ones allocate less working hours towards production of y. It is a tradeoff between extensive and intensive margin. Countries with smaller amounts of $k(z)\forall z$ are likely to generate a higher $\tilde{z}$ at the initial equilibrium ($\lambda = 1$) implying the reluctance of the people to move into y as $R > r$. Surely, in such cases trade in fragments will lead to greater production of y and lower production of x. However, if initial $\tilde{z}$ is fairly low, further decline in $\tilde{z}$ may actually reduce production of y. Since $(1 - \tilde{z})$ is relatively high, a drop in λ, from $\lambda = 1$, impacts y more heavily which cannot be compensated by allowing more workers in production of y.

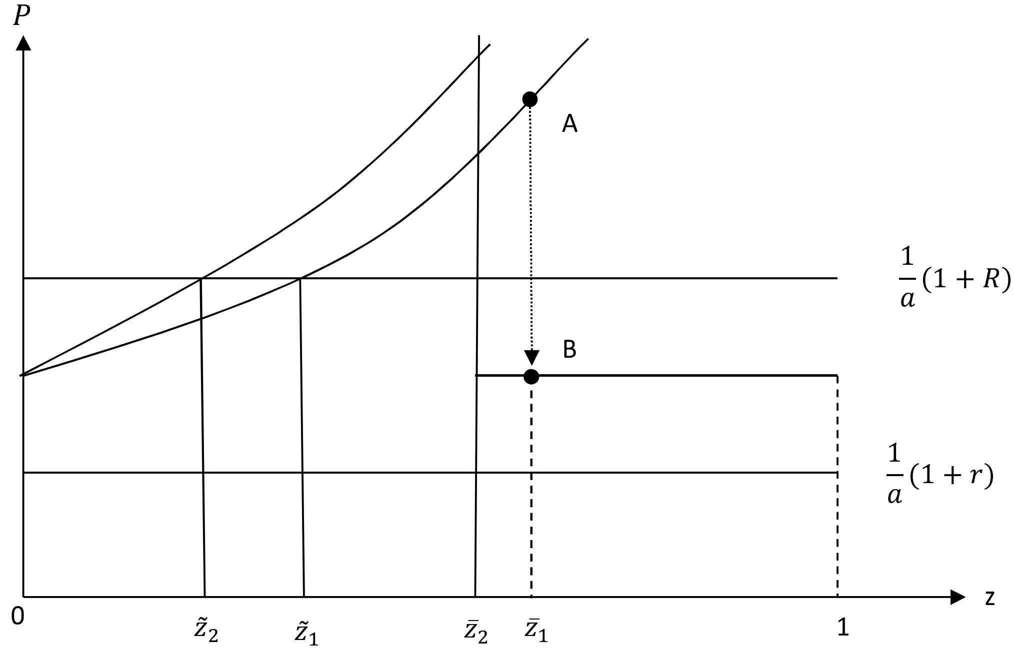

Figure 2

Let us now consider the possibility that at least some workers are endowed with enough capital so that they do not have to borrow. Since $k'(z) > 0$, let us stipulate some $\bar{z}$ such that $k(\bar{z}) = \frac{1}{a}, \bar{z} < 1$. Therefore, for $z \epsilon [\bar{z}, 1]$, workers-entrepreneurs do not need to borrow.This incentive constraint boils down to

$$P + \frac{1}{a}(1 + r) + \left(k(z) - \frac{1}{a}\right)(1 + r) \geq \frac{1}{a}(1 + r) + k(z)(1 + r)$$

$$or, P \geq \frac{1}{a}(1 + r)$$

In Figure 1, P exceeded $\frac{1}{a}(1+r)$ and, therefore, all such worker-entrepreneurs beyond $\bar{z}$ would definitely produce y. Figure 2 summarizes the new equilibrium. Initially workers from 0 to $\tilde{z}_1$ were engaged in x and $\tilde{z}_1$ to 1 were engaged in y. But for $z \in (\bar{z}_1, 1)$, the incentive constraint jumps down from A to B and coincides with the price line. With fragmentation $\tilde{z}_1$ declines up to $\tilde{z}_2$ and $z_1$declines up to $\bar{z}_2$.

In fact, relatively rich workers i.e. indexed $\bar{z}$ and beyond do not need to engage in trade in fragments since λ does not affect their incentive constraint. However, now more people do not face the constraint any more and $\bar{z}_2 < \tilde{z}_1$. Thus the prediction of the model is that with credit constraints binding, relatively poor will engage in trade. Net benefit from trade, net of the opportunity cost is greater for those who face the credit constraint because for them having greater amount of internal finance provides an added benefit. For those who does not face the borrowing constraint own finances do not matter. While relatively rich will be reluctant to trade in fragments, relatively poor will be eager to engage in such a trade. Of course those who continue to produce x will not derive the benefit from trade in fragments. Thus the workers are divided into three categories. First, the poorest who wish to move into y sector but will find credit too costly to borrow and will produce x. Second, those who will borrow and trade in fragments to produce y. Third, the richest ones who will produce y but will be indifferent towards trade in fragments.

