Why Are Population Flows So Persistent? Supplemental Material

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Contents

*Supplemental material to "Why Are Population Flows so Persistent?" *Journal of Urban Economics* 56, 3 (November 2004), pp. 554–580. Thank you to Taisuke Nakata for excellent research assistance. The views expressed herein are those of the author and do not necessarily reflect the position of the Federal Reserve Bank of Kansas City or the Federal Reserve System. Email: jordan.rappaport@kc.frb.org

Appendix A Equations of Motion and Steady-State Levels

The system equations of motion are given by

$$\dot{L}_s = \frac{\triangle U^{\text{wealth}} + \triangle U^{\text{price}} + \triangle U^{\text{quality}}}{b_L} L_s \tag{A.1a}$$

$$\dot{k}_s = \left(\frac{q_s - 1}{b_{K,s}} - \delta - \frac{\triangle U^{\text{wealth}} + \triangle U^{\text{price}} + \triangle U^{\text{quality}}}{b_L} \right) k_s \tag{A.1b}$$

$$\dot{assets}_s = (1-\alpha) A_s k_s^{\alpha} + \rho \, assets_s - \rho \left(h_l + assets_s \right) \mathrm{e}^{\rho \triangle U^{\text{wealth}}} \tag{A.1c}$$

$$\dot{q}_s = (\delta + \rho) q_s - \alpha A_s k_s^{-(1-\alpha)} - \frac{(q_s - 1)^2}{2 b_{K,s}} \tag{A.1d}$$

$$\dot{\triangle U}^{\text{wealth}} = \mathrm{e}^{\rho \triangle U^{\text{wealth}}} - \frac{(1-\alpha) A_s k_s^{\alpha} + \rho \, assets_s}{\rho \left(h_l + assets_s \right)} \tag{A.1e}$$

$$\dot{\triangle U}^{\text{price}} = \zeta \log \left(\frac{\zeta \rho \left(h_l + assets_s \right) L_s}{p_l D_s} \right) \tag{A.1f}$$

$$\dot{value}_s = \rho \, value_s - \frac{\zeta \rho \left(h_l + assets_s \right) L_s \, \mathrm{e}^{\rho \triangle U^{\text{wealth}}}}{D_s} \tag{A.1g}$$

Setting each of the system equations equal to zero and assuming steady-state small-economy asset wealth of $assets_s^*$ implies remaining system variables have steady-state levels,

$$\begin{aligned} L_s^* \quad = \quad & \left(\frac{(1-\alpha)(A_s)^{\frac{1}{1-\alpha}} \left(\frac{2\alpha}{\tilde{b}_{K,s}} \right)^{\frac{\alpha}{1-\alpha}} + \rho \cdot assets_s^*}{(1-\alpha)(A_l)^{\frac{1}{1-\alpha}} \left(\frac{2\alpha}{\tilde{b}_{K,l}} \right)^{\frac{\alpha}{1-\alpha}} + \rho \cdot assets_s^*} \right)^{\frac{1}{\zeta}} \cdot \left(\frac{quality_s}{quality_l} \right)^{\frac{1}{\zeta}} \cdot \\ & \left(\frac{(1-\alpha)(A_l)^{\frac{1}{1-\alpha}} \left(\frac{2\alpha}{\tilde{b}_{K,l}} \right)^{\frac{\alpha}{1-\alpha}} + \rho \cdot \overline{assets}_l}{(1-\alpha)(A_s)^{\frac{1}{1-\alpha}} \left(\frac{2\alpha}{\tilde{b}_{K,s}} \right)^{\frac{\alpha}{1-\alpha}} + \rho \cdot assets_s^*} \right) \cdot \left(\frac{D_s}{\overline{d}_l} \right) \end{aligned} \tag{A.2a}$$

$$k_s^* = (A_s)^{\frac{1}{1-\alpha}} \left(\frac{2\ \alpha}{\tilde{b}_{K,s}} \right)^{\frac{1}{1-\alpha}} \tag{A.2b}$$

$$q_s^* = 1 + \delta b_{K,s} \tag{A.2c}$$

$$\triangle U^{\text{wealth},*} = \frac{1}{\rho}\log\left(\frac{(1-\alpha)\left(A_s\right)^{\frac{1}{1-\alpha}}\left(\frac{2\alpha}{\tilde{b}_{K,s}}\right)^{\frac{\alpha}{1-\alpha}} + \rho\cdot assets_s^*}{(1-\alpha)\left(A_l\right)^{\frac{1}{1-\alpha}}\left(\frac{2\alpha}{\tilde{b}_{K,l}}\right)^{\frac{\alpha}{1-\alpha}} + \rho\cdot assets_s^*}\right) \tag{A.2d}$$

$$\triangle U^{\text{price},*} = -\frac{1}{\rho}\log\left(\frac{(1-\alpha)\left(A_s\right)^{\frac{1}{1-\alpha}}\left(\frac{2\alpha}{\tilde{b}_{K,s}}\right)^{\frac{\alpha}{1-\alpha}} + \rho\cdot assets_s^*}{(1-\alpha)\left(A_l\right)^{\frac{1}{1-\alpha}}\left(\frac{2\alpha}{\tilde{b}_{K,l}}\right)^{\frac{\alpha}{1-\alpha}} + \rho\cdot assets_s^*}\right) - \frac{1}{\rho}\log\left(\frac{quality_s}{quality_l}\right) \tag{A.2e}$$

$$\begin{aligned} value_s^* \;&=\; \left((1-\alpha)\left(A_l\right)^{\frac{1}{1-\alpha}}\left(\frac{2\alpha}{\tilde{b}_{K,l}}\right)^{\frac{\alpha}{1-\alpha}} + \rho\cdot assets_l^*\right)\cdot\left(\frac{1}{\rho\, d_l}\right)\cdot \\ &\left(\frac{(1-\alpha)\left(A_s\right)^{\frac{1}{1-\alpha}}\left(\frac{2\alpha}{\tilde{b}_{K,s}}\right)^{\frac{\alpha}{1-\alpha}} + \rho\cdot assets_s^*}{(1-\alpha)\left(A_l\right)^{\frac{1}{1-\alpha}}\left(\frac{2\alpha}{\tilde{b}_{K,l}}\right)^{\frac{\alpha}{1-\alpha}} + \rho\cdot assets_s^*}\right)^{\frac{1}{\zeta}}\cdot\left(\frac{quality_s}{quality_l}\right)^{\frac{1}{\zeta}} \end{aligned} \tag{A.2f}$$

Appendix B Effect of Change in Steady-State Asset Wealth on Steady-State Population and Steady-State House Price

