Money, Exchange Rate and Export Quality

Ganguly, Shrimoyee and Acharyya, Rajat

Jadavpur University

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Shrimoyee Ganguly[♣]

Rajat Acharyya[♦]

Abstract

This paper theoretically examines the effect of an expansionary monetary policy on export quality and its ramifications on the aggregate employment of the unskilled workers in a competitive general equilibrium framework of a small open economy. This issue assumes relevance since monetary policies are often pursued by the central bank of an economy to manage exchange rate fluctuations under a managed float regime, which may have adverse consequences for export-quality choices and thereby for export growth given the growing preference of buyers in richer nations for higher qualities of goods they consume. Under optimal allocation of wealth over a portfolio of cash, domestic assets and foreign assets, we show that an increase in the domestic money supply affects the choice of export-quality primarily in two ways. One is through larger investment, capital formation and consequent endowment effect; the other is through changes in the nominal exchange rate. Under less price-elastic demand for a non-traded good, the export quality is upgraded when higher quality varieties of the export good are relatively capital intensive. On the other hand, though the expansionary monetary policy may raise the aggregate employment of unskilled workers due to its endowment effect, may lower it through changes in the quality of the export good. The overall effect is thus ambiguous. A larger initial size of bequests has a similar effect.

Keywords: Monetary Policy, Export Quality, Employment, Exchange rate, Portfolio choice.

JEL Classification: E52, F11, E24

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[♣] Corresponding Author. Department of Economics, Jadavpur University, Kolkata, India. Email: shrimoyeeganguly.rs@jadavpuruniversity.in

[♦] Department of Economics, Jadavpur University, Kolkata, India. Email: rajat.acharyya@gmail.com

1. Introduction

In recent times, the global economy has witnessed a shift in the demand pattern from cheaper low quality products to high quality varieties. Studies by AbdGhani, NikMat and Sulaiman (2019), Baldwin and Harrigan (2011), Dongwen, Na, Xin, and Li (2016), Hallak (2006), Johnson (2012), Manova and Zhang (2012), among others document how quality relates to the performance of exporters. Growth rates of nations are also observed to be much higher for countries that export high-quality, high-technology intensive and sophisticated products than countries exporting low-quality products [Rodrik (2006), Hausman et al. (2007), Bayudan-Dacuycuy and Lim (2014)]. In such a context, efficacies of trade and exchange rate policies in promoting exports now largely depend on whether and to what extent these policies can incentivize domestic firms to upgrade quality of goods they export. This is all the more important for the developing countries as they typically produce cheaper goods of lower quality[1]. Effects of liberal trade policies on the quality choice by exporters have been studied by Acharyya and Jones (2001), Bas and Paunov (2021), Bas and Strauss-Khan (2013), Fan et. al. (2017), Ganguly and Acharyya (2021), and Ma and Dei (2009), in terms of the impacts that these policies have on import of inputs essential to produce high quality exports and/or the domestic factor costs for quality-upgrading.

On the other hand, effects of exchange rate changes on export quality have been analyzed by Chen and Juvenal (2016), Hu, Parsely and Tan (2017), Ganguly and Acharyya (2022) and Yu (2013). These analyses, however, have considered exchange rate as an "exogenous" variable and studied effects of exchange rate changes as exogenous shocks. But, with many developing countries switching to floating exchange rate regimes, and their central banks using monetary policies to moderate or manage exchange rate fluctuations arising from external shocks for containing inflation rates within limits and/or maintaining export competitiveness, exchange rate changes are often the (managed) outcomes of monetary policies. That is, under a managed float, the effects of exchange rate changes on quality of exports are actually consequences of monetary policies pursued by the central banks of the developing countries. Thus, a more appropriate and

[1] This low-quality phenomenon in the developing countries and a positive association between per capita income and the quality of exports have been documented in many studies. See Acharyya (2005) for an early survey and Schott (2004), Hummels and Klenow (2005) and Hallak and Schott (2011).

relevant research question would be how an expansionary or a contractionary monetary policy affects quality of exports. This is in fact a broader research question than what the existing literature on exchange rate changes and export quality addresses. This is because the monetary policies affect the choice of export-quality through other channels as well and thus have larger ramifications for quality-competitiveness of exports. One such channel, particularly relevant for the developing countries for which the aggregate output levels are constrained by scarcity of capital, is boosting investment and capital formation by lowering the cost of borrowing. But, this favourable endowment (or capacity) effect of an expansionary monetary policy causes a change in the composition of aggregate output as well due to scarcity of other factors like land and skilled workers, thereby changing the demand for these scarce factors and their prices. Such factor price (and corresponding factor-cost) changes, however, are asymmetric because the goods produced in the economy have different factor-intensities. Thus, an expansionary monetary policy affects the choice of export-quality favourably or adversely depending on whether quality upgrading requires more intensive use of skilled labour and/or domestic capital.[2] To best of our knowledge, this inter-relationship between money supply, exchange rate, domestic factor costs and the export quality remains unexplored in the existing literature and this is the broader issue that the present paper is concerned with. More precisely, we examine theoretically the effect of an expansionary monetary policy on the export quality through changes in the exchange rate for its domestic currency as well as through changes in domestic factor costs. Alternatively put, we examine the efficacy of monetary policies in promoting exports at the extensive margin.

For the purpose, we consider a competitive general equilibrium framework of an open economy suitably modified to incorporate capital formation through investment, which is, however, constrained by the availability of loanable funds. The latter is the outcome of optimal allocation of wealth by the domestic wealth-holders over a portfolio of cash, domestic assets and foreign assets. This portfolio choice theory, or the asset approach, also underlies exchange rate determination in this paper and links the money supply with the nominal exchange rate. The preference for cash holding along with our assumption of rigid unskilled money wage – that are

[2] The importance of the availability of specific skills and of capital and consequent domestic factor costs for quality choices by the exporting firms have been recently evidenced by Brambilla et al. [2012], Brambilla et al. [2014], Brambilla and Porto [2016] among others.

usually observed in many developing countries as an outcome of minimum wage laws – causes monetary policies to affect real sector of the economy and consequently the export quality. Following Acharyya and Jones (2001) and Marjit et al. (2020), we assume that the real sector of the small open economy under consideration produces three final goods: a homogenous composite traded good (T), a quality differentiated export good (Z) and a non-traded good (N). The composite traded good and non-traded goods are produced by capital, land and unskilled labour, while the quality differentiated export good uses skilled labour and capital. Flexibility of prices of capital and land ensure full employment of these resources. But all unskilled workers are not employed due to the money wage rigidity. In fact, the output levels of the composite traded and the non-traded good, and correspondingly the aggregate level of employment of unskilled workers, are constrained by the scarcity of capital and land. This has two important implications. First, the aggregate level of employment can be affected through investment and capital formation, though the direction of change would depend on how the composition of aggregate output changes. Second, since higher quality of exports require larger capital per unit, so quality upgrading may adversely affect the output of the composite-traded and the non-traded good, and correspondingly the aggregate level of employment of unskilled workers. Thus, there *may* be a potential policy conflict between augmenting exports through quality upgrading and generating larger employment for the unskilled workers. To keep things simple, we assume that the quality-differentiated export good is not domestically consumed, and in the benchmark case, consumers have identical and homothetic tastes for consumption of the composite-traded good and the non-traded good.

In this set up, we show that an increase in the domestic money supply upgrades the export quality when higher quality varieties of the export good are relatively capital intensive, under some specific conditions about the factor intensity ranking of the composite traded good and less price-elastic demand for the non-traded good defined later. On the other hand, though an expansionary monetary policy raises the aggregate level of employment of unskilled workers at the initial quality level, overall the employment change may be ambiguous since quality upgrading may lower it. These results may hold even under non-homothetic preferences, depending on the value of income elasticity of the non-traded good.

The rest of the paper is organized as follows. Section 2 describes the model whereas Section 3 discusses the comparative static analysis of the effect of an expansionary monetary policy on choice of export quality and aggregate employment of unskilled workers. In Section 4 we study role of the size of bequest, which is part of the aggregate wealth of the economy, for the choice of export quality and the aggregate employment of unskilled labour. Section 5 considers the robustness of our results under non-homothetic tastes and finally, Section 6 concludes the paper.

2. The Model

The small open economy under consideration produces two types of homogenous goods: the composite traded good (T) formed by clubbing all the traditional traded goods; and a non traded good (N). Both these goods are produced by two primary factors of production, land (J) and unskilled/low-skilled labour (L), along with capital (K), which is a produced means of production in the sense defined later. We call the sub-sector of the economy that produces these two homogeneous goods as the (T, N) nugget[3]. The economy also produces a quality differentiated export good Z, using skilled labour (S) and capital. Its quality is observable to all and is indexed by $Q \in [0, \overline{Q}]$[4]. The stock of land and the number of unskilled/low-skilled and skilled workers are exogenously given, whereas physical capital is generated through investment and its supply is therefore endogenous. We will return to the specification and process of capital formation shortly.[5] Domestic markets for all the final commodities and markets for land, capital and skilled labour are perfectly competitive. Thus, the rate of return to land (R), the rate of return to capital (r) and the skilled money wage (w_S), all expressed in domestic currency, are fully flexible and adjusts to clear the relevant factor markets. Money wage to unskilled labour, however, is pegged at the level $\overline{w}$, which is a reflection of minimum wage laws enforced by the government in developing countries to guarantee wage earnings above the subsistence level.