II. General Equilibrium with endogenous P and R

In the preceding section we pinned down $\tilde{z}$ by

$$P + k(\tilde{z})(R - r) = \frac{1}{a}(1 + R) \tag{9}$$

P, R and r have been treated as given in our discussion so far. We continue to work with a deposit rate r given exogenously, but determine P and R as endogenous variables.

Given k'>0, (9) implies that with an increase in P, $k(\tilde{z})$ will fall and $\tilde{z}$ will fall. Total production of Y denoted by (1 - $\tilde{z}$) will rise and as $\tilde{z}$ goes down, production of X will decline. Hence,

$$Y/_X = f(P) \tag{10}$$

where $f' > 0$.

We close the model by a homothetic demand function

$$\frac{D_Y}{D_X} = \Phi(P) \tag{11}$$

where $\Phi' < 0$.

From (2) and (3) we determine the autarkic equilibrium relative price P_0 and the rest of the variables given R and r. Note that we shall get identical relative price in both countries as they are exact replica of each other. P^* is determined through the commodity market clearing condition given R and r.

Now we turn to the capital market or, more precisely, working capital market equilibrium which should simultaneously hold with commodity market equilibrium. We continue to assume that banks have to offer a deposit rate r, set by international considerations, which remains exogenous to the system. R is determined through demand-supply interactions in the capital market. Given P, it is straight forward to state the supply-demand balancing condition in the capital market.

$$K^s \equiv \int_0^{\tilde{z}} k(z)dz + \int_{\bar{z}}^1 (k(z) - 1/_a)dz \ = \int_{\tilde{z}}^{\bar{z}} (1/_a - k(z))dz \equiv K^d \tag{12}$$

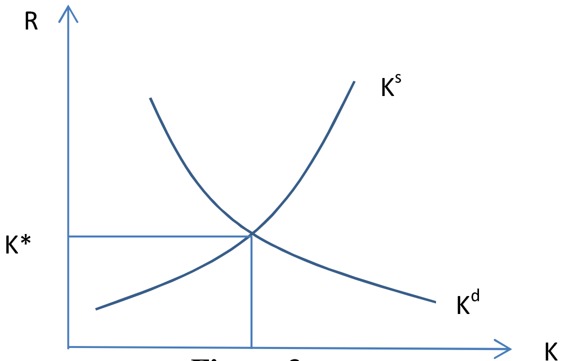

Figure 3

Consider the incentive constraint to participate in the production of Y.

$$P - {}^{1}\!/_{a}\,(1 + R) + k(\tilde{z})(R - r) = 0 \tag{13}$$

Therefore, $\left(k(\tilde{z}) - {}^{1}\!/_{a}\right) + k'(\tilde{z})\tilde{z}'(R - r) = 0$ (14)

Or, $\tilde{z}'(R) > 0$ as $k(\tilde{z}) < {}^{1}\!/_{a}$ and $k'(\tilde{z}) > 0$

An increase in R will raise K^s and reduce K^d. Intersection of K^d and K^s, in figure 3, determines k^* for a given P^*.

Finally, consider different combinations of (P^*, k^*) so that both commodity and capital markets are in equilibrium. For a given P^*, a rise in k^* will increase $\tilde{z}$, reducing relative output of Y and will raise equilibrating P^*. Thus, in Figure 4, we define an upward relation between (P^*, R^*) that clears the commodity market. Call it CC. Similarly, for a given R^*, a rise in P^* will reduce $\tilde{z}$, thus creating higher demand and lower supply of capital, thereby raising k^*. Thus we construct KK.

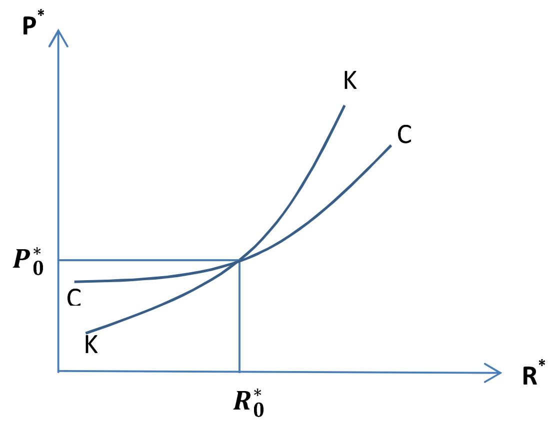

Figure 4

With the standard assumption that the commodity market equilibrium adjusts through a change in P^* and the capital market equilibrium adjusts through a change in k^*, we get the general equilibrium solution as (P_0^*, k_0^*) which is unique and stable. Now the autarkic equilibrium price needs to be compared with the rest of the world price to determine which good the country should export. One can easily show that even if one country faces a lower wage rate i.e. faces a relatively high "a" or unproductive x, compared to the other, most of the entrepreneurs will still crowd into x because they cannot get loans at a cheaper rate to produce y. On the other hand another country similarly poised but with a perfect credit market will eventually emerge as a winner by exporting y even if it does have a better x producing sector. The technological comparative advantage can be outweighed by credit disadvantage.