Changes in steady-state small-economy asset wealth affect the remaining history-dependent steady-state levels according to

$$\begin{aligned} \frac{\mathrm{d}\, value_s^*}{\mathrm{d}\, assets_s^*} \;&=\; \begin{matrix}+\\-\end{matrix}\ \text{as} \frac{(1-\alpha)\left(A_s\right)^{\frac{1}{1-\alpha}}\left(\frac{2\alpha}{\tilde{b}_{K,s}}\right)^{\frac{\alpha}{1-\alpha}} + \rho\cdot assets_s^*}{(1-\alpha)\left(A_l\right)^{\frac{1}{1-\alpha}}\left(\frac{2\alpha}{\tilde{b}_{K,l}}\right)^{\frac{\alpha}{1-\alpha}} + \rho\cdot assets_s^*} \begin{matrix}<\\>\end{matrix} 1 \\ &=\; \begin{matrix}+\\-\end{matrix}\ \text{as}\ \frac{A_s}{\tilde{b}_{K,s}^{\alpha}} \begin{matrix}<\\>\end{matrix} \frac{A_l}{\tilde{b}_{K,l}^{\alpha}} \end{aligned} \tag{B.1}$$

$$\frac{\mathrm{d}\, L_s^*}{\mathrm{d}\, assets_s^*} = \begin{matrix}+\\-\end{matrix}\ \text{as} \frac{(1-\alpha)\left(A_s\right)^{\frac{1}{1-\alpha}}\left(\frac{2\alpha}{\tilde{b}_{K,s}}\right)^{\frac{\alpha}{1-\alpha}} + \rho\cdot assets_s^*}{(1-\alpha)\left(A_l\right)^{\frac{1}{1-\alpha}}\left(\frac{2\alpha}{\tilde{b}_{K,l}}\right)^{\frac{\alpha}{1-\alpha}} + \rho\cdot assets_s^*} \begin{matrix}<\\>\end{matrix} 1-\zeta \tag{B.2}$$

An increase in steady-state small-economy per capita asset holdings can either increase or decrease steady-state small-economy house prices. A *partial* effect of an increase in small-economy asset wealth is to cause agents to increase their spending on housing services, thereby increasing the price on housing services. But the *total* effect additionally includes associated changes in steady-state small-economy population (i.e., (B.2)). When normalized productivity, $\frac{A}{\bar{b}_K^{\alpha}}$, is sufficiently low in the small economy relative to that in the large economy, increases in asset wealth cause steady-state small-economy population to increase as well. In this case, both the partial and population effects of the increase in asset wealth are to raise small-economy house prices. When normalized productivity is sufficiently high in the small economy relative to that in the large economy, increases in asset wealth cause steady-state small-economy population to decrease. In this case, the partial and population effects are in the opposite direction, and so increases in asset wealth can lower steady-state small-economy house prices. When the population total derivative is exactly zero, the partial effect of an increase in asset wealth on house prices remains positive. Hence the change in sign of the house price total derivative occurs at a higher normalized total factor productivity than does the change in sign of the population total derivative (i.e., at the the unitary cutoff in (B.1) versus the $1-\zeta$ cutoff in (B.2)).

Similarly, an increase in steady-state small-economy per capita asset holdings can either increase or decrease small-economy population. Consider the case when normalized productivity is lower in the small than in the large economy. Recall that the assumption of Tiebout wealth sorting implies that $assets_s^*$ is also the asset wealth of potential migrants from the large to the small economy. The higher the asset wealth of potential migrants, the lower their utility loss from the small economy's lower productivity. Therefore the partial effect of an increase in asset wealth is to make the small economy less unattractive and so increase its population. This partial effect is greater the lower the relative productivity of the small economy. Acting in the opposite direction is the positive effect of higher asset wealth on land prices, (B.1). For a given small-economy population, higher asset wealth implies higher land prices, thereby making the small economy more unattractive to potential migrants. As long as the left-hand side of the inequality in (B.2) is less than $1-\zeta$, the partial effect dominates this latter "price" effect, so that increases in asset wealth increase steady-state small-economy population. When the left-hand side of the inequality in (B.2) lies on the interval $[1-\zeta, 1]$, normalized relative productivity is still lower in the small economy. But now the price effect dominates the partial effect, so that increases in asset wealth decrease steady-state small-economy population.

Finally, consider the case when normalized productivity is higher in the small than in the large economy. In contrast to above, the partial effect of an increase in asset wealth on small-economy population is negative: the higher the asset wealth of potential migrants, the lower the utility gain from the small economy's productivity advantage. And the negative price effect of higher asset wealth on small-economy population remains. Together, these two partial effects imply that the total effect of an increase in asset wealth is to cause steady-state small-economy population to decrease.

Appendix C Robustness of Numerical Results

The high persistence of population growth and the ability of small-economy wages and house sales prices to jump to close much of the gap to their new steady state following changes in productivity and quality of life are highly robust results. For reference, the base calibration, as enumerated in Figures 1 and 3, is repeated here.

- Capital factor income share: $\alpha = \frac{1}{3}$.
- Capital depreciation rate: $\delta = 0.06$.
- Nontraded consumption share: $\zeta = 0.15$.
- Rate of time preference: $\rho = 0.03$.
- Steady-state shadow value of capital (inverse of capital mobility): $q^*_{K,l} = q^*_{K,s} = 1.48$.
- Net migration response to 1 percent wealth differential (labor mobility): $\mu = 2$.

C.1 Change in Productivity

Following an increase in small-economy total factor productivity, wages and house sales prices jump to close much of the gap to their new steady state. And population growth remains high for a very long period. These results are very robust to alternative parameterizations of the model.

Supplemental Table 1 shows summary statistics for different combinations of capital mobility and labor mobility. In the top panel, *capital* mobility is assumed to be "low", defined as $q^*_K = 2.92$ (which corresponds to $b_K = 32$). In the middle panel, capital mobility is assumed to be at its "base" level, defined as $q^*_K = 1.48$ ($b_K = 8$). This is the level of capital mobility used to generate the figures in the main text. It represents an increase in capital mobility by a multiplicative factor of four from the top panel. In the bottom panel, capital mobility is assumed to be "high", defined as $q_K^* = 1.12$ ($b_K = 2$). This again represents an increase in capital mobility by a multiplicative factor of four from the panel above.

Within each panel, the top shaded row shows results for "low" *labor* mobility, defined as $\mu = \frac{1}{8}$ (which corresponds to $b_L = 267$). The middle shaded row shows results for the base level of labor mobility, defined as $\mu = 2$ ($b_L = 16.7$). This represents an increase in labor mobility by a multiplicative factor of sixteen from the top shaded row. The bottom shaded row shows results for "high" labor mobility, defined as $\mu = 32$ ($b_L = 1.04$). This again represents an increase in labor mobility by a multiplicative factor of sixteen from the shaded row above it.