[3]For an earlier exposition of such a production structure see Jones (1974). Subsequently, in the open economy macro-economy literature, similar structure is used to analyse both the role of RER changes on trade balance and productivity changes on RER (Helpman (1977), Jones and Corden (1979), Dornbusch (1980) and Obsfeld and Rogoff (1996)).

[4]By the classification of Nelson (1974), the export good Z is a search good so that there is no asymmetric information and associated *lemons* problem.

[5] We here abstract from skill formation, and assume that some people are borne with some specific skill or ability. Of course, this is purpose specific given our primary concerns here as mentioned earlier.

Production technologies for the composite traded and non-traded goods, henceforth T and N, follow CRS, and per unit input requirements are technologically fixed. The economy under consideration being small, faces given world prices of all its traded goods.

Perfect competition leads to the following zero-profit conditions for T and N:

$$P_T = eP_T^W = a_{LT}\overline{w} + a_{JT}R + a_{KT}r \qquad (1)$$

$$P_N = a_{LN}\overline{w} + a_{JN}R + a_{KN}r \qquad (2)$$

where, P_T^W is the world price of good T; e is the nominal exchange rate, which is the units of the domestic currency per unit of a foreign currency (say, USD) in terms of which world prices of all traded goods are quoted; P_T is the domestic currency price of T; P_N is the domestic-currency price of the non-traded good which is determined locally; a_{ij}, $i = L,K,J$; $j = T,N$, denotes technologically fixed per unit requirement of factor i for producing good j.

On the demand side, we make two simplifying assumptions without any loss of generality. First, good Z is not domestically consumed and is produced only for export markets.[6] Second, tastes are homothetic, so that the demand for N relative to that of T depends only on the relative price of the non-traded good: $\frac{D_N}{D_T} = f\left(\frac{P_N}{P_T}\right)$. Thus, we write the domestic market clearing condition for N as:

$$\frac{D_N}{D_T} = f\left(\frac{P_N}{P_T}\right) = \frac{X_N}{X_T} \qquad (3)$$

where, $p \equiv P_N / P_T$ denotes the relative price of non tradables, or reciprocal of the real exchange rate; and X_N and X_T are the output levels of non-traded good and composite traded good respectively.

Coming to the quality differentiated export good Z, though for any given level of its quality the world price P_Z^W is exogenously given, the domestic producers get a higher price for a better quality of it, which reflects the higher marginal willingness of foreign consumers to pay for

[6] Since the economy is small, by demand irrelevance theory, even if we had assumed domestic consumption of Z, that would have no impact on domestic factor prices, and hence on export-quality.

better quality. More precisely, $P_Z^W = P_Z^W(Q)$, $P_Z^{W'}(Q) > 0$, $P_Z^{W''}(Q) > 0$. The production technology of good Z is such that the per unit requirements of skilled labour and capital, denoted by a_{SZ} and a_{KZ} respectively, are fixed for any given level of quality Q, but increase at an increasing rate with the quality level:

$$a_{hZ} = a_{hZ}(Q), a'_{hZ}(Q) > 0, a''_{hZ}(Q) > 0 \text{ ,} h = S, K \qquad (4)$$

However, larger units of skilled labour and capital required to produce a higher quality variety is not equi-proportionate, so that the relative skill intensity, $s_Z = a_{SZ}(Q)/a_{KZ}(Q)$, varies across different quality levels. Given such a specification, we write down the zero-profit condition under perfect competition with free entry of firms as:

$$eP_Z^W(Q) = a_{SZ}(Q)w_S + a_{KZ}(Q)r \qquad (5)$$

Profit maximizing export quality Q_0 is the one for which the marginal revenue from quality upgrading equals the marginal cost of quality upgrading:

$$P_Z^{W'}(Q_0) = a'_{KZ}(Q_0)r + a'_{SZ}(Q_0)w_S \qquad (6)$$

Let us now turn to capital formation. There are small investment-firms which borrow money from banks or financial intermediaries to invest in capital formation. Abstracting from the detailed process of capital formation, and considering investment simply as the addition to capital stock as in the macroeconomic and growth literature, we assume that investment worth of one domestic-currency unit generates $\phi(1)$ units of physical capital. Thus, if these investment firms together make investment worth I units of domestic currency, then the total capital stock generated is,

$$K = \phi(I), \ \phi(0) = 0, \phi' > 0, \phi'' = 0 \qquad (7)$$

With no initial stock of capital, *K* in (7) also means addition to capital stock. Note that in (7) we assume a proportionality rule: one percent increment in capital stock would require one percent additional investment. The investment-firms borrow money from the banks/financial intermediaries at the rate i_b. This lending rate of the banks is higher than the market interest rate *i* that these banks pay on bonds and deposits held by the domestic income earners (or, wealth-holders). Banks have no influence on this market interest rate (*i*), which is determined by the money market equilibrium condition stated later. The premium or the margin over the market

interest (i_b - i) charged by the banks for each unit of investment fund borrowed by the investor-firms covers the institutional costs and service charges. This margin is determined and varied by the banks according to the demand for and supply of loanable funds. We model this premium in the simplest possible manner as follows. Banks employ workers to facilitate the lending process, such as processing applications for investment loans and carrying out related administrative works. We assume that such tasks can be performed by the same low-skilled/unskilled workers who produce the composite traded good and the non-traded good. Banks employ these workers from the pool of unemployed and pay them the minimum wage $\overline{w}$ plus α, which can be interpreted in various ways such as incentives or return for some additional services they provide. Suppose each worker can manage investment fund worth one unit in domestic currency.[7] Thus, for each investment-firm the cost of borrowing unit value of investment fund is $i_b = (\alpha + \overline{w} + i)$. Setting aside any other costs of capital formation whatsoever, if each investment-firm borrows funds worth $\tilde{I}$ then, by (7), the unit cost of capital formation equals $\frac{i_b \tilde{I}}{\phi(\tilde{I})} \equiv \frac{(\alpha + \overline{w} + i)\tilde{I}}{\phi(\tilde{I})}$. The capital market offers r as the rate of return to capital which is determined by the competitive market forces: derived demand for capital coming from producers of the three goods, and the stock of capital generated through investment (according to rule (7)). Free entry in the investment sector then forces each investment firms to break-even:

$$r = \frac{i_b \tilde{I}}{\phi(\tilde{I})} \equiv \frac{(\alpha + \overline{w} + i)\tilde{I}}{\phi(\tilde{I})} \qquad (8)$$

The total value of investment (I) that can be made by the investment-firms and the consequent capital stock available for production of the three goods as per (7), however, depends on the loanable funds that can be borrowed from the banks or financial intermediaries. Following Krugman (1979), suppose foreign wealth-holders do not buy bonds denominated in home-country currency. Then the supply of such loanable funds comes entirely from the domestic wealth-holders buying domestic bonds -- assumed to be issued by these banks or financial

[7] Alternatively, this α can be viewed as a variable mark-up charged by the firm per unit of investment fund it lends out over and above the wage-cost and deposit rate i, which is paid out to each worker as "bonus".

intermediaries themselves – and/or holding deposits, with the banks lending out the entire amount of such loanable funds that it receives[8].

The total loanable funds received by the banks is an outcome of optimal allocation of wealth over portfolio. Each income earner or wealth-holder holds l proportion of wealth in zero return domestic currency, or cash, and the remainder $(1 - l)$ proportion on the interest bearing assets available.[9] Regarding interest-bearing assets, domestic wealth-holders have a choice to hold domestic currency denominated bonds or foreign currency denominated bonds, or both. Suppose, m proportion of $(1 - l)$ proportion of wealth is held in domestic assets (bonds and/or bank deposits, all yielding the same domestic interest rate), and $(1 - m)$ proportion on foreign-currency denominated assets/bonds. We assume that all economic agents have identical and homothetic preferences for allocating their wealth over cash and the two types of assets/ bonds. Thus, all wealth-holders allocate the same l and m proportions, which are outcome of their utility maximizations given the wealth-budget constraint. Cash holding means foregoing interest rate earned on domestic bonds, and accordingly the proportion of wealth held in cash would vary inversely with it:

$$l = l(i),\ l' < 0 \qquad (9)$$

On the other hand, the optimal allocation of fund over domestic and foreign bonds is determined solely by the expected returns from these two types of assets. Let the return earned against each unit of foreign bonds held be i^* in foreign currency.[10] If $\tilde{e}$ is the exchange rate expected by the wealth-holders at any point of time, then the expected rate of return on a unit of foreign bonds is

[8] Of late, production of traded goods by taking loans or credit from banks has been studied by Beladi et al. (2018), Marjit and Mishra (2020) and Marjit and Ray (2021), which motivates our analysis, although we have a different point of concern altogether.

