Appendices to Barriers to Firm Growth in Open Economies

Facundo Piguillem[*] EIEF

Loris Rubini[†] UC3M

Appendix A The Endogenous Distribution of Firms

Define $\mathcal{Z} = [z_1, z_2]$

$$\hat{\mu}(t + dt, \mathcal{Z}) = \int_{\mathcal{Z}} \hat{\mu}(t, z - \dot{z}dt)e^{-\delta dt}dz$$

Taking limits as $z_1 \to z_2 \to z$

$$\hat{\mu}(t + dt, z) = \hat{\mu}(t, z - \dot{z}dt)e^{-\delta dt}$$

For small dt, the following holds:

$$\begin{aligned} \hat{\mu}(t + dt, z) &\approx \hat{\mu}(t, z) + \hat{\mu}_1(t, z)dt \\ \hat{\mu}(t, z - \dot{z}dt) &\approx \hat{\mu}(t, z) - \hat{\mu}_2(t, z)\dot{z}dt \\ e^{-\delta dt} &\approx (1 - \delta dt) \end{aligned}$$

Thus,

$$\hat{\mu}(t, z) + \hat{\mu}_1(t, z)dt = \hat{\mu}(t, z) - \hat{\mu}_2(t, z)\dot{z}dt - \delta dt \left(\hat{\mu}(t, z) + \hat{\mu}_2(t, z)\dot{z}dt\right)$$

Note that in steady state $\hat{\mu}_1(t, z) = 0$. Putting all together,

$$\hat{\mu}(t, z) = \hat{\mu}(t, z) - \hat{\mu}_2(t, z)\dot{z}dt - \delta dt \left(\hat{\mu}(t, z) + \hat{\mu}_2(t, z)\dot{z}dt\right)$$

Eliminating all the terms with dt elevated to a power larger than 1,

$$\hat{\mu}(t, z) = \hat{\mu}(t, z) - \hat{\mu}_2(t, z)\dot{z}dt - \delta\hat{\mu}(t, z)dt$$

[*]facundo.piguillem@gmail.com

[†]lrubini@eco.uc3m.es

Cancelling terms and dividing by dt,

$$\delta\hat{\mu}(t,z) = -\hat{\mu}_2(t,z)\dot{z}$$

Define the steady state distribution as $\mu(z) = \hat{\mu}(t,z)$ for all t. For non exporters, the distribution is

$$\delta\mu(z) = -\mu'(z)g_d(z)z$$

To solve, use the border condition $\mu(1) = M$. For exporters

$$\delta\mu(z) = -\mu'(z)g_x z$$

To solve, use the border condition $\mu(z_x) = \mu_d(z_x)$, where $\mu_d(z_x)$ is the measure of non exporters that reach the export threshold.

The solution to these distributions works as follows. Start with the exporter distribution. The differential equation can be written as

$$-\frac{\mu'(z)}{\mu(z)} = \frac{\delta}{g(z)z} \tag{1}$$

where $g(z) = g_x$ for exporters and $g_d(z)$ for non exporters. For exporters, integrating on both sides,

$$\log(\mu(z)) = \log(z^{-\delta/g_x}) + C_x$$

where C_x is the constant of integration, and is determined using the border condition. Taking exponentials yields the distribution of exporters.

For non exporters, we can only integrate both sides of (1) given our guess for the growth rates. The equation becomes

$$-\frac{\mu'(z)}{\mu(z)} = \delta(a/z + b + cz + dz^2)$$

Integrating on both sides,

$$\log(\mu(z)) = \delta(a\log(z) + bz + \frac{cz^2}{2} + \frac{dz^3}{3}) + C_d$$

where C_d is the constant of integration and is determined using the border condition. Taking exponentials yields the distribution of non exporters.