For each level of capital mobility, increasing the degree of labor mobility has several effects. These are relatively intuitive. Specifically, increasing labor mobility

- Does not effect the size of the initial jump in wages. Increases the size of the initial jump in house sales prices.
- Increases the initial rate of population growth and house sales price growth. Decreases the initial rate of wage growth, which may switch from positive to negative.
- Decreases the autoregressive persistence of population growth and house sales price growth (between the first two decades, inclusive of any initial jump). Increases the autoregressive persistence of wage price growth (since more negative initial growth partly offsets the initial jump).
- Both increases and decreases the last time the three growth rates exceed a 0.2% threshold. (The last time growth rates exceed 0.2% is meant to give a sense of how long transitional growth might be observationally distinguished from stochastic growth.) For population and house sales price growth, the increases in time come from higher growth rates during the early portion of the transition; the decreases come from more quickly closing the gap to the new steady state. In other words, the growth time path rotates clockwise.

Figure 2 in the main text illustrates transition paths for both low and high labor mobility combined with the base level of capital mobility.

For each level of labor mobility, increasing the degree of capital mobility has several effects. Specifically, increasing capital mobility

- Does not effect the size of the initial jump in wages. Increases the size of the initial jump in house sales prices.

- Increases the initial rate of population growth, wage growth, and house sales price growth. For wage growth, this may imply either a less negative initial rate or the initial rate switching from negative to positive.

- Both slightly increases and slightly decreases autoregressive persistence of population growth and wage price growth. Slightly decreases the autoregressive persistence of house sales price growth.

- Both increases and decreases the last time the three growth rates exceed a 0.2% threshold.

Also important for transitional dynamics are the capital share of factor income and the nontraded share of consumption. Supplemental Table 2 shows some summary statistics from increasing each of these.

The first row in Supplemental Table 2 shows summary statistics under the base scenario that is discussed in the main text.

The second row in Supplemental Table 2 shows summary statistics from doubling the share of consumption expenditure devoted to nontraded goods. Above and within the main text, nontraded goods have generally been interpreted as corresponding to housing services. But the broader the assumed nontraded consumption share, the more nontraded goods should be interpreted to also include other local nontraded goods such as local distribution services. Nevertheless, the summary statistics under this alternative scenario will continue to focus on "house sales price", which is the net present value of the instantaneous price of nontraded goods.

The larger the nontraded consumption share, the greater the utility cost from the rise in nontraded prices and so the lower the increase in steady-state population from a given increase in small-economy traded-good productivity. Doubling the housing consumption share to $\zeta = 0.30$ causes steady-state population to rise to 1.07 rather than to 1.23. As a result, steady-state housing prices rise only to 1.10 rather than to 1.27. Given the smaller change in steady-state population and housing prices, the corresponding growth rates are smaller than under the base calibration. For population, the initial growth rate is 0.54% rather than 1.08%. For house prices, the initial growth rate is 0.15% rather than 0.36%. The time during which population growth remains above a 0.2% threshold falls to 12.0 years from 32.9 years. But the autoregressive persistence of population growth remains high at 0.46, down from 0.57 under the base calibration.

The third row shows summary statistics from doubling the capital factor income share to $\alpha = \frac{2}{3}$. The capital factor income share and the size of the productivity change interact in the sense that steady-state wages increase more than proportionately to increases in productivity, according to $w_s^*/w_l^* = (A_s/A_l)^{\frac{1}{1-\alpha}}$. The higher the capital share, the smaller the increase in total factor productivity needed to achieve a given increase in steady-state wages. And so the higher the capital share, the smaller the percentage of the gap between pre-change wages and their new steady state closed by wages' initial jump. Similarly, the larger the increase in steady-state wages, the smaller the percentage of the gap between pre-change wages and their new steady state closed by wages' initial jump.

A 5% increase in steady-state wages with $\alpha = \frac{2}{3}$ rather than $\alpha = \frac{1}{3}$ requires a productivity increase of 1.6% rather than 3.3%. Thus in their initial jump, wages close 32.7% rather than 66.1% of the gap to their new steady state. The sales price of housing also jumps to close a smaller portion of the gap to its new steady state, 50.0% rather than 63.2%. Other differences from the base scenario include smaller changes in *steady-state* population and house sales prices, slower growth rates of these, higher persistence of these growth rates, and a shorter transition.

The last two rows of Supplemental Table 2 show differences from the base scenario from larger changes in small-economy total factor productivity. These will be discussed in Appendix D below.

C.2 Change in Quality of Life

Following an increase in small-economy quality of life, house sales prices jump to close much of the gap to their new steady state. And population growth remains high for a long period. As above, these results are very robust to alternative parameterizations of the model.

Supplemental Table 3 shows summary statistics for different combinations of capital mobility and labor mobility. Its organization is the same as Supplemental Table 1. The middle panel shows the base calibration level of capital mobility ($q_K^* = 1.48$). The panels above and below show results for capital mobility one-fourth and four times this base calibration. Within each panel, the middle shaded row shows results for the base calibration level of labor mobility, ($\mu = 2$). Each of the rows (shaded or not) shows results for labor mobility twice that of the row above it.

For each level of capital mobility, increasing labor mobility

- Increases the size of the initial jump in house sales prices.
- Decreases the level to which wages eventually fall. Decreases the time during which wages are falling.
- Increases the initial rates of population and house sales price growth. Decreases (i.e., makes

more negative) the initial rate of wage growth.

- Decreases the autoregressive persistence of population growth and house sales price growth (between the first two decades, inclusive of any initial jump). Decreases (possibly makes more negative) the autoregressive persistence of wage growth.

- Both increases and decreases the last time the three growth rates exceed 0.2%. The reason for this are the same as described above for changes in productivity.

Supplemental Figure 1 illustrates transition paths for both "low" and "high" labor mobility ($\mu = \frac{1}{8}$ and $\mu = 32$) combined with the base level of capital mobility.

For each level of labor mobility, increasing the degree of capital mobility has several effects. Specifically, increasing capital mobility

- Increases the size of the initial jump in house sales prices.

- Increases the level to which wages eventually fall. Decreases the time during which wages are falling.

- Increases initial growth rates of population, wages, and house sales prices. For wages, this means initial growth rates are less negative.

- Leaves autoregressive persistence of population growth essentially unchanged. Decreases (makes more negative) autoregressive persistence of wage growth.

Supplemental Table 4 shows some summary statistics from changing the nontraded-goods share of consumption and the capital share of factor income. The first row shows these summary statistics for the base scenario.