Proposition 3

During financial crisis if the credit availability is adversely affected through a rise in the global deposit rate r, P must rise, but R might not. However, (R-r) must go down in equilibrium. Thus countries exporting y will have to reduce production and export of y.

Proof:

At any given P and R, a rise in r must increase the cut off pint for participation in production of y, raising x and reducing y. That in turn increases P at any given R. Also as capital demand falters and supply increases, given P, R must fall. Thus in figure-4 CC shifts up and KK to the left, implying a rise in P. But R can move either way. But (R-r) must drop as the cut off k (z) cannot go down and P has to rise. QED

Point to note is that even if we do not have any explicit role of trade credit, credit shortage does affect production and reduce volume of exports. In fact as we have already argued, it can actually alter the pattern of trade.

Fragmentation is likely to affect both CC and KK and will impact (P_0^*, k_0^*). The equilibrium conditions are given by

$$S(P,R) = \frac{1-\tilde{z}(R,P)}{\frac{\tilde{z}(R,P)}{a}} \equiv D(R,P) \tag{15}$$

$$K^s(R,P) = K^d(R,P) \tag{16}$$

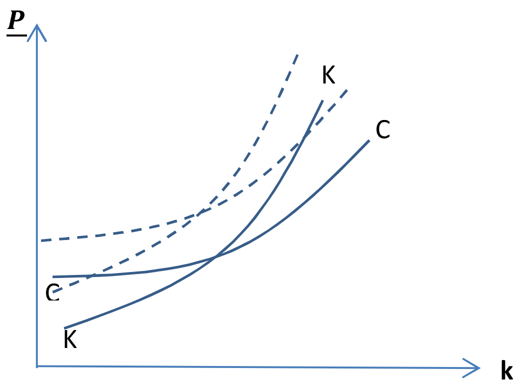

Figure 5

Equation (15) defines CC and (16) defines KK with $\frac{dp}{dk}\,|_{KK} > \frac{dp}{dr}\,|_{CC}$ for stability. Fragmentation potentially will affect both CC and KK. At a given (R,P), if we do not allow entry (i.e. if $\tilde{z}$ does not change), demand for capital will fall shifting KK to the left and CC upwards as supply of Y falls. If the effect of entry is not strong enough, the outcome can be visualized in figure 5. P is likely to increase, but R may move up or down depending on the price effect. The dominating entry effect can move CC and KK so that P may actually fall. Thus, fragmentation leads to greater efficiency by reducing the relative price of Y.

As we open up trade in fragments we get different $\tilde{z}$ in both countries. Without loss of generality let us assume that the production process of Y can be divided into only two fragments of equal size. Such a division is technologically given which splits up the process in half.

The way we have defined $\tilde{z}$ now is

$$P + \frac{k(\tilde{z})}{{}^{1}/_{2}}(R - r) = {}^{1}/_{a}\,(1 + R) \tag{17}$$

We have shown earlier that at any given P, $\tilde{z}$ will fall. Given P, we have same $\tilde{z}$ in both countries and they are lower. Total production of Y at a given P in each country is determined by

$$Y = \frac{1}{2}(1 - \tilde{z}_T) \tag{18}$$

Total production in each country will increase iff the following holds

$$\tilde{z}_T < 2\tilde{z} - 1 \tag{19}$$

The condition above states that if the new $\tilde{z}$ is lower than the old one by a certain margin, total production in each country will increase and P will fall if we allow fragmentation. The significance of this result can be seen as follows. In the standard literature in industrial organization and financial economics (Nocke and Thanassoulis (2009)) credit constraints, that force the firms to choose smaller size or fragment, tend to increase price for the consumers due to the problem of double marginalization. In this set up we can have a rising P as a consequence of fragmentation if we ignore the effect of fresh entry into the business by workers-entrepreneurs. But if we allow the entry effect to be significant fragmentation must reduce price as well and improve efficiency. Of course market structure does matter and efficiency of vertical relation will depend on price setting capacity of producers in an imperfectly competitive set up. But in that set up also one cannot ignore the consequent entry of firms who now find it profitable to engage in the production of Y.