Appendix B Productivity

The goal is to derive the reduced form for aggregate output

$$Q_j = Z_j N_{pj}$$

where $Q_j = \left[\int_1^\infty q_j(z)^{\frac{\sigma-1}{\sigma}}\mu_j(dz) + \int_{z_x^*}^\infty q_j^*(z)^{\frac{\sigma-1}{\sigma}}\mu^*(dz)\right]^{\frac{\sigma}{\sigma-1}}$ and N_{pj} is labor used for production. Let $n_{dj}(z)$ denote labor for production of units sold domestically and $n_{j,*}(z)$ for exports. With some algebra, we find

$$n_{dj}(z) = (\sigma-1)\frac{\pi_{dj}}{w_j(1+\tau_{lj})}z$$
$$n_{j,*}(z) = (\sigma-1)\frac{\pi_{xj}-\pi_{dj}}{w_j(1+\tau_{lj})}z$$

Labor used in production is

$$N_{pj} = (\sigma-1)\left[\frac{\pi_{dj}}{w_j(1+\tau_{lj})}\int_1^\infty z\mu_j(dz) + \frac{\pi_{xj}-\pi_{dj}}{w_j(1+\tau_{lj})}\int_{z_{xj}}^\infty z\mu_j(dz)\right]$$

From trade balance,

$$\sigma(\pi_{xj}-\pi_{dj})\int_{z_{xj}}^\infty z\mu(dz) = \sigma\frac{\pi_{dj}}{(w_j(1+\tau_{lj}))^{1-\sigma}}X^* \tag{2}$$

where $X^* = (1+\tau_x^*)^{1-\sigma}(w^*(1+\tau_l^*))^{1-\sigma}\int_{z_x^*}^\infty z\mu^*(dz)$. The left hand side of equation (2) is exports and the right hand side is imports. X^* is supply of foreign goods, which we take as given following the small open economy assumption. We can rewrite total production labor as

$$N_{pj} = (\sigma-1)\frac{\pi_{dj}}{(w_j(1+\tau_{lj}))}\left[\int_1^\infty z\mu_j(dz) + (w_j(1+\tau_{lj}))^{\sigma-1}X^*\right]$$

Since $\pi_{dj} = Q_j P_j^\sigma (w_j(1+\tau_{lj}))^{1-\sigma}\sigma^{-\sigma}(\sigma-1)^{\sigma-1}$.

$$N_{pj} = \left(\frac{(\sigma-1)}{\sigma}\right)^\sigma \frac{Q_j P_j^\sigma}{(w_j(1+\tau_{lj}))^\sigma}\left[\int_1^\infty z\mu_j(dz) + (w_j(1+\tau_{lj}))^{\sigma-1}X^*\right]$$
$$N_{pj} = \left(\frac{(\sigma-1)}{\sigma}\right)^\sigma \frac{Q_j P_j^\sigma}{(w_j(1+\tau_{lj}))^\sigma}\tilde{Z}_j$$

where $\tilde{Z}_j = \int_1^\infty z\mu_j(dz) + (w_j(1+\tau_{lj}))^{\sigma-1}X^*$.

Next consider the price P_j. By definition,

$$\begin{aligned}
P_j^{1-\sigma} &= \int_1^\infty p_j(z)^{1-\sigma} + (1+\tau_x^*)^{1-\sigma} \int_{z_x^*}^\infty p^*(z)^{1-\sigma} \\
&= \left(\frac{\sigma}{\sigma-1}(w_j(1+\tau_{lj}))\right)^{1-\sigma} \left(\int_1^\infty z\mu_j(dz) + (w_j(1+\tau_{lj}))^{\sigma-1} X^*\right) \\
&= \left(\frac{\sigma}{\sigma-1}(w_j(1+\tau_{lj}))\right)^{1-\sigma} \tilde{Z}_j
\end{aligned}$$

Thus,

$$\begin{aligned}
N_{pj} &= \left(\frac{(\sigma-1)}{\sigma}\right)^{\sigma} \frac{Q_j P_j^{\sigma}}{(w_j(1+\tau_{lj}))^{\sigma}} P^{1-\sigma} \left(\frac{\sigma}{\sigma-1}(w_j(1+\tau_l j))\right)^{\sigma-1} \\
&= \frac{(\sigma-1)}{\sigma} \frac{Q_j P_j}{w_j(1+\tau_{lj})} \\
&= \frac{(\sigma-1)}{\sigma} \frac{Q_j}{w_j(1+\tau_{lj})} \frac{\sigma}{\sigma-1}(w_j(1+\tau_{lj})) \tilde{Z}_j^{\frac{1}{1-\sigma}} \\
&= Q_j \tilde{Z}_j^{\frac{1}{1-\sigma}}
\end{aligned}$$