The second row of Supplemental Table 4 shows results from doubling the share of consumption expenditures devoted to nontraded goods to $\zeta = 0.30$ from $\zeta = 0.15$. Doing so increases the congestion effect of the rise in nontraded goods prices. So steady-state population rises only to 1.12 rather than to 1.26. House sales prices (i.e. the net present value of nontraded goods prices) also rise only to 1.12 rather than to 1.26. Partly due to this smaller rise in *steady-state* house sales prices, the initial jump in house sales price closes 73.2% rather than 61.5% of the gap between pre-change and steady-state house sales prices. The smaller changes in steady-state population and house sales prices also causes initial growth rates to be smaller than under the base scenario. The autoregressive persistence of population growth moderates to 0.33 from 0.48. The autoregressive persistence of wage growth becomes more negative, falling to -0.26 from -0.14. The time during which the annual rate of population growth remains above 0.2% falls to 16.4 years from 32.4 years.

The third row of Supplemental Table 4 shows results from doubling in the share of factor income accruing to capital to $\alpha = \frac{2}{3}$ from $\alpha = \frac{1}{3}$. Doing so leaves steady state levels of population, wages, and house sales prices approximately unchanged. The initial jump in house sales prices closes 52.1% rather than 61.5% of the gap between pre-change and steady-state levels. The minimum to which wages fall decreases to 0.97 from 0.99. And the time during which wages are falling increases to 13.4 years from 11.4 years. The initial growth rate of population growth is slightly lower at 1.42% rather than 1.58%. And initial wage growth is more negative at -0.64% rather than -0.30%. The autoregressive persistence of population growth and the time during which population growth remains above 0.2% are essentially unchanged.

The last two rows of Supplemental Table 4 show differences from the base scenario from larger changes in small-economy quality of life. These will be discussed in Appendix D below.

C.3 Capital Shock

The base-scenario capital shock is one that leaves small-economy initial wages at 90% of their steady-state level. Accompanying this shock is a smaller downward jump in the sales price of housing. Population growth in the small economy is negative for approximately a decade, after which it turns positive. The autoregressive persistence of population growth, wage growth, and house sales price growth between the first two decades (inclusive of the initial shock) are all negative. These results are quite robust to alternative parameterizations of the model.

Supplemental Table 5 shows summary statistics for different combinations of capital mobility and labor mobility. Its organization is similar to that of Supplemental Tables 1 and 3 above. For each level of capital mobility, increasing labor mobility

- Decreases the initial sales price of housing (i.e., increases the initial fall in house sales prices).
- Decreases the level to which population falls. Decreases the time during which population is falling.
- Decreases the initial rate of population growth (i.e., makes it more negative). Increases the initial rate of wage growth.
- Decreases (makes more negative) the autoregressive persistence of population growth and house sales price growth (between the first two decades, inclusive of any initial jump). In-

creases (makes less negative) the autoregressive persistence of wage growth (between the first two decades, inclusive of the initial jump).

- Both increases and decreases the last time population growth exceeds a 0.2% threshold.

Supplemental Figure 2 illustrates transition paths for both "low" and "high" labor mobility ($\mu = \frac{1}{8}$ and $\mu = 32$) combined with the base level of capital mobility.

For a each level of labor mobility, increasing capital mobility

- Increases initial house sales prices (i.e., decreases their fall).
- Increases the level to which population falls (i.e., decreases the size of the fall). Decreases the time during which population is falling.
- Increases (makes less negative) the initial rate of population growth. Increases the initial rate of wage growth.
- Decreases (makes more negative) the autoregressive persistence of all three growth rates (between the first two decades, inclusive of any jumps).
- Decreases the last time at which population growth exceeds a 0.2% threshold.

Rappaport [2] more extensively discusses the effects of labor and capital mobility on transitional dynamics following a capital shock.

Supplemental Table 6 shows some summary statistics from changing the nontraded goods share of consumption and the capital share of factor income. The first row shows these summary statistics for the base scenario.

The second row of Supplemental Table 6 shows results from doubling the share of consumption expenditures devoted to nontraded goods to $\zeta = 0.30$ from $\zeta = 0.15$. Doing so lessens the incentive to exit the small economy following the fall in traded-good-denominated wages. Hence the initial rate of outmigration decreases, as do the level to which population falls and the time during which population growth is negative. The autoregressive persistence of population growth becomes more negative. The return flow of population never exceeds a 0.2% annual rate. So the last time the *absolute value* of population growth is above 0.2% is during the initial exit. Hence this time falls sharply to 5.7 years from 26.7 years.

The third row of Supplemental Table 6 shows results from doubling the share of factor income accruing to capital to $\alpha = \frac{2}{3}$ from $\alpha = \frac{1}{3}$. Doing so slows the initial rate of outmigration to -1.26%

from -1.75%. This slowing is counterintuitive. During the entire transition (i.e., at comparable points in time), wages are higher when the capital share is small. So this would seem to give more incentive for outmigration with a high capital share. Moreover, house sales prices are initially higher with a large capital share, again giving more of an incentive for outmigration. The reason this does not happen is that a higher capital share implies that asset wealth represents a larger fraction of individuals' wealth. And the higher is asset wealth as a fraction of total wealth, the smaller the utility cost of lower wages. So even though wages are always lower with a high capital share, the utility loss from this is lower. And hence initial outmigration is slower. Other changes from doubling the capital share include that the autoregressive persistence of population growth increases to -0.06 from -0.20. And the return population flow never exceeds a 0.2% annual rate so that the time the absolute value of population growth is above 0.2% falls sharply to 8.0 years from 26.7 years.

Appendix D The Proportionality of Population Growth to Changes in Productivity and Quality-of-Life

One of the main empirical implications of the neoclassical local growth model is that cross-sectional regressions of local population growth on local characteristics can help to identify *changes* in the contributions from local characteristics to representative-agent welfare. Local areas that have experienced changes in local productivity and local quality of life are expected to subsequently experience population flows that are proportional to such changes and that persist over several decades.

Supplemental Figure 3 illustrates for the case of changes in productivity. Transition dynamics are shown for three small economies, each of which simultaneously experiences an increase in productivity. The size of the increases varies across the economies. The smallest increase is 3.3%. For the baseline parameters, this increase corresponds to a 5% rise in steady-state wages, which is the same as the increase discussed in the main text and included as the base scenario in Supplemental Table 2. The other small economies experience productivity increases of 6.6% and 12.9%. These respectively correspond to a 10% and a 20% increase in steady-state wages.

The proportionality of population growth to changes in productivity is shown in Panel D. *Relative* population growth rates across the three small economies, both initially and at all subsequent times, are approximately the same as the *relative* size of the productivity increases. For initial growth rates, this proportionality is also enumerated in Supplemental Table 2 (column 11, top row versus last two rows). For subsequent growth rates, it is implied by the numerical result that autoregressive persistence does not depend on the size of the productivity change (column 14).