III. Concluding Remarks

The main message of our paper is that inherently Ricardian economies constrained by the availability of credit, as reflected in a difference between the borrowing and the lending rate, will have a natural tendency to produce less of credit intensive good, will create less entrepreneurs, try to fragment production process to save the cost of borrowing etc. Such actions will lead to different outcomes when compared with a Ricardian world that enjoys perfect credit market. Richest set of firms will be like text book examples choosing to produce according to comparative advantage generated by technology as they do not face credit constraints. The poorest will choose not to produce the credit intensive good, though they would very much like to do it if there were no such constraint. They are unable to exploit the rule of comparative technological advantage. The middle ones will switch groups depending on the price and borrowing cost. It is possible that identical countries will gain from trade by sharing production of the credit intensive good releasing the pressure on their internal finance. Smaller sized activities to some extent alleviate the problem of credit market imperfection. International trade in fragments allows firms to choose smaller size of output which suffers the credit constraint. Our results suggest that those with more than adequate amount of capital are not likely to engage in such trade simply because internal financing does not assume a special role in this context. Relatively poor workers – entrepreneurs will engage in trade in intermediate or fragments. Fragmentation contributes in terms of encouraging entrepreneurs among the relatively poor echoing the observations in Jones and Marjit (2001).

We have not dealt with credit rationing in this model and credit market imperfection does not lead to any kind of quantity constraint. The idea of credit constraint used in this paper is drawn from the standard development literature i.e. papers such as Galor and Zeira (1993) or texts such as Basu (2003). It will be interesting to work out the model with credit caps. Also how inequality of asset distribution can lead to trade and then affect the asset distribution itself through a dynamic mechanism is an issue needs to be addressed in future.

References

Aghion, P., Banerjee, A., & Piketty, T. (1999). Dualism And Macroeconomic Volatility. *The Quarterly Journal of Economics, 114*(4), 1359-1397.

Basu, K (2003) - Analytical Development Economics, MIT Press

Chor, D. and K. Manova. (2012) "Off the cliff and back? Credit conditions and international trade during the global financial crisis", *Journal of International Economics*, 87.1, 117-133.

Deardorff, A. V. (2000). Financial Crisis, Trade and Fragmentation, University of Michigan, School of Public Policy, Discussion paper no. 458

Findlay, R. (1984). Growth and development in trade models. In R. W. Jones, & P. B. Kenen (Eds.), *Handbook of International Economics* (Vol. 1, pp. 185-236). Elsevier.

Findlay, R. (1995). *Factor Proportions, Trade, and Growth* (Vol. 1). MIT Press .

Galor, O and J. Zeira (1993)- Income Distribution and Macroeconomics, Review of Economic Studies, 60(1) 35-52

Hubbard, G. R. (Ed.). (1989). *Asymmetric Information, Corporate Finance, and Investment.* Chicago: University of Chicago Press.

Jones, R. W., & Marjit, S. (2001). The Role of International Fragmentation in the Development Process. *American Economic Review, 91*(2), pp. 363-366.

Jones, R., & Kierzkowski, H. (2001). A framework for fragmentation. In S. Arndt, & H. Kierzkowski (Eds.), *Fragmentation. New production patterns in the world economy.* Oxford University Press.

Manova, K. (2013), Credit Constraints, Heterogeneous Firms, and International Trade", *Review of Economic Studies* 80, 711-744.

Manova, K. and Yu, Z. (2012), "Firms and Credit Constraints along the Global Value Chain: Processing Trade in China", NBER Working Paper 18561.

Marjit, S. (1987). Trade in Intermediates and the Colonial Pattern of Trade. *Economica, 54*(214), pp. 173-184.

Marjit, S., & Yu, E. S. (Eds.). (2008). *Skill Formation and Income Distribution in a Three Class Small Developing Economy* (1 ed., Vol. 4). in Marjit , S and E. yu (eds) -Emerging Issues in International Trade, Emerlad Publishers, UK.

Matsuyama, K. (2005). Credit Market Imperfections and Patterns of International Trade and Capital Flows. *Journal of the European Economic Association, 3*(2-3 (04/05)), pp. 714 - 723.

Nocke,V and J. Thanassoulis (2009) - Vertical Relation under Credit Constraints - CEPR / CESifo working Paper

Sanyal, K. K. (1983). Vertical Specialization in a Ricardian Model with Continuum of Stages of Production. *Economica, 50*, pp. 71-78.

Steedman, I. (1979). *Fundamental Issues in Trade Theory.* Macmillan.

Endnotes

[1] Chor and Manova (2012) observe that credit conditions are an important channel through which financial crises affect trade volumes.

[2] Manova and Yu (2012) find that credit-constrained firms, and financially underdeveloped countries as a whole, are restricted to low value-added stages of the supply chain.