Rearranging,

$$Q_j = Z_j N_{pj}$$

where

$$Z_j = \left[\int_1^\infty z\mu_j(dz) + (w_j(1+\tau_{lj}))^{\sigma-1} X^*\right]^{\frac{1}{\sigma-1}}$$

Appendix C Proof of Proposition 2

Proof: Using equation (15) evaluated at $z = 1$ and using the free-entry condition,

$$w_j \kappa_e = \pi_{jj} + \frac{\kappa_{I,j} g_{dj}(1)^2}{2}$$

Exporter profits are

$$\pi_{xj} = \pi_{jj} + \left(\frac{D_j w_j}{w^*}\right)^2 \pi_d^*$$

where $D_j = 1 + \tau_{xj}$. Thus,

$$\pi_{xj} = w_j\kappa_e - \frac{w_j\kappa_{Ij}g_{dj}(1)^2}{2} + \left(\frac{D_j w_j}{w^*}\right)^{1-\sigma}\pi_d^*$$

Rearrange the above equation to introduce the growth rate g_x into it. To do so, multiply both sides by $2[(\rho+\delta)^2\kappa_{Ij}w_j]^{-1}$ to obtain

$$\frac{2\pi_{xj}}{(\rho+\delta)^2\kappa_{Ij}w_j} = \frac{2\kappa_e}{\kappa_{Ij}(\rho+\delta)} - \frac{g_{dj}(1)^2}{(\rho+\delta)^2} + \frac{2\pi_d^*}{\kappa_{Ij}w_j(\rho+\delta)^2}\left(D_j\frac{w_j}{w^*}\right)^{1-\sigma}$$

Using equation (12) on the left hand side of the above equation,

$$1 - \left(1 - \frac{g_{xj}}{(\rho+\delta)}\right)^2 = \frac{2\kappa_e}{\kappa_{Ij}(\rho+\delta)} - \frac{g_{dj}(1)^2}{(\rho+\delta)^2} + \frac{2\pi_d^*}{w_j\kappa_{Ij}(\rho+\delta)^2}\left(D_j\frac{w_j}{w^*}\right)^{1-\sigma} \tag{3}$$

To introduce κ_j^c, notice that in the closed economy the following must hold:

$$1 - \left(1 - \frac{\kappa_e}{(\rho+\delta)\kappa_j^c}\right)^2 = 1 - \left(1 - \frac{g_{xj}}{(\rho+\delta)}\right)^2$$

Introducing the last expression in equation (3) and simplifying,

$$2\frac{\kappa_e}{\rho+\delta}\left[\frac{1}{\kappa_j^c} - \frac{1}{\kappa_{Ij}}\right] = \left(\frac{\kappa_e}{(\rho+\delta)\kappa_j^c}\right)^2 - \frac{g_{dj}(1)^2}{(\rho+\delta)^2} + \frac{2\pi_d^*}{\kappa_{Ij}w_j(\rho+\delta)^2}\left(D_j\frac{w_j}{w^*}\right)^{1-\sigma}$$

From free entry in the closed economy, $g_{xj} = \frac{\kappa_e}{\kappa_j^c}$, so

$$2\kappa_e(\rho+\delta)\left[\frac{1}{\kappa_j^c} - \frac{1}{\kappa_{Ij}}\right] = g_{xj}^2 - g_{dj}(1)^2 + \frac{2\pi_d^*}{w_j\kappa_{Ij}}\left(D_j\frac{w_j}{w^*}\right)^{1-\sigma} \tag{4}$$

Since profits are always positive and by Proposition 1, $g_{xj} > g_{dj}(1)$, the right hand side of the above equation is positive. Thus, it must be the case that $\frac{1}{\kappa_j^c} > \frac{1}{\kappa_{Ij}}$, or $\kappa_j^c < \kappa_{Ij}$. □