Supplemental Figure 4 illustrates for the case of changes in quality-of-life. Transition dynamics are shown for three economies, each of which simultaneously experiences a different-sized increase in quality-of-life. The smallest increase is an equivalent variation of 3.5%, which is the same as the increase discussed in the main text and included as the base scenario in Supplemental Table 4. The other small economies experience quality-of-life increases with equivalent variations of 7% and 14%.

The proportionality of population growth to changes in quality of life is shown in Panel D. Relative population growth rates across the three small economies, both initially and at all subsequent times, are approximately the same as the relative size of the quality-of-life increases. For initial and subsequent population growth rates, this numerical result is also enumerated in Supplemental Table 4 (columns 9 and 12, top row versus last two rows).

To see that cross-sectional regressions of local population growth on local characteristics can help to identify changes in the contributions from local characteristics to local productivity and local quality-of-life, consider first a discrete shock that simultaneously realigns productivity (and only productivity) across a number of localities as some function of local characteristics. Subsequent to such a shock, population growth — *regardless of when it is actually observed* — will measure the *relative* sizes of the productivity changes experienced by each of the localities. Similarly, consider a discrete shock that simultaneously realigns quality-of-life (and only quality-of-life) across a large number of localities as some function of local characteristics. Subsequent to such a shock, population growth — again regardless of when it is actually observed — will measure the *relative* sizes of the quality-of-life changes experienced by each of the localities.

Next, consider a discrete shock that simultaneously realigns both productivity and quality-of-life across a number of localities. Immediately following such a shock, relative population growth rates will be proportional to the relative changes to representative agent welfare from the combined productivity and quality-of-life changes. This is just a restatement of the assumed migration function, $\frac{\dot{L}_i(t)}{L_i(t)} = \frac{\triangle U_i(t)}{b_L}$.

To gain insight on local population growth as the transition proceeds, it helps to assume that such growth is approximated by the additive sum of local population growth due solely to the change in local productivity and local population growth due solely to the change in local quality-of-life. With such an assumption of separability, transitional relative population growth will always be proportional to a weighted average of the welfare change attributable to each of productivity and quality-of-life. Specifically, suppose a discrete shock at some unkown time $t_1 < t$ realigns productivity and quality-of-life across a large number of localities. Then

$$\frac{\dot{L}_i\,(t)}{L_i\,(t)} \approx \kappa_{\text{tfp}}(t)\triangle U_i^{\triangle \text{tfp}_i, t_1} + \kappa_{\text{qlty}}(t)\triangle U_i^{\triangle \text{quality}_i, t_1} \tag{D.1}$$

$$\kappa_{\text{tfp}}(t_1) = \kappa_{\text{qlty}}(t_1) = \frac{1}{b_L} \;\; ; \;\; \kappa_{\text{tfp}}(t) > \kappa_{\text{qlty}}(t) > 0 \;\; ; \;\; \kappa_{\text{qlty}}{}'(t) < \kappa_{\text{tfp}}{}'(t) < 0$$

Here, $\kappa_{\text{tfp}}(t)$ and $\kappa_{\text{qlty}}(t)$ are positive constants of proportionality linking current growth to the initial changes in productivity and quality-of-life. Their negative derivatives just capture that growth falls off as time since the shock passes. That $\kappa_{\text{qlty}}{}'(t)$ is more negative than $\kappa_{\text{tfp}}{}'(t)$ captures that as the transition proceeds, relative growth attributable to the initial change in quality-of-life dies out faster than relative growth attributable to the initial change in productivity. This occurs because autoregressive persistence following a change in productivity (0.57 between the first two decades rising to 0.66 between the fourth and fifth decade) is higher than autoregressive persistence following a change in quality-of-life (0.48 between the first two decades rising to 0.65 between the fourth and fifth decades).

Relaxing the assumption of separability, the specific functional form of (D.1) may no longer hold (further numerical simulations can be done to check the appropriateness of the separability assumption). But the result that localities' relative transitional growth remains approximately proportional to the initial relative changes to representative agent welfare (but not necessarily proportional to the sum of the productivity and quality-of-life components) should continue to hold. The main caveat is that during the transition there is likely to be some shifting in the distribution of local growth rates depending on the extent to which changes in productivity versus changes in quality-of-life were the source of initial shifts in welfare.

A second caveat is that if a sufficient number of local areas experience changes in local productivity and quality of life, collectively such localities may be "large". But this should not change the proportionality of observed relative growth rates to initial relative changes in welfare. With two *large* economies, an increase in the productivity or quality of life of one economy should induce similar dynamics to those shown in Supplemental Figures 3 and 4 in it and mirror dynamics in the other economy. The main difference from the small economy case is that during the transition, the interest rate shared by the two large economies will differ from its steady-state value.

Next, consider *a sequence* of shocks that realign productivity and quality-of-life across a number of localities. To get insight into transition dynamics, in this case it is helpful to assume that population growth can be decomposed as the additive sum of the growth attributable to each of the shocks. Specifically, suppose discrete shocks at unkown times $t_1 < t_2 < t$ realign productivity and quality-of-life across a number of localities. Then

$$\frac{\dot{L}_i(t)}{L_i(t)} \approx \kappa_1(t)\triangle U_i^{t_1} + \kappa_2(t)\triangle U_i^{t_2} \tag{D.2}$$

$$\kappa_2(t) > \kappa_1(t) > 0\ ;\ \kappa_2{}'(t) < \kappa_1{}'(t) < 0$$

As above , $\kappa_1(t)$ and $\kappa_1(t)$ are the positive but otherwise unkown constants of proportionality that are decreasing over time. Restricting $\kappa_2(t)$ to be greater than $\kappa_1(t)$ assures that the more recent shock *always* receives a higher weight. The restriction that $\kappa_2{}'(t)$ is more negative than $\kappa_1{}'(t)$ captures that the more distant a shock, the slower the rate at which it dies out. This reflects the numerical result that autoregressive persistence slightly increases the longer the time since a shock occurred.