[9] The demand for cash may be for various reasons including precautionary and speculative purposes.

[10] By the small country assumption, any change in domestic demand for foreign assets will have no effect whatsoever on this i^* and so it is given to the domestic wealth-holders. On the other hand, an unit of DCDB will yield a return of i (in home currency).

given as $i^* + \frac{\tilde{e} - e}{e}$. So the following (uncovered) interest parity condition determines the optimal portfolio-allocation over domestic and foreign assets (or bonds)[11]:

$$i = i^* + \frac{\tilde{e} - e}{e} \qquad (10)$$

A ceteris paribus increase in the domestic interest rate (or a fall in the foreign interest rate) induces a larger proportion of wealth being put in domestic bonds i.e. *m* rises. On the other hand, for any given interest rates and expectations about the future exchange rate, a depreciation of a country's currency lowers the expected domestic currency return on foreign currency deposits. This will also induce *m* to rise. Thus,

$$m = m(i, i^*, e) \quad , \quad m_i > 0,\ m_{i^*} < 0, m_e > 0 \qquad (11)$$

Given these optimal allocations, the aggregate stock of wealth of the economy (*W*) and identical and homothetic preferences, the *aggregate* demand for cash, for domestic bonds and for foreign bonds can be written as:

$$M_d = l(i)W \qquad (12)$$

$$B^D = m(i, i^*, e)[1 - l(i)]W \qquad (13a)$$

$$FB^D = [1 - m(i, i^*, e)][1 - l(i)]W \qquad (13b)$$

The aggregate stock of wealth of the economy consists of the stock of domestic money (*M*) supplied exogenously by the central bank, and the sum of bequests (Ω) that some of the citizens are endowed with:[12]

$$W = M + \Omega \qquad (14)$$

[11]We assume that the two types of assets are otherwise perfect substitutes. When assets are imperfect substitutes, they are differentiated by the element of *risk* and its degree, and this will become an additional reason for the expected returns to differ. Here we abstract from this dimension to keep our analysis simple.

[12] We assume that the bequests are received by the wealth-holders in the form of domestic financial assets which, depending on their portfolio choice, can be converted into cash and/or foreign assets. Many studies find quite large magnitudes of bequests in aggregate wealth (Kotlikoff and Summers, 1981; Lord, 1992; Modigliani, 1988; Piketty 2011). In their seminal study, Kotlikoff and Summers (1981) observed the share of bequests and other intergenerational transfers in total household wealth in the United States ranging between 46 and 81 percent depending on the calculation method used. For Denmark, Boserup et al. (2016) found that bequests account for 26 percent of average post-bequest wealth. Barthold and Ito (1992) calculated this share for both Japan and the United States in the range 25-40% in both countries. Campbell (1997) and Horioka, et al. (2002) also arrived at similar figures for Japan, viz. 23.4-28.1% and 23.9% respectively. See Davies and Shorrocks (2000) and Horioka, et al. (2002) for early surveys on such estimates.

We are not concerned here about the distribution of wealth (and bequests) and implications of inequality in wealth distribution for consumption, aggregate employment of unskilled workers, and possibly for the export quality. As such, our assumption of homothetic preferences apply not only for the goods consumed but also for portfolio allocation over cash holding and other interest-bearing assets is purpose specific and is intended to rule out implications, whatsoever, of unequal distribution of wealth.

Two comments are warranted at this point. First, at equilibrium, domestic residents must be just willing to hold the stock of domestic money supplied by the central bank. So by the portfolio choice, the money market equilibrium can be stated as:

$$M = \frac{l(i)}{1-l(i)}\Omega \qquad (15)$$

Second, by (10) and (13b) the exchange rate for the domestic currency varies with the changes in i, i^* and the stock of wealth for any given value of $\tilde{e}$:

$$e = e(i, i^*, W),\ \frac{\partial e}{\partial i} < 0,\ \frac{\partial e}{\partial i^*} > 0,\ \frac{\partial e}{\partial W} > 0 \qquad (16)$$

The larger is the stock of wealth of the economy, larger is the demand for foreign-currency denominated assets or bonds, and consequently larger is the demand for foreign currency. This causes the domestic currency to depreciate. On the other hand, a higher domestic interest rate and/or lower foreign interest rate will cause the domestic currency to appreciate by lowering the demand for foreign assets through the portfolio-allocation effect. Essentially (16) reflects how the central bank can influence the nominal exchange rate by adopting expansionary or contractionary monetary policies.

We close the characterization of the real sector of the economy with the following full employment conditions for skilled labour, capital and land, and the aggregate employment of unskilled labour as follows:

$$\bar{S} = a_{SZ}(Q)X_Z \qquad (17)$$

$$K = a_{KT}X_T + a_{KN}X_N + a_{KZ}(Q)X_Z \qquad (18)$$

$$\bar{J} = a_{JT}X_T + a_{JN}X_N \qquad (19)$$

$$L_e = a_{LT} X_T + a_{LN} X_N + L_b \qquad (20)$$

where, L_b is the employment in the banking sector, which is equal to the total loanable funds held by this sector, or total investment *I*.

The equation system (1)-(3), (5)-(8), (13a), (14), and (15)-(20) comprising of fifteen independent equations determines the fifteen variables – r, R, w_S, i, e, P_N, W, Q, α, L_e, I, K, X_T, X_N *and* X_Z – given the values of the technology and policy parameters. The market clearing condition for non-traded good (3), the money market equilibrium condition (15) and the asset market (or foreign exchange market) equilibrium condition (10) along with the marginal condition for quality choice (6) are the four key conditions of the model reflecting interdependence of the four variables of interest – domestic interest rate *i,* price of the non-traded good P_N, the nominal exchange rate e, and the level of quality Q of the export good-Z.

To explain these relationships, note first of all, that the domestic interest rate is determined solely by the level of wealth regardless of the values of P_N, e and Q. This follows directly from the money market equilibrium condition (15). Further, an increase in the money supply will increase the demand for domestic bonds through a wealth-effect – as is evident from (13a) and (14) – and thus raise the bond price and consequently lower the domestic interest rate. The lower domestic interest rate will cause a portfolio-allocation effect, which together with the wealth-effect will raise the demand for money to restore the money market equilibrium. Algebraically,

$$\hat{i} = -\frac{1}{\tilde{\mu}} \hat{M} \qquad (21)$$

where, "hat" over a variable denotes its proportional change; $\tilde{\mu} = \dfrac{\mu}{1 - l(i)} > 0$ and $\mu = -\dfrac{l'(i)i}{l(i)}$ is the absolute value of interest elasticity of the proportion of wealth held in cash.

Second, the exchange rate is also determined by the level of wealth regardless of the values of P_N and Q. But now, any change in the level of wealth will affect the value of *e* through both the wealth effect as well as the portfolio-allocation effect. From (16) we can check this:

$$\hat{e} = -e_i \hat{i} + e_W W_M \hat{M} \qquad (22)$$

where, e_i *and* e_W are the absolute values of elasticity of nominal value of exchange rate with respect to change in the domestic rate of interest and the value of wealth respectively; and W_M is the share of money stock in total wealth.

Third, P_N and Q are interdependent, causing each other for any given level of wealth. Therefore, given these three observations, we focus on the simultaneous determination of P_N and Q. Consider a ceteris paribus rise in the level of quality of export good Z. As shown in the appendix, this will raise the capital requirement in the Z sector (denoted by K_Z) if higher qualities are relatively more capital intensive than skilled labour, and lower it in the opposite case:

$$\hat{K}_Z = \hat{a}_{KZ} + \hat{Z} = (\gamma_{KZ} - \gamma_{SZ})\hat{Q} \begin{cases} > 0 \text{ if } \gamma_{KZ} > \gamma_{SZ} \\ < 0 \text{ if } \gamma_{KZ} < \gamma_{SZ} \end{cases} \qquad (23)$$

Note that changes in the relative skill intensity, $s_Z = a_{SZ}(Q)/a_{KZ}(Q)$, across different quality levels is captured by $\hat{s}_Z = (\gamma_{SZ} - \gamma_{KZ})\hat{Q}$, where, $\gamma_{iZ} \equiv \dfrac{Qa'_{iZ}(Q)}{a_{iZ}(Q)}$, $i = S, K$, are the quality elasticities of the per unit input requirement and are positive. Thus, quality varieties of Z are relatively more skill intensive if $\gamma_{SZ} > \gamma_{KZ}$, and more capital intensive otherwise.