Appendix D Proof of Corollary 1

Taking the difference of (20) for the two countries and reorganizing:

$$\kappa^{d2} - \kappa^{d1} = \alpha(\kappa_{I2} - \kappa_{I1}) + \frac{\chi}{2\rho}[g_{x1}^2 - g_{x1}^2 + g_{d2}(1)^2 - g_{d1}(1)^2] + \frac{\chi}{2\rho}\left[\frac{2\pi_2}{\kappa_{I,1}w_1}\left(D_1\frac{w_1}{w_2}\right)^{1-\sigma} - \frac{2\pi_1}{\kappa_{I,2}w_2}\left(D_2\frac{w_2}{w_1}\right)^{1-\sigma}\right]$$

where $0 < \alpha = \frac{\kappa^{d2}\kappa^{d1}}{\kappa_{I2}\kappa_{I1}} < 1$ and $\chi = \frac{\kappa^{d2}\kappa^{d1}}{\kappa_e} > 0$.

Because of the definition of exporters's profits

$$\kappa^{d2} - \kappa^{d1} = \alpha(\kappa_{I2} - \kappa_{I1}) + \frac{\chi}{2\rho}[g_{x1}^2 - g_{x1}^2 + g_{d2}(1)^2 - g_{d1}(1)^2] + \frac{\chi}{2\rho}\left[\frac{2(\pi_{x1} - \pi_1)}{\kappa_{I,1}w_1} - \frac{2(\pi_{x2} - \pi_2)}{\kappa_{I,2}w_2}\right]$$

$$\kappa^{d2} - \kappa^{d1} = \alpha(\kappa_{I2} - \kappa_{I1}) + \frac{\chi}{2\rho}[g_{x1}^2 - g_{x1}^2 + g_{d2}(1)^2 - g_{d1}(1)^2] + \frac{\rho\chi}{2}\left[h_{x1} - h_{d1} - (h_{x2} - h_{d2})\right]$$

Using the optimal innovation policy of the exporter

$$h_{x1} - h_{x2} = \left(1 - \frac{g_{x2}}{\rho}\right)^2 - \left(1 - \frac{g_{x2}}{\rho}\right)^2 = \left(\frac{g_{x2}}{\rho}\right)^2 - \left(\frac{g_{x1}}{\rho}\right)^2 + \frac{2}{\rho}(g_{x1} - g_{x2})$$

Therefore:

$$\kappa^{d2} - \kappa^{d1} = \alpha(\kappa_{I2} - \kappa_{I1}) + \chi[g_{x1} - g_{x2}] + \frac{\chi}{2\rho}[g_{d2}(1)^2 - g_{d1}(1)^2] + \frac{\rho\chi}{2}\left[h_{d2} - h_{d1}\right]$$

Similarly,

$$\kappa^{d2} - \kappa^{d1} = \alpha(\kappa_{I2} - \kappa_{I1}) + \chi[g_{x1} - g_{x2}] + \frac{\chi}{2\rho}[g_{d2}(1)^2 - g_{1,2}^2 - g_{d1}(1)^2 + g_{,11}^2] + \chi[g_{1,2} - g_{1,1}]$$

where $g_{1,i}$ are given by equation (**??**) for all i.

$$\kappa^{d2} - \kappa^{d1} = \alpha(\kappa_{I2} - \kappa_{I1}) + \chi[g_{x1} - g_{x2} + g_{1,2} - g_{1,1}] + \frac{\chi}{2\rho}[g_{d2}(1)^2 - g_{1,2}^2 - g_{d1}(1)^2 + g_{1,1}^2]$$

where $g_{di}(1) \geq g_i = \rho\left(1 - \sqrt{1 - h_{di}}\right)$

Appendix E Proof of Proposition 5

When $\kappa_x = 0$, given the closed form solution for the variables in equilibrium derived in the main section of the paper, and using trade balance, wages are

$$w^{\sigma-1} = \frac{\int z d\mu(z)}{X^*}\frac{\pi_x - \pi_d}{\pi_d} = \frac{\int z d\mu(z)}{X^*}\frac{w^{1-\sigma}\tilde{\pi}}{\pi_d} \Rightarrow w^{2(\sigma-1)} = \frac{\kappa_e}{\delta\kappa_I\kappa_e - \kappa_e^2}\frac{\tilde{\pi}}{X^*}\frac{1}{\pi_d}$$

$$w = \left(\frac{\kappa_e}{\delta\kappa_I\kappa_e - \kappa_e^2}\frac{\tilde{\pi}}{X^*}\frac{1}{\pi_d}\right)^{\frac{1}{2(\sigma-1)}}$$