Combining (D.1) and (D.2) gives the contributions to growth from the productivity components and the quality-of-life components from a sequence of shocks. With unknown $t_1 < t_2 < t$,

$$\begin{aligned}\frac{\dot{L}_i(t)}{L_i(t)} \approx\ & \beta_1(t)\triangle U_i^{\triangle \mathrm{tfp}_i,t_1} + \beta_2(t)\triangle U_i^{\triangle \mathrm{quality}_i,t_1} \\ & + \beta_3(t)\triangle U_i^{\triangle \mathrm{tfp}_i,t_2} + \beta_4\triangle U_i^{\triangle \mathrm{quality}_i,t_2}\end{aligned} \tag{D.3}$$

$$\begin{aligned}&\beta_1(t_1) = \beta_2(t_1) = \beta_3(t_2) = \beta_4(t_2) = \frac{1}{b_L}\ ;\\ &\beta_3(t) > \beta_1(t) > \beta_2(t) > 0\ \ ;\ \ \beta_3(t) > \beta_4(t) > \beta_2(t) > 0\ ;\\ &\beta_4{}'(t) < \beta_2{}'(t) < \beta_1{}'(t) < 0\ \ ;\ \ \beta_4{}'(t) < \beta_3{}'(t) < \beta_1{}'(t) < 0\end{aligned}$$

The various restrictions just replicate those in (D.1) and (D.2). The key insight is that population growth remains proportional to a weighted average of changes to local productivity and local quality-of-life in the recent and more distant past. Although the specific functional form of (D.3) may no longer hold once the separability assumption on the multiple shocks and their productivity and quality-of-life components is relaxed, the various numerically derived transitions included in the main text and the supplemental materials strongly suggest that this insight remains valid.

To the extent that growth does indeed remain proportional to past changes in productivity and past changes in quality-of-life, then cross-sectional regressions of local population growth on local characteristics will identify the partial correlates of such changes. In other words, if a certain local characteristic is found to have a positive partial correlation with local population growth, then it must have a positive partial correlation with a weighted average of past changes to local productivity and local quality of life. The actual magnitude of any estimated coefficients (as opposed to their sign) is more difficult to interpret since it combines several unidentified parameters including the degree of labor mobility (b_L), the unknown times at which the changes occurred (t_1, and t_2), and the changes themselves (i.e., $\triangle U_i^{\triangle \mathrm{tfp}_i, t_1}$, $\triangle U_i^{\triangle \mathrm{qlty}_i, t_1}$, $\triangle U_i^{\triangle \mathrm{tfp}_i, t_2}$, $\triangle U_i^{\triangle \mathrm{qlty}_i, t_2}$).

Within the current framework, the *only* source of population growth other than a change in local productivity or local quality-of-life is a shock to local capital stock. Rather than being driven by increases in local productivity and quality-of-life, an alternative explanation for observed positive population growth is that it captures the population inflow immediately following a positive capital shock or the return population flow that begins approximately a decade after a negative capital shock. In other words, estimated partial correlations *may* reflect changes to local productivity and local quality-of-life. Or, they may reflect capital shocks. Both possibilities need to be considered in interpreting the results from cross-sectional regressions of local population growth on local characteristics.

For researchers who are more interested in identifying the partial correlates of productivity and quality-of-life shocks, one way to minimize the possibility that estimated partial correlations reflect the high *initial* population growth rates accompanying a capital shock is to focus on growth over relatively long periods. The numerical results suggest that high initial rates die out very quickly. Except when labor mobility and capital mobility are *both* very low, the population exit following a negative capital shock is mostly complete by the end of the first decade (Supplemental Tables 5 and 6). So the longer the period of observation, the smaller will be the contribution to average growth from the initial outflow. An even stronger indication that partial correlations do not reflect the *initial* population growth accompanying capital shocks would be if such correlations are observed over several adjacent time periods. For example, the initial growth accompanying a capital shock should be confined to no more than two adjacent decades.

On the other hand, the *return* population flows beginning approximately a decade after capital shocks will be observed over longer periods. These tend to be much smaller than the initial flows, and the relative weight attached to them in a specification like (D.3) would seem likely to be low. Nevertheless, partial correlations of local population growth with local characteristics that persist over several decades may reflect the return flow following a negative capital shock (or return exit following a positive one).

Finally, note that unlike population growth arising from changes in productivity or quality-of-life, population growth following a capital shock may not be proportional to the size of the shock. Supplemental Figure 5 shows transitions for three small economies that experience negative capital shocks that lower initial wages to 90%, 80%, and 60% of their steady-state level. As shown in Panel D, negative population growth immediately following the shock is indeed proportional in magnitude to the size of the shock. But later in the transition, relative growth rates reverse. For example, the economy that experiences the largest capital shock eventually has the most positive rather than the most negative population growth rate. This reversal is characteristic of growth rates that have negative autoregressive persistence.

Appendix E Local Growth with Frictionless Labor

An assumption of frictionless labor (i.e., $b_L = 0$) implies that level utility (i.e., the discounted value of flow utility) must always be equal between residents in the large and small economies. But frictionless labor does not imply that flow utility will be identical between the two. The key to the proof that follows is that equal flow utility between the two economies implies equal asset accumulation but that together these two conditions overdetermine the dynamic system. Rather than equating flow utility, frictionless labor implies an intertemporal tradeoff in the sense that living in one economy is associated with higher flow utility today while living in the other is associated with higher asset accumulation today and so higher flow utility in the future.

Suppose that flow utility available from living in the small economy always equaled flow utility from living in the large economy. Then asset accumulation for individuals with asset wealth j would be equal across the two economies, $\dot{assets}_{s,j}(t) = \dot{assets}_{l,j}(t)$ for all t. If not, utility could be increased by first accumulating more assets in one economy (while enjoying the same flow utility) and then moving to the other economy and using the increased assets to enjoy an even higher flow utility.

Recall that the consumption first-order conditions are given by

$$c_{i,j}(t) = \rho (1 - \zeta)\, wealth_{i,j}(t) \tag{E.1}$$

$$d_{i,j}(t) = \frac{\rho\zeta}{p_i(t)}\, wealth_{i,j}(t) \tag{E.2}$$

And asset accumulation is given by

$$\dot{assets}_{i,j}(t) = r \cdot assets_{i,j}(t) + w_i(t) - c_i(t) - p_i(t)\, d_{i,j}(t) \tag{E.3}$$

Substituting (E.1) and (E.2) into (E.3) gives

$$\dot{assets}_{i,j}(t) = (r-\rho)\cdot assets_{i,j}(t) + w_i\left(K_i(t), L_i(t)\right) - \rho\int_t^{\infty} w_i\left(K_i(v), L_i(v)\right)\mathrm{e}^{-r(v-t)}\mathrm{d}v \quad \text{(E.4)}$$

Assume that the large economy is at its steady state, so that the asset wealth of each of its residents is constant and $r=\rho$. It follows that the second two terms on the right hand side of (E.4) must always sum to zero for the large economy. And for asset accumulation to be equal across economies, the same two terms must sum to zero for the small economy as well. Hence the time path of small-economy population must always satisfy

$$\begin{aligned} &\{L_s(v)\}_{v=t}^{\infty} \quad \text{s.t.} \\ &w_s\left(K_s(t), L_s(t)\right) - \rho\int_t^{\infty} w_s\left(K_s(v), L_s(v)\right)\mathrm{e}^{-r(v-t)}\mathrm{d}v = 0 \end{aligned} \quad \text{(E.5)}$$