Let us first consider the case when $\gamma_{KZ} < \gamma_{SZ}$ so that $\hat{K}_Z < 0$. The capital released from production of Z increases the net capital stock available for production of other goods, and thus triggers an output magnification effect by which output of T rises and that of N falls under the assumption that the former uses capital more intensively than land per unit of output relative to the latter in the following sense:[13]

$$\frac{a_{KT}}{a_{KN}} > \frac{a_{JT}}{a_{JN}} \qquad (24)$$

The emerging excess demand, at the initial P_N, will cause the market for N to clear at a higher price P_N. By similar reasoning, an increase in the export quality will lower P_N when $\gamma_{KZ} > \gamma_{SZ}$. These relationships are represented by the curve labelled $P_N(Q)$ in Figure 1, which is the locus

[13] See Jones (1965) or Caves, Frankel and Jones (1997, or any other edition) for the output magnification effect.

of all combinations of Q and P_N for which the non-traded market clears and all the zero-profit conditions are fulfilled.

On the other hand, from the marginal condition for quality choice (6) emerges how a change in P_N will affect the quality choice through change in the factor prices. By the price magnification effect, a ceteris paribus increase in P_N, *for any given value of the nominal exchange rate,* will raise the rate of return to land (R) and lower the rate of return to capital (r) under (24). The fall in *r* lowers the cost of production for any given quality of Z, and thereby encourages producers to expand the scale of production of Z. The demand for skilled workers and their wages thus rise. Accordingly, the marginal cost of quality falls (rises) if higher qualities are relatively capital-(skill)-intensive, which induces producers to upgrade (downgrade) the quality of good Z. As the marginal revenue from quality is unchanged for any given Q at an initial value of the nominal exchange rate, so for the producers of export-good Z, what matters is how the marginal cost of quality changes when P_N rises ceteris paribus. This locus of all combinations of Q and P_N for which the marginal condition for quality choice is satisfied is represented by the curve labelled $Q(P_N)$ in Figure 1. Thus, the relative skill-intensity of higher quality varieties of good Z determines the nature of both the causal relationships, but in exactly the opposite ways. Under $\gamma_{KZ} < \gamma_{SZ}$, whereas the $P_N(Q)$ curve slopes upward, the $Q(P_N)$ curve slopes downward. For $\gamma_{KZ} > \gamma_{SZ}$, these slopes reverse. Given these two relationships, for any given level of aggregate wealth, equilibrium P_N and Q are determined simultaneously at the intersection of $Q(P_N)$ and $P_N(Q)$ schedules in Figure 1. These in turn determine the output levels and correspondingly the aggregate level of employment of the unskilled workers.

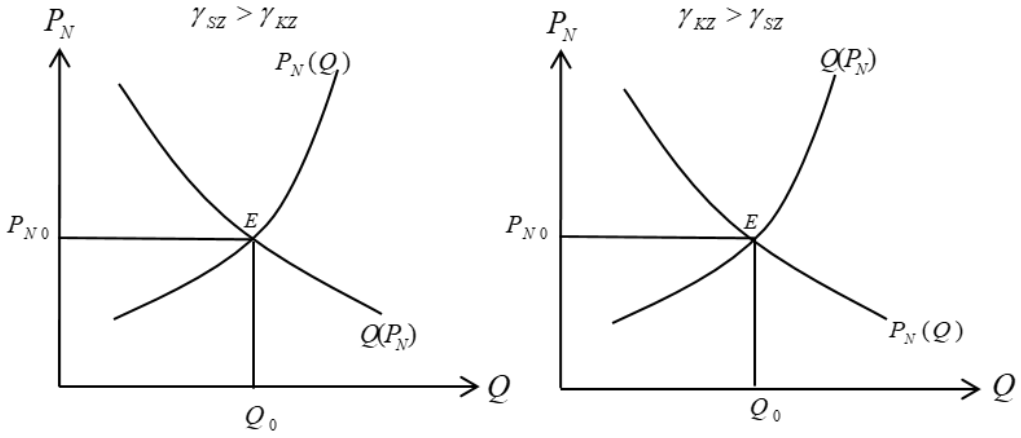

Figure 1: Simultaneous derivation of $Q(P_N)$ and $P_N(Q)$ at initial level of wealth

In the following sections, given this initial equilibrium, we discuss implications of a higher money stock and/or a higher level of bequests on the choice of export quality and consequently on the aggregate level of employment of unskilled labour.

3. Expansionary Monetary Policy, Quality and Employment

We first consider the effect on the export quality – which does not depend on the level of employment of unskilled workers – and thereafter on the aggregate level of employment.

3.1 Effect on Export Quality

Suppose the central bank prints new currency notes and puts into circulation, which increases the aggregate wealth of the economy proportionately. Accordingly, at the initial equilibrium domestic interest rate, the cash holding and demand for domestic and foreign assets all increase equi-proportionately. Thus, by the wealth-effect the supply of loanable funds in the banks increases. At the initial rate of return to capital, consequent excess supply of loanable funds forces the banks to lower the premium α to generate the demand from the investment-firms. The level of investment and capital formation thus increase. There are also subsequent portfolio-allocation effects triggered by these wealth-effects. First, a larger demand for foreign assets raises the demand for foreign currency and thereby causes the domestic currency to depreciate in value. Given the expectations about the future exchange rate, this lowers the expected domestic currency return on foreign currency deposits and induces the domestic wealth-holders to

substitute foreign assets by domestic assets dampening the initial increase in the demand for foreign assets to some extent. Thus, a larger *proportion* of wealth will now be held in domestic assets, which raises the investment further. Second, increase in the demand for domestic bonds due to wealth effect raises the bond price and correspondingly lowers the domestic interest rate. Hence, a smaller proportion of wealth will now be held in domestic assets or bonds. On this account the supply of loanable funds and correspondingly investment decline. Since these effects are triggered by the wealth-effect that initially raised the demand for domestic bonds, so even if the *net* portfolio-allocation effect is adverse[14], it is likely to be weaker so that, overall, an increase in the money supply raises the investment. Algebraically, this is given by the following *sufficient* condition (see appendix):

$$(1+m_e e_W)W_M > \frac{(m_i+\tilde{\mu}-\mu)-m_e e_i}{\tilde{\mu}} \qquad (25)$$

where, the parameters are as defined earlier.

As the investment-firms can invest more, it raises capital formation, by (7). The consequent increase in the capital stock triggers an output magnification effect by which output of the composite traded rises and that of the non-traded good falls under the assumption in (24). The emerging excess demand for the non-traded good causes its price to rise, for all values of Q. Since this occurs irrespective of the relative skill intensity of higher qualities of Z, it is captured through an upward shift of the $P_N(Q)$ schedule in both panels of Figure 2. On the other hand, the rise in value of the nominal exchange rate induced by the money supply expansion will lead to reallocation of resources in the (T,N) nugget for any given P_N. This will raise the rate of return to capital and lower that of land. As the cost of production of good Z rises for any given level of quality, producers will lower output and the demand as well as wage to skilled labour will fall. From the marginal condition for quality choice, the quality of export good Z will be upgraded when higher quality varieties of good Z is relatively skill intensive than capital and downgraded

[14] Note, a negative net portfolio-allocation effect means that the supply of loanable funds is an increasing function of the domestic interest rate.

otherwise. Referring back to Figure 2, this effect on Q for all values of P_N will be captured through a rightward shift of the $Q(P_N)$ schedule in panel-a and a leftward shift in panel-b.

Thus, whereas the equilibrium price of the non-traded good rises unambiguously, change in the export quality is ambiguous and depends on the relative shifts of the two loci. As shown in the appendix, if the composite traded good employs relatively more labour per unit of output than land in the following sense,

$$\frac{a_{LT}}{a_{JT}} > \frac{a_{LN}}{a_{JN}} \tag{26}$$

then the vertical shift of the $P_N(Q)$ curve is larger than the vertical shift of the $Q(P_N)$ curve if the price elasticity of the demand for non-traded good is smaller than a critical value:

$$\varepsilon_N < \bar{\varepsilon}_N = \frac{\theta_{JT}\left\{\frac{W_M}{|\lambda|_{KJ}} + \frac{m_e}{|\lambda|_{KJ}}\left(\frac{e_i}{\tilde{\mu}} + e_W W_M\right) - \frac{(m_i + \tilde{\mu} - \mu)}{|\lambda|_{KJ}\ \tilde{\mu}}\right\}}{\left(\frac{e_i}{\tilde{\mu}} + e_W W_M\right)|\theta|_{LJ}} \tag{27}$$

Note, $|\theta|_{LJ} = \theta_{LT}\theta_{JN} - \theta_{JT}\theta_{LN}$ is positive by (26). Recall that an increase in the money supply lowers the supply of the non-traded good under the assumption in (24). Consequent excess demand necessitates P_N to rise to restore equilibrium in the non-traded market. Smaller is the price elasticity of demand for the non-traded good, larger will be the required increase in P_N, and accordingly larger will be the vertical shift of the P_N(Q) curve. Thus, if the price elasticity of demand for the non-traded good is sufficiently low in the sense defined in (27), the vertical shift of the P_N(Q) curve is larger than the vertical shift of the $Q(P_N)$ curve. In such a case, export quality is upgraded when $\gamma_{KZ} > \gamma_{SZ}$ and downgraded when $\gamma_{KZ} < \gamma_{SZ}$. These cases are illustrated in Figure 2.