To solve this, we need to know the value of π_d. Notice that

$$\frac{\pi_x}{w} = \kappa_e \left(1 - \frac{\kappa_e}{2\kappa_I}\right) = \frac{\pi_d + w^{1-\sigma}\tilde{\pi}}{w}$$

where $\tilde{\pi} = (1+\tau_x)^{1-\sigma} \frac{\pi^*}{w^{*1-\sigma}}$.

Introducing in this expression the value for w defines the following implicit function

$$\pi_d^{\frac{2\sigma-1}{2(\sigma-1)}} \left(\frac{(\delta\kappa_I - \kappa_e)X^*}{\tilde{\pi}}\right)^{\frac{1}{2(\sigma-1)}} + \pi_d^{\frac{\sigma}{2(\sigma-1)}} \left(\frac{(\delta\kappa_I - \kappa_e)X^*}{\tilde{\pi}}\right)^{\frac{\sigma}{2(\sigma-1)}} \tilde{\pi} = \kappa_e \left(1 - \frac{\kappa_e}{2\kappa_I}\right)$$

Next we build towards showing that $\frac{\partial Z_x}{\partial \kappa_I} > \frac{\partial Z_c}{\partial \kappa_I}$. We cannot show it generally, but we can find a sufficient condition for this to happen. This condition is that $\sigma < 3/2$.

We first show that $\frac{\partial \frac{\pi_x}{\pi_d}}{\partial \kappa_I} < 0$, which, by proposition 4, implies that $\frac{\partial Z_x}{\partial \kappa_I} > \frac{\partial Z_c}{\partial \kappa_I}$. To show $\frac{\partial \frac{\pi_x}{\pi_d}}{\partial \kappa_I} < 0$ we proceed by contradiction. Thus, we show that if $\frac{\partial \frac{\pi_x}{\pi_d}}{\partial \kappa_I} \geq 0$, then it must be the case that $\frac{\partial \pi_d}{\partial \kappa_I} \geq 0$. But we also show that under our sufficient condition this cannot happen. We start by showing this last result, and then the main proposition.

Lemma 1 *If $\sigma < 3/2$*

$$\partial \pi_d / \partial \kappa_I < 0$$

Proof: Using the implicit function theorem, we show that if $\sigma < 3/2$ then $\partial \pi_d / \partial \kappa_I < 0$. Notice, this is a *sufficient* condition, but it will help us prove that $\partial \pi_x / \pi_d / \partial \kappa_I > 0$.

Define

$$\hat{\pi}_d = \pi_d^{\frac{1}{2(\sigma-1)}}$$

Then the equation that defines $\hat{\pi}_d$ is

$$F = \hat{\pi}_d^{2\sigma-1} \left(\frac{X^*}{\tilde{\pi}}\right)^{\frac{1}{2(\sigma-1)}} (\delta\kappa_I - \kappa_e)^{\frac{1}{2(\sigma-1)}} + \hat{\pi}_d^{\sigma} \left(\frac{X^*}{\tilde{\pi}}\right)^{\frac{\sigma}{2(\sigma-1)}} (\delta\kappa_I - \kappa_e)^{\frac{\sigma}{2(\sigma-1)}} \tilde{\pi} - \kappa_e + \frac{\kappa_e^2}{2\kappa_I} = 0 \tag{5}$$

The implicit function theorem says

$$\frac{\partial \hat{\pi}_d}{\partial \kappa_I} = -\frac{\frac{\partial F}{\partial \kappa_I}}{\frac{\partial F}{\partial \hat{\pi}_d}}$$

It is easy to check that $\frac{\partial F}{\partial \hat{\pi}_d} > 0$. So we need to check that $\frac{\partial F}{\partial \kappa_I} > 0$.