The instantaneous equating of level utility between the two economies implies

$$\triangle U_j^{\text{wealth}}(t) + \triangle U^{\text{price}}(t) + \triangle U^{\text{quality}} = 0 \quad \text{(E.6)}$$

Using (18a) – (18c) in the main text and the definition of labor wealth to substitute, the time path of small-economy population must also always satisfy

$$\begin{aligned} &\{L_s(v)\}_{v=t}^{\infty} \quad \text{s.t.} \\ &\frac{1}{\rho}\log\left(\frac{\int_t^{\infty} w_s\left(K_s(v), L_s(v)\right)\mathrm{e}^{-r(v-t)}\mathrm{d}v + assets_{s,j}(t)}{\frac{w_l}{r} + assets_{s,j}(t)}\right) \\ &+ \quad \zeta\int_t^{\infty}\log\left(\frac{p_l}{p_s\left(\{K_s(v)\}_{v=t}^{\infty}\,,\ \{L_s(v)\}_{v=t}^{\infty}\,,\ assets_{s,j}(v)\right)}\right)\mathrm{e}^{-\rho(v-t)}\mathrm{d}v \\ &+ \quad \frac{1}{\rho}\log\left(\frac{quality_s}{quality_l}\right) = 0 \end{aligned} \quad \text{(E.7)}$$

Differentiating (E.5) with respect to t and substituting gives that small-economy wage growth is always zero. Hence small-economy wages must immediately jump to their steady state. With small-economy wages at their steady state, the first and third terms of (E.7) are constant. And so the second term of (E.7) must be constant as well. Small-economy house prices must therefore also immediately jump to their steady state.

Assume that there exists a time path of population that satisfies (E.7). In general this will differ from a time path of population that satisfies (E.5). The system is overdetermined. Consider the case of the positive productivity shock shown in Figure 1. With gross capital stock instantaneously fixed, for wages to immediately jump to their steady state requires a decrease in population; but with asset wealth instantaneously fixed, for house prices to immediately jump to their steady state requires an increase in population. Similar contradictions arise from quality-of-life and capital shocks.

The inability of frictionless population movements to equate flow utility underscores a limitation the present model deriving from its assumption that individuals compare their lifetime utility from residing *forever* in a given locality, $U_i(t) = \int_t^\infty u_i(v)\mathrm{e}^{-\rho(v-t)}\,\mathrm{d}v$. Differentiating with respect to t gives $\dot{U}_i(t) = \rho U_i(t) - u_i(t)$. So $U_s(t) = U_l(t)$ implies that $u_s(t) = u_l(t)$ always. But as just shown, this cannot be. Instead, a dynamic framework in which utility level differences are instantaneously arbitraged away must allow for planned temporary migration. In the real world, one can find numerous examples of "localities" that allow for a tradeoff of low current flow utility for high future flow utility via high current asset accumulation. Some possibilities include off-shore oil rigs, commercial fishing boats, investment banks, and the first year of Ph.D. programs.

Appendix F Data Description

Population and median family income for each of 1970, 1980, 1990, and 2000 are from the respective decennial census as disseminated in U.S. Census Bureau [5, 6, 7, 8]. Population, median family income for 1950 and 1960, and median house sales prices for 1950, 1960, and 1970 are from the consolidated 1947–1977 electonic file of the County and City Data Book (U.S. Census Bureau, [5]). Population for earlier years is based on the respective decennial census as corrected by Michael Haines (U.S. Census Bureau, [4]).

I make a few adjustments to counties' geographic borders. First is to include the District of Columbia as a county equivalent. Second is to exclude counties in Alaska and Hawaii. Third is to combine "independent cities" with the counties that completely surround them but from which they are formally separate (especially common in Virginia). Fourth is to adjust for the occasional county border changes.

County border changes usually are the result of the splitting of a county into two or more counties. Wherever possible, I have recombined such "split" counties to allow for intertemporal comparisons, based primarily on Horan and Hargis [1] and Thorndale and Dollarhide [3]. I limit such adjustments to only those correlations and regressions for which it is required. So, for instance, only two such adjustments are needed to calculate the correlation between population growth during the 1980s and population growth during the 1990s. But many are needed to calculate the correlation between population growth during the 1910s and population growth during 1990s. The need to combine counties applies especially within U.S. territories that had not yet been admitted to the union. Oklahoma was admitted as a U.S. state subsequent to the 1900 census. New Mexico and Arizona were admitted subsequent to the 1910 census.

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Supplemental Table 1: Change in Productivity, Alternative Capital and Labor Mobility

Numerical results for an increase in total factor productivity such that new steady-state wage level is 1.05 times old level. For $\alpha = 0.33$, this implies a 3.5% rise in TFP. Except for enumerated capital and labor mobility, all parameters are the same as in Figure 1

A. "Low" Capital Mobility ($q_K^* = 2.92$)

Steady-state population ≈ 1.23; Steady-state housing price ≈ 1.26; Steady-state asset wealth ≈ 0.97

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	Labor Mobility	% of Gap Closed at $t=0^+$		Initial Growth Rates (annual % rate at $t=0^+$)			Avg. Growth Rate, Decade 1			Growth Persistence, Decade 2 vs. Decade 1			Last Year |Growth| Exceeds 0.2%		
		wage	hsg val	pop	wage	hsg val	pop	wage	hsg val	pop	wage	hsg val	pop	wage	hsg val
	1/16	66.1	26.0	0.12	0.07	0.11	0.12	0.38	0.76	0.98	0.08	0.13	-	-	-
"low"	1/8	66.1	32.9	0.20	0.06	0.16	0.20	0.37	0.97	0.93	0.08	0.14	2.0	-	-
	1/4	66.1	40.2	0.32	0.04	0.21	0.30	0.36	1.19	0.86	0.07	0.14	31.1	-	2.7
	1/2	66.1	46.8	0.48	0.01	0.25	0.42	0.34	1.37	0.77	0.06	0.13	35.3	-	10.2
	1	66.1	52.0	0.69	-0.04	0.29	0.54	0.32	1.52	0.66	0.07	0.12	34.2	-	11.0
base	2	66.1	55.7	0.95	-0.12	0.31	0.67	0.29	1.61	0.55	0.10	0.11	31.9	-	10.1
	4	66.1	58.3	1.30	-0.22	0.33	0.76	0.27	1.66	0.46	0.15	0.10	30.1	0.4	8.8
	8	66.1	59.9	1.79	-0.37	0.34	0.83	0.26	1.69	0.39	0.20	0.09	29.1	1.6	7.4
	16	66.1	60.9	2.44	-0.58	0.35	0.87	0.25	1.70	0.35	0.24	0.09	28.8	2.0	6.3
"high"	32	66.1	61.4	3.34	-0.87	0.35	0.89	0.24	1.71	0.34	0.25	0.09	28.3	2.0	5.4
	64	66.1	61.7	4.60	-1.29	0.35	0.89	0.24	1.71	0.33	0.25	0.09	27.4	1.9	4.8