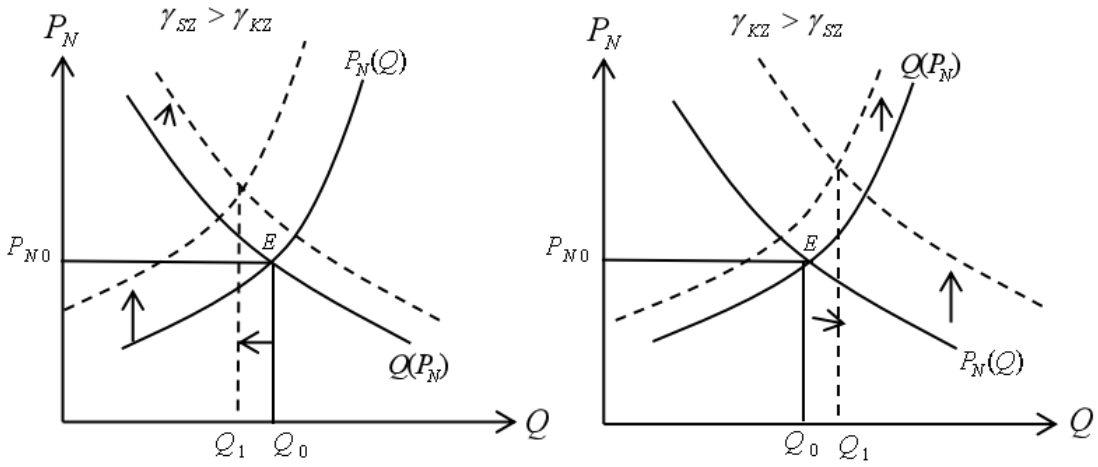

Figure 2: Effect of rise in Money Supply on Export Quality

On the other hand, if the composite traded sector employ relatively less unskilled labour per unit of output so that the reverse inequality in (26) holds – and accordingly $|\theta|_{LJ} < 0$ – then the vertical shift of the P_N(Q) curve will *always* be larger than the vertical shift of the $Q(P_N)$ curve. Accordingly, the export quality will be upgraded when $\gamma_{KZ} > \gamma_{SZ}$ and downgraded when $\gamma_{KZ} < \gamma_{SZ}$ regardless of the value of ε_N. All these can be verified from the following algebraic expression for change in the export quality:

$$\hat{Q} = \frac{\theta_{KZ}(\gamma_{SZ} - \gamma_{KZ})}{\phi\delta|\theta|\Delta}\left[\frac{\theta_{JT}\{m_e e_i - (m_i + \tilde{\mu} - \mu) + e_W m_e \tilde{\mu} W_M\}}{\tilde{\mu}|\lambda|_{KJ}} - \varepsilon_N\left(\frac{e_i}{\tilde{\mu}} + e_W W_M\right)|\theta|_{LJ}\right]\hat{M} \qquad (28)$$

where, $\Delta = \left(\varepsilon_N - \frac{\theta_{KZ}\lambda_{KZ}\theta_{JT}(\gamma_{SZ} - \gamma_{KZ})^2}{\phi\delta|\theta|_{KJ}|\lambda|_{KJ}}\right) > 0$.

The above discussions can be summarized as follows,

Proposition 1:
Under the factor intensity assumption in (26) and the elasticity condition in (27)*, an increase in the domestic money supply upgrades the export quality when higher quality varieties of the export good are relatively capital intensive, and downgrades the export quality otherwise. The same result holds under the factor intensity ranking opposite to that defined in (26), regardless of the value of price elasticity of the non-traded good.*

Proof: Follows from the discussions above and (28). See appendix for algebraic details. □

Proposition 1 implies that even under some specific conditions such as the factor intensity ranking of the composite traded good defined in (26), and less elastic demand for the non-traded good – like the one in (27) – the impact of an expansionary monetary policy on quality of an export good is uncertain and depends on its nature. If the quality-differentiated export product Z is a manufacturing good like scientific instruments, defence equipments, household and office equipments, electrical appliances, transport equipment and the like, then higher qualities of it are relatively more capital intensive. Its quality is then upgraded by the producers consequent upon the expansionary monetary policy. On the other hand, if Z is a product like gems and jewellery, software, ITeS, and financial services, the higher quality varieties of which are more skill-intensive, then an expansionary monetary policy is expected to downgrade its quality. The intuition is simple. As explained earlier, an increase in the money supply raises both P_N and the value of the exchange rate, which in turn have contrasting effects on the rate of return to capital and the skilled wage, and consequently on the marginal cost of quality. While the increase in P_N lowers the rate of return to capital (under the factor intensity assumption in (24)) and raises the skilled wage, the increase in e changes those in the opposite directions. Thus, overall, the change in the marginal cost of quality depends on two things. First, whether the impacts of the increase in P_N is larger than that of the increase in e or not; and, second, whether higher quality varieties of Z is relatively skill or capital intensive. The vertical shift of the $Q(P_N)$ curve indicates the extent to which P_N must rise to offset exactly the contrasting effects of the increase in e so that the export quality remains the same. But, this will characterize the new equilibrium only when the $P_N(Q)$ curve shifts up to the same extent, that is, when $\varepsilon_N = \bar{\varepsilon}_N$ for reasons spelled out earlier. But, if $\varepsilon_N < \bar{\varepsilon}_N$ then at the new equilibrium P_N rises more than the level that could exactly offset the impacts of the increase in e. Consequently, overall, the rate of return to capital would fall and the skilled wage would rise, thereby lowering the marginal cost of quality if $\gamma_{KZ} > \gamma_{SZ}$ and raising it when $\gamma_{KZ} < \gamma_{SZ}$. Hence quality is upgraded in the former case and downgraded in the latter by the producers. On the other hand, when the composite traded good and the non-traded good have the opposite factor intensity ranking with regard to unskilled labour and land than the one specified in (26), then at the new equilibrium, the rise in P_N is always more than level that could exactly offset the impacts of the increase in e. Thus, again the

quality is upgraded when $\gamma_{KZ} > \gamma_{SZ}$ and downgraded when $\gamma_{KZ} < \gamma_{SZ}$, but now for any value of the price elasticity of demand for the non-traded good.

These results as stated in Proposition 1 also imply that there will be asymmetric quality variations across product groups in the export basket of a country consequent upon an expansionary monetary policy when such product groups differ from each other in terms of relative skill-intensity of their respective higher qualities. This provides another theoretical explanation for the observed asymmetric quality variations in countries like Brazil, China and India documented and explained in a companion paper in terms of trade liberalization (Ganguly and Acharyya, 2021).

3.2 Employment effect

It may be imperative from the discussions so far that an expansionary monetary policy affects the aggregate level of employment of unskilled labour in two ways. First, by changing the level of investment and capital formation at the initial level of export quality; and second, by reallocating scarce capital between the export-sector Z and the (T, N) nugget through the variation in the quality of good Z. As spelled out above, at initial *Q,* a rise in the money supply raises the level of investment both by the primary wealth effect as well as secondary portfolio allocation effect under the assumption in (25). Consequent capital formation, in turn, raises output of the composite traded and lowers that of the non-traded good. This change in the composition of output in the (T, N) nugget raises the aggregate employment of unskilled workers if the factor intensity condition in (26) holds. But, in the opposite case, the aggregate employment will fall due to this composition effect. This brings out the importance of how a policy changes the composition of output in a multi-sector economy.

There will, however, be an employment expansion in the banking sector due to larger banking activity as the increase in the money supply raises the supply of loanable funds. Thus, if this employment expansion in the banking sector is larger than the net fall in employment due to change in output composition when reverse inequality in (26) holds, overall the aggregate employment can still increase, at the initial level of quality. Algebraically, as shown in the

appendix, this will happen when the following condition holds, which is quite plausible under the assumption of relative capital-land ratio made in (24):

$$\lambda_{Lb} + \frac{|\lambda|_{LJ}}{|\lambda|_{KJ}} > 0 \qquad (29)$$

where, λ_{Lb} is the share of banking sector in total employment of unskilled workers; $|\lambda|_{LJ} = \lambda_{LT}\lambda_{JN} - \lambda_{LN}\lambda_{JT}$, which is positive if (26) holds and negative otherwise; and $|\lambda|_{KJ} = \lambda_{KT}\lambda_{JN} - \lambda_{JT}\lambda_{KN}$ is positive under (24).