$$\frac{\partial F}{\partial \kappa_I} = \frac{\delta \left[\hat{\pi}_d^{2\sigma-1} \left(\frac{X^*}{\tilde{\pi}}\right)^{\frac{1}{2(\sigma-1)}} (\delta\kappa_I - \kappa_e)^{\frac{1}{2(\sigma-1)}} + \sigma \hat{\pi}_d^{\sigma} \left(\frac{X^*}{\tilde{\pi}}\right)^{\frac{\sigma}{2(\sigma-1)}} (\delta\kappa_I - \kappa_e)^{\frac{\sigma}{2(\sigma-1)}} \tilde{\pi} \right]}{2(\sigma-1)(\delta\kappa_I - \kappa_e)} - \frac{\kappa_e^2}{2\kappa_I^2} >$$
$$\frac{\delta \left[\hat{\pi}_d^{2\sigma-1} \left(\frac{X^*}{\tilde{\pi}}\right)^{\frac{1}{2(\sigma-1)}} (\delta\kappa_I - \kappa_e)^{\frac{1}{2(\sigma-1)}} + \hat{\pi}_d^{\sigma} \left(\frac{X^*}{\tilde{\pi}}\right)^{\frac{\sigma}{2(\sigma-1)}} (\delta\kappa_I - \kappa_e)^{\frac{\sigma}{2(\sigma-1)}} \tilde{\pi} \right]}{2(\sigma-1)(\delta\kappa_I - \kappa_e)} - \frac{\kappa_e^2}{2\kappa_I^2} =$$
$$\frac{\delta \left[\kappa_e (1 - \frac{\kappa_e}{2\kappa_I}) \right]}{2(\sigma-1)(\delta\kappa_I - \kappa_e)} - \frac{\kappa_e^2}{2\kappa_I^2} = \frac{\delta}{2(\sigma-1)(\delta\kappa_I - \kappa_e)} \frac{\pi_x}{w} - \frac{g_x^2}{2}$$

The first term on the third line comes from rearranging the expression F. The second term comes from the expressions derived previously for π_x/w and the equilibrium value for g_x.

Multiplying the equation by κ_I gives

$$\frac{\delta\kappa_I}{2(\sigma-1)(\delta\kappa_I - \kappa_e)} \frac{\pi_x}{w} - \frac{\kappa_I g_x^2}{2} = \frac{\pi_x}{w} \left(\frac{\delta\kappa_I}{2(\sigma-1)(\delta\kappa_I - \kappa_e)} - 1 \right) > \frac{\pi_x}{w} \left(\frac{1}{2(\sigma-1)} - 1 \right) > 0$$

□

We use the lemma for the proof of the proposition. The proposition says

$$\frac{\partial Z_x}{\partial \kappa_I} > \frac{\partial Z_c}{\partial \kappa_I}$$

To prove it, we proceed by contradiction. So suppose this is not true. Then if $\frac{\partial Z_x}{\partial \kappa_I} \leq \frac{\partial Z_c}{\partial \kappa_I}$ it must be the case that

$$\frac{\partial \frac{\pi_x}{\pi_d}}{\partial \kappa_I} \leq 0$$

From the definition of π_x,

$$\frac{\pi_x}{\pi_d} = 1 + \frac{w^{1-\sigma}}{\pi_d} \tilde{\pi} \Rightarrow \frac{\partial \frac{w^{1-\sigma}}{\pi_d}}{\partial \kappa_I} \leq 0$$

From trade balance,

$$\frac{Exports}{Imports} = \frac{\pi_x - \pi_d}{\pi_d} \frac{Z_c}{X^*} w^{1-\sigma} = 1$$

We know that $\frac{\partial \frac{\pi_x - \pi_d}{\pi_d}}{\partial \kappa_I} \leq 0$ and $\frac{\frac{Z_c}{X^*}}{\partial \kappa_I} < 0$. Then we must have $\frac{\partial w^{1-\sigma}}{\partial \kappa_I} > 0$. Since $\partial \frac{\frac{w^{1-\sigma}}{\pi_d}}{\partial \kappa_I} < 0$, this implies that $\frac{\partial \pi_d}{\partial \kappa_I} > 0$, which is a contradiction.