Turning now to the employment effect through quality variations, note that by (23) and the conditions laid down in Proposition 1 – that is, the factor intensity condition (26) along with the low elasticity value defined in (27), or the factor intensity condition opposite to the one specified in (27) – the capital requirement in Z sector rises, regardless of whether the quality of good Z is upgraded or downgraded. Consequently, quality variation following the rise in the domestic money supply withdraws some capital from the (T, N) nugget, which changes the composition of output *now* in favour of the non-traded good. Thus, the aggregate employment of unskilled workers declines due to quality variation under condition (26). So, overall, the employment change is ambiguous: while there is an employment expansion at the initial quality level, the aggregate employment declines due to the quality variation. On the other hand, when the reverse factor intensity condition than stated in (26) holds, then aggregate employment rises due to quality variation through withdrawal of some capital from the (T, N) nugget and consequent change in the composition of output towards the non-traded good. Thus, now the employment expansion at the initial quality level gets reinforced. All these can be verified from the following algebraic expression for the change in the aggregate employment of unskilled labour:

$$\hat{L}_e = \left[\left(\lambda_{Lb} + \frac{|\lambda|_{LJ}}{|\lambda|_{KJ}}\right)\left\{W_M + m_e\left(\frac{e_i}{\tilde{\mu}} + e_W W_M\right) - \frac{(m_i + \tilde{\mu} - \mu)}{\tilde{\mu}}\right\}\right]\hat{M} + \frac{|\lambda|_{LJ}}{|\lambda|_{KJ}}\frac{\lambda_{KZ}\theta_{KZ}(\gamma_{SZ} - \gamma_{KZ})^2 F}{\phi\delta|\theta|\Delta}\hat{M} \qquad (30)$$

where, $F \equiv \left[\frac{\theta_{JT}\{m_e e_i - (m_i + \tilde{\mu} - \mu) + e_W m_e \tilde{\mu} W_M\}}{\tilde{\mu}|\lambda|_{KJ}} - \varepsilon_N\left(\frac{e_i}{\tilde{\mu}} + e_W W_M\right)|\theta|_{LJ}\right] > 0$ under the conditions stated in Proposition 1.

The first term on the right-hand-side in (30) is the direct effect of the expansionary monetary policy, whereas the second term captures the employment change induced by the quality variation. The above discussion can be summarized in the Proposition 2 below:

Proposition 2: *An expansionary monetary policy though raises the aggregate level of employment of unskilled workers at the initial quality level under the factor intensity condition (26) and the elasticity condition (27), overall the employment change may be ambiguous. For the factor intensity condition opposite to the one stated in (26), overall aggregate employment increases if (29) holds.*
Proof: Follows from discussion above. See appendix for algebraic details. □

Proposition 2 and the underlying discussions have several implications. First, they bring out the role of the output composition brought about by a policy change in a multi-sector economy. Second, a policy conflict between promoting exports at the extensive margin and generating employment through an expansionary monetary policy emerges in the case where the level of employment declines due to quality variation. It also highlights the need for taking into account changes in exports at the extensive margin while evaluating the employment effects of a policy like monetary expansion. Finally, overall contractionary employment effect of an expansionary monetary policy can be related to the contractionary effect of a devaluation demonstrated by Krugman and Taylor (1977).

4. Role of Bequest

To capture the importance of the initial level or size of the bequest in the present context, consider a larger sum of bequest held by the domestic wealth-holders. Given a particular stock of money, this larger sum of bequest would increase the supply of loanable funds and therefore level of investment in the economy through the wealth effect, similar to the one spelled out in the earlier section. But, now the portfolio-allocation effects induced by this wealth effect would be different. First, the domestic interest rate will now be higher since larger wealth due to larger bequests would increase the demand for cash holding. This is evident from (21) for any given money stock and capturing larger bequests by $\hat{\Omega} > 0$:

$$\hat{i} = \frac{1}{\tilde{\mu}}\hat{\Omega} \qquad (31)$$

This would cause a smaller proportion of wealth to be held in cash and a larger proportion in domestic bonds. Higher domestic interest rate will also cause domestic wealth holders to substitute foreign assets by domestic assets. Supply of loanable funds for investment thus increases on both counts. Second, a larger size of bequests also means a higher demand for foreign assets by wealth effect for any given *i* and *e*. This raises the demand for foreign currency and causes the domestic currency to depreciate. On the other hand, as higher domestic interest rate corresponding to larger bequests leads to substitution of foreign assets by the domestic assets, the demand for foreign currency declines, thereby causing the domestic currency to appreciate. This will dampen to some extent the larger proportion of wealth being held in domestic assets. Overall, initial level of bequests being larger will imply larger holding of domestic assets and supply of loanable funds, and a sufficient condition, though not a necessary one, to ensure this is that the value of the exchange rate is higher:

$$\hat{e} = \left(e_W (1 - W_M) - \frac{e_i}{\tilde{\mu}} \right) \hat{b} > 0 \qquad (32)$$

That is, we assume the wealth effect on *e* is stronger than the portfolio allocation effect due to higher domestic interest rate:

$$e_W (1 - W_M) > \frac{e_i}{\tilde{\mu}} \qquad (32a)$$

Given this assumption, it is straightforward to comprehend that the implications of a larger initial size of bequests for the export quality and the aggregate employment of labour would be similar to that of an increase in money supply.

The above discussion gives us the following Proposition:

Proposition 3: *Larger initial size of bequest, will have the same implications for the choice of export quality and the aggregate employment of unskilled labour as an expansionary monetary policy.*

Proof: Follows from the discussion above. □

The above implications of the size of the bequests for export quality and aggregate employment have some interesting policy dimensions. Bequests are often taxed by the government. Denote the post-tax value of bequests as $\Pi = (1 - \tau)\Omega$, where $0 < \tau < 1$ is the proportional tax imposed on the value of bequest, such that $\hat{\Pi} = (1 - \hat{\xi}) + \hat{\Omega}$. It then follows from the above discussion that

such a tax on bequest may lower export quality, and also may have a contractionary employment effect.

5. Robustness Analysis: Non-Homothetic Tastes and the Income Effect

In this section we check robustness of our results when consumers have non-homothetic preferences for the two consumption goods. The aggregate demand for T and N will now depend on the national income in addition to the relative price (or the RER). Accordingly, we rewrite the market clearing condition for non-traded good as:

$$D_N(p, y) = X_N \qquad (3a)$$

where, $y = w_s\bar{S} + R\bar{J} + \bar{w}L_e + \alpha L_B$ is the national income of the economy measured in domestic currency.

Change in the demand for good N will therefore be brought about by the changes in the RER as well as in the national income consequent upon the expansionary monetary policy:

$$\hat{D}_N = -\tilde{\varepsilon}_N(\hat{P}_N - \hat{e}) + \eta\hat{y} \qquad (33)$$

where, $\tilde{\varepsilon}_N$ and η are respectively price and income elasticity of the demand for good N.

On the other hand, proportional change in the real income is given as:

$$\hat{y} = \theta_S\hat{w}_S + \theta_J\hat{R} + \theta_L\hat{L}_e + \theta_B(\hat{\alpha} + \hat{L}_B) \qquad (34)$$

where, θ_i ; $i = S, J, L, B$, denotes share of the income earners in national income (and total consumption expenditure) y.

Note that if the non-traded good is income inelastic in demand $(\eta = 0)$, then (33) essentially boils down to the benchmark case with homothetic tastes. Since the non-traded market clearing condition underlies the derivation of the $P_N(Q)$ schedule, we revisit that particular relationship when $\eta \neq 0$. Recall that by (23), a ceteris paribus upgrading of quality releases capital from the Z sector and thus lowers the output of the N good when $\gamma_{KZ} < \gamma_{SZ}$. This is captured through a leftward shift of the supply curve of good N in Figure 3. The assumption of non-homothetic tastes will now cause the demand curve to shift as well. However, from the zero-profit conditions it follows that the factor prices can change only through a change in P_N, given e. Thus, part of the change in y and corresponding shift of the demand curve D_N will be triggered by the change in

$P_{N.}$ As P_N rises under $\gamma_{KZ} < \gamma_{SZ}$, the rate of return to land rises and that to capital falls given the ranking by capital-land ratio specified in (24). The skilled wage rises as well. Hence, on these accounts, the national income increases. The level of employment in the (T, N) nugget also increases under the factor intensity condition (26). Note that the employment in the banking sector is tied to the total supply of loanable funds, and remain invariant with respect to ceteris paribus rise in the level of quality. But lower rate of return to capital causes investment demand to fall and the banks lower α to maintain equality between investment demand and supply. Thus, income of the workers employed in the banking sector falls. But overall, one can expect *y* to rise. Thus, demand for N rises which reinforces the rise in P_N. Hence, $P_N(Q)$ curve is still positively sloped under $\gamma_{KZ} < \gamma_{SZ}$. On the other hand, when $\gamma_{KZ} > \gamma_{SZ}$, a ceteris paribus rise in quality withdraws some capital from the (T, N) nugget. This raises the output of the non-traded good by output magnification effect and lowers P_N by the supply effect. This in turn causes *r* to rise and both w_S and *R* to fall. Hence, now the national income falls on this account. Employment in the (T, N) nugget now falls under (26). On the other hand, higher *r* and consequent larger investment demand induces banks to raise α and workers in the banking sector gains. But again we can expect national income to fall. Hence, demand for N must fall, thereby depressing the price further, so that $P_N(Q)$ curve is still negatively sloped when $\gamma_{KZ} > \gamma_{SZ}$.