Appendix F   Fit of the Approximation

Recall that our solution for the non exporter growth rate involves a differential equation with no closed form solution. Since we need a closed form to derive the distribution of firms, we approximate the non exporter with the following functional form

$$g_{di}(z) = (a_i + b_i z + c_i z^2 + d_i z^3)^{-1}$$

In this section, we discuss the goodness of this fit. Table 1 shows the values we compute for the variables a, b, c, and d for each country. Figures F.1 through F.5 show how good this approximation is for the growth rates and the non exporter value function.

Table 1: Fitted Values

Country	a	b	c	d
France	39.93	44.58	-54.27	14.69
Germany	23.39	66.24	-62.75	15.83
Italy	-20.83	275.59	-296.97	91.45
Spain	36.33	50.34	-56.99	15.17
U.K.	42.65	31.97	-47.01	13.80

Figure F.1: France

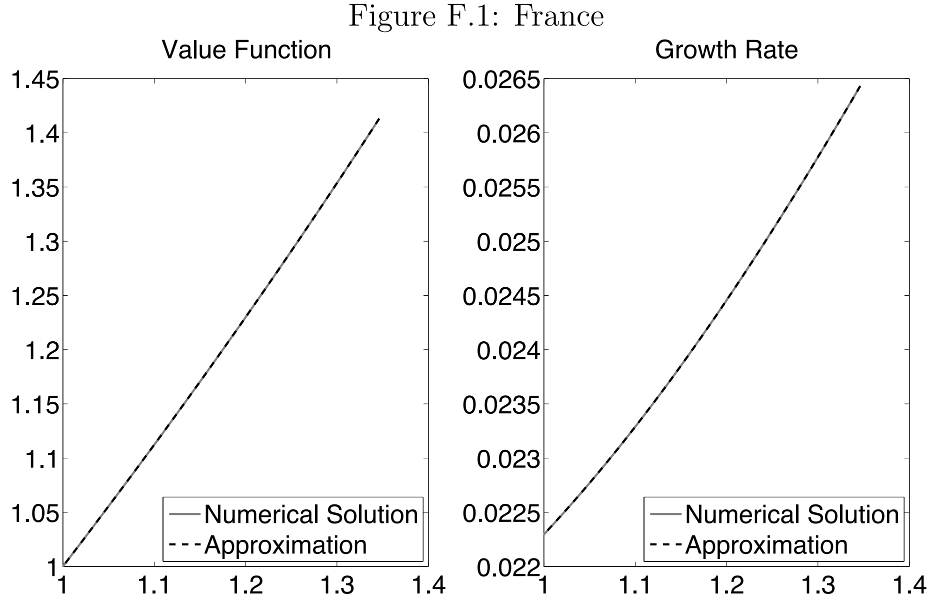

Figure F.2: Germany

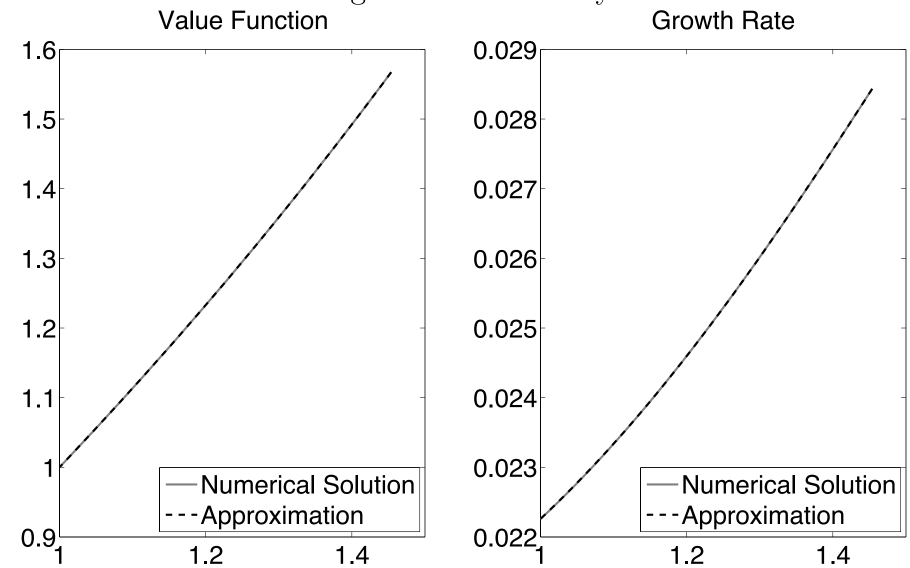

Figure F.3: Italy

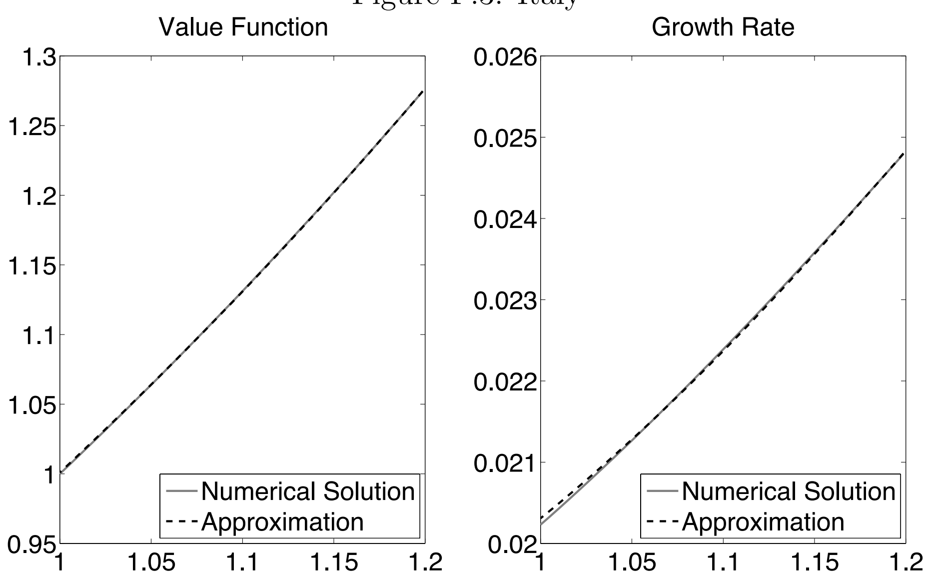

Figure F.4: Spain

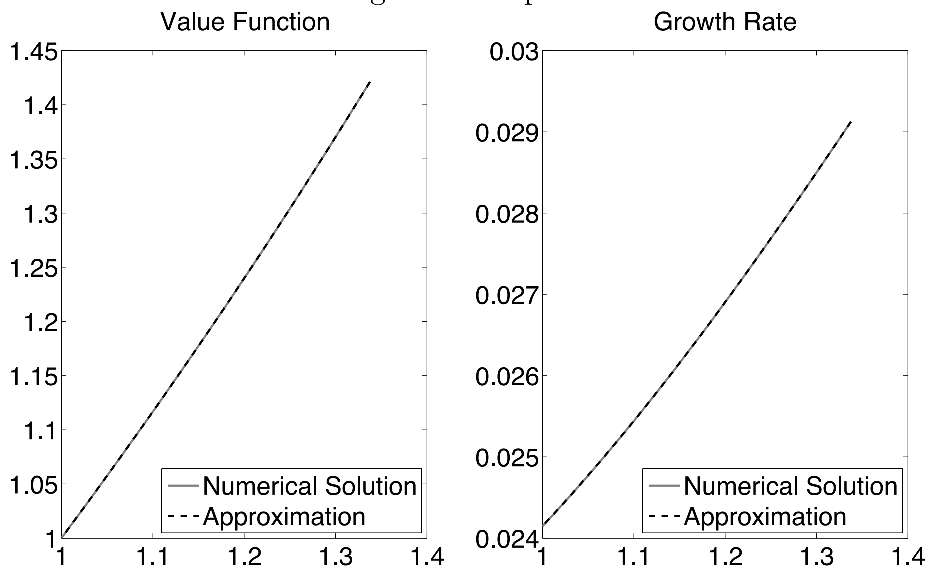

Figure F.5: U.K.