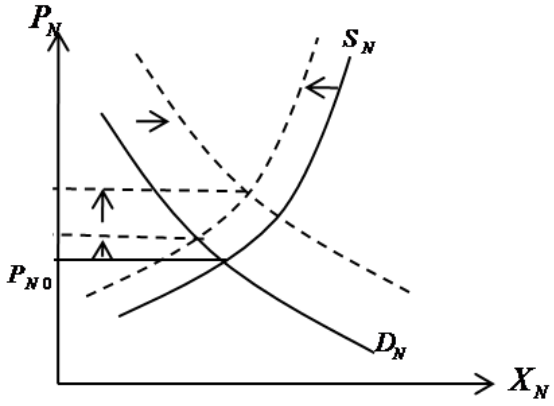

Figure 3: Non-traded market clearing under non-homothetic tastes

So non-homothetic tastes only enhance the magnitude by which P_N changes in response to rise in *Q,* the magnitude being larger, stronger is the value of income elasticity of demand (η). So the relationship represented by $P_N(Q)$ curve will remain unchanged in essence as in the benchmark

case but only be steeper. Therefore, the rest of the analysis will remain the same and so will Proposition 1 and 2. Moreover, the strength of Proposition 1 will also be magnified in the sense that now, the rise in money supply will generate an additional income effect. The positive wealth effect and the consequent fall in domestic interest rate and depreciation of domestic currency together raises *y* by raising the level of investment in the economy. This will cause the $P_N(Q)$ curve to shift up by a greater magnitude than it would have in the benchmark case ($\eta=0$). This raises the range of values of elasticity of demand of the non-traded good for which the magnitude of upward shift of $P_N(Q)$ curve will exceed that of the $Q(P_N)$ curve. Put in another way, the condition in (27) will become even more plausible and chances of quality upgrading when $\gamma_{KZ} > \gamma_{SZ}$ and its downgrading when $\gamma_{KZ} < \gamma_{SZ}$ will be even more robust. On the other hand, if the condition in (26) does not hold, then the change in national income *y* is ambiguous under both $\gamma_{KZ} > \gamma_{SZ}$ and $\gamma_{KZ} < \gamma_{SZ}$. For example, under $\gamma_{KZ} < \gamma_{SZ}$, whereas w_S and R rises, employment in the (T, N) nugget falls along with the income of workers in the banking sector. So the increase in *y* when $\gamma_{KZ} < \gamma_{SZ}$ and its fall otherwise will now only be conditional. This may reverse the slope of the $P_N(Q)$ curve represented in Figure 1. However, a sufficiently small value of income elasticity will ensure the results stated in Propositions 1 and 2 in case the rise in P_N lowers the national income.

6. Conclusion

In this paper we have examined the effect of an expansionary monetary policy on the export quality and its ramifications for the aggregate employment of the unskilled workers. In a competitive three sector general equilibrium framework with rigid unskilled money wage and endogenous capital formation financed by the supply of loanable funds by the domestic wealth holders, we have shown that an increase in the domestic money supply upgrades the export quality under some specific factor-intensity and elasticity conditions when higher quality varieties of the export good are relatively capital intensive. On the other hand, though the aggregate employment increases at the initial quality level, the overall effect may be ambiguous. A larger initial size of bequests has a similar effect on the export quality and the aggregate employment. Results are robust and even stronger under non-homothetic tastes if the composite traded good employs more unskilled labour than the non-traded good.

The paper lends itself readily for future extensions. One such extension is to consider alternative transmission mechanism of an expansionary monetary policy, such as credit expansion through commercial banks. In this context, another relevant future extension can be exploring the role of imperfect credit market with credit rationing. The level of financial development itself can be an important determinant and explanation for low-quality phenomenon in the developing country.

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Appendix

A.1. Effect of rise in money supply on Investment

As investment is given by the supply of loanable funds or demand for domestic bonds in the economy, total differentiation of the expression for B^D given by (13a) yields:

$$dI = \left(\frac{\partial m}{\partial i}di + \frac{\partial m}{\partial i^*}di^* + \frac{\partial m}{\partial e}de\right)\left[1-l(i)\right]W + m(i,i^*,e)W\left(-\frac{\partial l}{\partial i}di\right) + m(i,i^*,e)\left[1-l(i)\right]dW$$

$$\Rightarrow \hat{I} = m_i\hat{i} + m_{i^*}\hat{i}^* + m_e\hat{e} + \left(\tilde{\mu}-\mu\right)\hat{i} + \hat{W} \qquad \text{(A.1)}$$

where, $\left(\tilde{\mu}-\mu\right) > 0$ by definition.

Substituting expression for change in wealth as $\hat{W} = W_M\hat{M}$ at initial unchanged level of bequest such that $\hat{\Omega} = 0$ and $\hat{i}^* = 0$, in (A.1) we get:

$$\Rightarrow \hat{I} = m_e\hat{e} + \left(m_i + \tilde{\mu} - \mu\right)\hat{i} + W_M\hat{M} \qquad \text{(A.2)}$$

A.2 Derivation of $P_N(Q)$ schedule

Using (7) in the text, the percentage change form of the capital constraint (18) gives us:

$$\hat{I} = \frac{a_{KT}X_T}{\bar{K}}\hat{X}_T + \frac{a_{KN}X_N}{\bar{K}}\hat{X}_N + \frac{a_{SZ}(Q)X_Z}{\bar{K}}\left(\frac{\partial a_{KZ}(Q)}{\partial Q}\frac{Q}{a_{KZ}(Q)}\hat{Q} + \hat{X}_Z\right)$$

$$\Rightarrow \hat{I} = \lambda_{KT}\hat{X}_T + \lambda_{KN}\hat{X}_N + \lambda_{KZ}\left(\gamma_{KZ}\hat{Q} + \hat{X}_Z\right) \quad \text{(A.3)}$$

Percentage change form of the skilled labour constraint (17) will give:

$$0 = \left(\frac{\partial a_{SZ}(Q)}{\partial Q}\frac{Q}{a_{SZ}(Q)}\hat{Q} + \hat{X}_Z\right)\frac{a_{SZ}(Q)X_Z}{\bar{S}}$$

$$\Rightarrow \hat{X}_Z = -\gamma_{SZ}\hat{Q} \quad \text{(A.4)}$$

Note that the term in the parenthesis on the right hand side in (A.3) is the proportional change in the capital requirement in the Z sector, which using (A.4) boils down to the expression in (23) in the text:

$$\hat{K}_Z = \gamma_{KZ}\hat{Q} + \hat{Z} = (\gamma_{KZ} - \gamma_{SZ})\hat{Q}$$

Now, substituting (A.2) and (A.4) back in (A.3) gives:

$$\lambda_{KT}\hat{X}_T + \lambda_{KN}\hat{X}_N = m_e\hat{e} + (m_i + \tilde{\mu} - \mu)\hat{i} + W_M\hat{M} + \lambda_{KZ}(\gamma_{SZ} - \gamma_{KZ})\hat{Q} \quad \text{(A.5)}$$

Percentage change form of the land constraint (19) will give:

$$\lambda_{JT}\hat{X}_T + \lambda_{JN}\hat{X}_N = 0 \quad \text{(A.6)}$$

Representing (A.5) and (A.6) in matrix notation:

$$\begin{bmatrix} \lambda_{KT} & \lambda_{KN} \\ \lambda_{JT} & \lambda_{JN} \end{bmatrix}\begin{bmatrix} \hat{X}_T \\ \hat{X}_N \end{bmatrix} = \begin{bmatrix} m_e\hat{e} + (m_i + \tilde{\mu} - \mu)\hat{i} + W_M\hat{M} + \lambda_{KZ}(\gamma_{SZ} - \gamma_{KZ})\hat{Q} \\ 0 \end{bmatrix}$$

Solving for the values of $\hat{X}_T$ and $\hat{X}_N$ by Cramer's rule, we get:

$$\hat{X}_T = \lambda_{JN}\frac{m_e\hat{e} + (m_i + \tilde{\mu} - \mu)\hat{i} + W_M\hat{M} + \lambda_{KZ}(\gamma_{SZ} - \gamma_{KZ})\hat{Q}}{|\lambda|_{KJ}} \quad \text{(A.7)}$$

$$\hat{X}_N = -\lambda_{JT}\frac{m_e\hat{e} + (m_i + \tilde{\mu} - \mu)\hat{i} + W_M\hat{M} + \lambda_{KZ}(\gamma_{SZ} - \gamma_{KZ})\hat{Q}}{|\lambda|_{KJ}} \quad \text{(A.8)}$$

The market clearing condition in the non traded sector under homothetic tastes gives:

$$-\varepsilon_N(\hat{P}_N - \hat{e}) = \hat{X}_N - \hat{X}_T \quad \text{(A.9)}$$

Substituting expression for $\hat{e}$ as given in (22) in the text, and using (A.7) and (A.8), we can rewrite (A.9) as:

$$\varepsilon_N\hat{P}_N - \frac{\lambda_{KZ}(\gamma_{SZ} - \gamma_{KZ})}{|\lambda|_{KJ}}\hat{Q} = \left\{\frac{W_M}{|\lambda|_{KJ}} + \left(\varepsilon_N + \frac{m_e}{|\lambda|_{KJ}}\right)\left(e_W W_M + \frac{e_i}{\tilde{\mu}}\right) - \frac{(m_i + \tilde{\mu} - \mu)}{\tilde{\mu}|\lambda|_{KJ}}\right\}\hat{M} \quad \text{(A.10)}$$

For $\hat{M} = 0$, (A.10) gives us a relationship between Q and P_N consistent with the market-clearing condition for the non-traded good as captured by the $P_N(Q)$ curve in the text:

$$\hat{P}_N = \frac{\lambda_{KZ}(\gamma_{SZ} - \gamma_{KZ})}{\varepsilon_N|\lambda|_{KJ}}\hat{Q} \quad \text{(A.10a)}$$

A.3. Derivation of $Q(P_N)$ schedule

From the zero profit conditions for good T and good N we can obtain:

$$\hat{R} = \frac{\theta_{KT}\hat{P}_N - \theta_{KN}\hat{e}}{|\theta|_{KJ}} \;;\; \hat{r} = \frac{\theta_{JN}\hat{e} - \theta_{JT}\hat{P}_N}{|\theta|_{KJ}} \qquad \text{(A.11)}$$

From the zero profit condition in the Z sector we get:

$$eP_Z^{W'}(Q)dQ + P_Z^W(Q)de = w_S\frac{\partial a_{SZ}(Q)}{\partial Q}dQ + a_{SZ}(Q)dw_S + r\frac{\partial a_{KZ}(Q)}{\partial Q}dQ + a_{KZ}(Q)dr \qquad \text{(A.12)}$$

Using the marginal condition for quality choice given by (6) in (A.12) we get change in skilled wage as:

$$\hat{w}_S = \frac{\hat{e}}{\theta_{SZ}} - \frac{\theta_{KZ}\hat{r}}{\theta_{SZ}} \qquad \text{(A.13)}$$

From (A.12) we get:

$$\Rightarrow \frac{Q^2}{eP_Z^W}\delta\hat{Q} + \frac{QP_Z^{W'}}{P_Z^W}\hat{e} = \frac{a_{SZ}(Q)w_S}{eP_Z^W}\left[\frac{Qa_{SZ}'(Q)}{a_{SZ}(Q)}\right]\hat{w}_S + \frac{a_{KZ}(Q)r}{eP_Z^W}\left[\frac{Qa_{KZ}'(Q)}{a_{KZ}(Q)}\right]\hat{r}$$

$$\Rightarrow \varphi\delta\hat{Q} + \gamma_Z\hat{e} = \theta_{SZ}\gamma_{SZ}\hat{w}_S + \theta_{KZ}\gamma_{KZ}\hat{r} \qquad \text{(A.14)}$$

where, $\varphi = \frac{Q^2}{eP_Z^W}$ *and* $\delta \equiv \left[eP_Z^{W''}(Q) - w_S a_{SZ}''(Q)dQ - r a_{KZ}''(Q)dQ\right] < 0$ by the second order condition for profit maximization.

Substitution of $\hat{w}_S$ from (A.13) and $\hat{r}$ from (A.11) and expression for $\hat{e}$ as given in (22) in the text, in (A.14), we get:

$$\hat{Q} - \frac{\theta_{KZ}(\gamma_{SZ}-\gamma_{KZ})}{\varphi\delta|\theta|}\theta_{JT}\hat{P}_N = \frac{\theta_{KZ}(\gamma_{SZ}-\gamma_{KZ})}{\varphi\delta|\theta|}\left\{(|\theta| - \theta_{JN})\left(e_W W_M + \frac{e_i}{\tilde{\mu}}\right)\right\}\hat{M} \qquad \text{(A.15)}$$

For $\hat{M} = 0$, (A.15) gives us a relationship between Q and P_N consistent with the marginal condition for quality choice of good Z as captured by the $Q(P_N)$ curve in the text:

$$\hat{Q} = \frac{\theta_{KZ}(\gamma_{SZ}-\gamma_{KZ})}{\varphi\delta|\theta|}\theta_{JT}\hat{P}_N \qquad \text{(A.15a)}$$

A.4. Money supply and Investment

Substitution of $\hat{e} = -e_i\hat{i} + e_W W_M\hat{M}$ and $\hat{i} = -\frac{1}{\tilde{\mu}}\hat{M}$ in (A.2) yields:

$$\hat{I} = \left\{(1 + m_e e_W)W_M + \frac{m_e e_i - (m_i + \tilde{\mu} - \mu)}{\tilde{\mu}}\right\}\hat{M}$$

Hence, $\hat{I} > 0$ for $\hat{M} > 0$ if the condition in (25) holds.

A.5. Derivation of the critical value of ε_N

The magnitude of upward shift of the $P_N(Q)$ curve, that is the effect of $\hat{M} > 0$ on P_N for any given quality ($\hat{Q} = 0$) is given as:

$$\left.\frac{dP_N}{dM}\right|_{P_N(Q)} = \frac{1}{\varepsilon_N}\left\{\frac{W_M}{|\lambda|_{KJ}} + \left(\varepsilon_N + \frac{m_e}{|\lambda|_{KJ}}\right)\left(e_W W_M + \frac{e_i}{\tilde{\mu}}\right) - \frac{(m_i + \tilde{\mu} - \mu)}{\tilde{\mu}\,|\lambda|_{KJ}}\right\}\frac{P_N}{M}$$

The magnitude of upward shift of the $Q(P_N)$ curve, that is the effect of $\hat{M} > 0$ on P_N for any given quality ($\hat{Q} = 0$) is given as:

$$\left.\frac{dP_N}{dM}\right|_{Q(P_N)} = \left\{-\left(\frac{|\theta| - \theta_{JN}}{\theta_{JT}}\right)\left(e_W W_M + \frac{e_i}{\tilde{\mu}}\right)\right\}\frac{P_N}{M}$$

The vertical shift of the $P_N(Q)$ curve will be larger than the vertical shift of the $Q(P_N)$ curve if:

$$\left.\frac{dP_N}{dM}\right|_{P_N(Q)} > \left.\frac{dP_N}{dM}\right|_{Q(P_N)} \Rightarrow \frac{1}{\varepsilon_N}\left\{\frac{W_M}{|\lambda|_{KJ}} + \left(\varepsilon_N + \frac{m_e}{|\lambda|_{KJ}}\right)\left(e_W W_M + \frac{e_i}{\tilde{\mu}}\right) - \frac{(m_i + \tilde{\mu} - \mu)}{\tilde{\mu}\,|\lambda|_{KJ}}\right\} > -\left(\frac{|\theta|_{KJ} - \theta_{JN}}{\theta_{JT}}\right)\left(e_W W_M + \frac{e_i}{\tilde{\mu}}\right)$$

where, $\left(1 + \frac{|\theta|_{KJ} - \theta_{JN}}{\theta_{JT}}\right) = -\frac{|\theta|_{LJ}}{\theta_{JT}}$.

Rearranging the terms in the above inequality gives the critical value $\bar{\varepsilon}_N$ as in (27) in the text.

A.6. Condition for $\lambda_{Lb} + \frac{|\lambda|_{LJ}}{|\lambda|_{KJ}} > 0$

By definition,

$$\lambda_{Lb} + \frac{|\lambda|_{LJ}}{|\lambda|_{KJ}} = \frac{\lambda_{Lb}(\lambda_{KT}\lambda_{JN} - \lambda_{KN}\lambda_{JT}) + \lambda_{LT}\lambda_{JN} - \lambda_{JT}\lambda_{LN}}{|\lambda|_{KJ}}$$

$$= \frac{\lambda_{Lb}\{\lambda_{KT}(1 - \lambda_{JT}) - (1 - \lambda_{KT})\lambda_{JT}\} + \lambda_{LT}(1 - \lambda_{JT}) - \lambda_{JT}(1 - \lambda_{LT} - \lambda_{Lb})}{|\lambda|_{KJ}}$$

$$= \frac{\lambda_{Lb}(\lambda_{KT} - \lambda_{JT}) + \lambda_{LT} - \lambda_{JT} + \lambda_{JT}\lambda_{Lb}}{|\lambda|_{KJ}} = \frac{\lambda_{Lb}\lambda_{KT} + \lambda_{LT} - \lambda_{JT}}{|\lambda|_{KJ}}$$

So even if $|\lambda|_{LJ} < 0$, $\lambda_{Lb} + \frac{|\lambda|_{LJ}}{|\lambda|_{KJ}}$ can be positive since $\lambda_{KT} > \lambda_{JT}$ by condition (24) in the text.