B. Base Capital Mobility ($q_K^* = 1.48$)

Steady-state population ≈ 1.23; Steady-state housing price ≈ 1.27; Steady-state asset wealth ≈ 0.98

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	Labor Mobility	% of Gap Closed at $t=0^+$		Initial Growth Rates (annual % rate at $t=0^+$)			Avg. Growth Rate, Decade 1			Growth Persistence, Decade 2 vs. Decade 1			Last Year |Growth| Exceeds 0.2%		
		wage	hsg val	pop	wage	hsg val	pop	wage	hsg val	pop	wage	hsg val	pop	wage	hsg val
	1/16	66.1	27.5	0.13	0.13	0.12	0.13	0.41	0.82	0.98	0.09	0.13	-	-	-
"low"	1/8	66.1	35.2	0.22	0.12	0.17	0.22	0.41	1.06	0.93	0.08	0.14	16.5	-	-
	1/4	66.1	43.7	0.36	0.10	0.23	0.34	0.40	1.31	0.86	0.08	0.14	35.9	-	8.2
	1/2	66.1	51.7	0.54	0.08	0.28	0.48	0.38	1.54	0.78	0.08	0.13	38.3	-	13.6
	1	66.1	58.3	0.78	0.03	0.32	0.64	0.36	1.72	0.68	0.09	0.11	36.0	-	13.4
base	2	66.1	63.2	1.08	-0.04	0.36	0.79	0.34	1.84	0.57	0.12	0.10	32.9	-	12.1
	4	66.1	66.6	1.48	-0.14	0.38	0.92	0.32	1.91	0.48	0.17	0.09	30.5	-	10.6
	8	66.1	68.8	1.98	-0.29	0.39	1.01	0.30	1.95	0.41	0.21	0.08	29.2	0.8	9.3
	16	66.1	70.1	2.65	-0.49	0.40	1.07	0.30	1.97	0.37	0.24	0.07	28.6	1.5	8.5
"high"	32	66.1	70.9	3.59	-0.79	0.41	1.09	0.29	1.98	0.35	0.26	0.07	28.1	1.7	8.0
	64	66.1	71.4	4.84	-1.20	0.41	1.11	0.29	1.99	0.34	0.26	0.07	27.8	1.6	7.7

C. "High" Capital Mobility ($q_K^* = 1.12$)

Steady-state population ≈ 1.23; Steady-state housing price ≈ 1.27; Steady-state asset wealth ≈ 0.99

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	Labor Mobility	% of Gap Closed at $t=0^+$		Initial Growth Rates (annual % rate at $t=0^+$)			Avg. Growth Rate, Decade 1			Growth Persistence, Decade 2 vs. Decade 1			Last Year |Growth| Exceeds 0.2%		
		wage	hsg val	pop	wage	hsg val	pop	wage	hsg val	pop	wage	hsg val	pop	wage	hsg val
	1/16	66.1	28.6	0.14	0.26	0.12	0.14	0.45	0.86	0.96	0.05	0.13	-	1.7	-
"low"	1/8	66.1	37.0	0.24	0.26	0.18	0.24	0.45	1.12	0.91	0.05	0.13	21.2	1.5	-
	1/4	66.1	46.5	0.39	0.25	0.24	0.37	0.44	1.40	0.84	0.05	0.13	36.9	1.3	10.4
	1/2	66.1	55.8	0.61	0.23	0.30	0.54	0.44	1.66	0.76	0.06	0.12	37.6	0.8	14.2
	1	66.1	63.9	0.89	0.19	0.35	0.75	0.42	1.87	0.65	0.07	0.10	34.1	-	13.3
base	2	66.1	70.2	1.26	0.14	0.39	0.95	0.41	2.03	0.54	0.09	0.08	29.8	-	11.4
	4	66.1	74.8	1.74	0.05	0.42	1.14	0.39	2.13	0.43	0.12	0.06	26.4	-	9.6
	8	66.1	78.0	2.32	-0.09	0.44	1.29	0.38	2.18	0.35	0.16	0.05	24.0	-	8.2
	16	66.1	80.0	3.07	-0.29	0.45	1.38	0.37	2.21	0.30	0.18	0.05	22.6	0.5	7.2
"high"	32	66.1	81.2	4.06	-0.58	0.46	1.43	0.37	2.23	0.28	0.19	0.04	21.8	1.0	6.5
	64	66.1	81.9	5.34	-0.98	0.46	1.46	0.37	2.24	0.26	0.20	0.04	21.4	1.2	6.2

Supplemental Table 2: Change in Productivity, Alternative Parameterizations and Shocks

Base Scenario: $\mu = 2$; $q_K^* = 1.48$; $\alpha = 0.33$; $\zeta = 0.15$; Δtfp = 3.3%

(1) Change from base scenario	(2) Steady-State Levels (relative to large economy)	(3)	(4)	(5)	(6) % of Gap Closed at $t=0^+$	(7)	(8) Initial Growth Rates (annual % rate at $t=0^+$)	(9)	(10)	(11) Avg. Growth Rate, Decade 1	(12)	(13)	(14) Growth Persistence, Decade 2 vs. Decade 1	(15)	(16)	(17) Last Year |Growth| Exceeds 0.2%	(18)	(19)
	pop	wage	hsg val	assets	wage	hsg val	pop	wage	hsg val	pop	wage	hsg val	pop	wage	hsg val	pop	wage	hsg val
none	1.23	1.05	1.27	0.98	66.1	63.2	1.08	-0.04	0.36	0.79	0.34	1.84	0.57	0.12	0.10	32.9	-	12.1
$\zeta = 0.30$	1.07	1.05	1.10	0.99	66.1	76.3	0.54	0.04	0.15	0.36	0.38	0.85	0.46	0.12	0.06	12.0	-	-
$\alpha = 0.67$ Δtfp = 1.6%	1.16	1.05	1.18	0.98	32.7	50.0	0.43	0.04	0.20	0.35	0.22	1.01	0.72	0.26	0.13	23.4	-	0.1
Δtfp = 6.6%	1.51	1.1	1.60	0.95	65.6	61.3	2.13	-0.05	0.67	1.57	0.67	3.65	0.57	0.12	0.09	49.3	-	27.8
Δtfp = 12.9%	2.24	1.2	2.50	0.90	64.6	57.4	4.15	-0.03	1.20	3.06	1.31	7.18	0.57	0.11	0.09	66.3	-	44.5

Supplemental Table 3: Change in Quality of Life, Alternative Capital and Labor Mobility

Numerical results for an increase in small economy quality of life equivalent to 3.5% of large economy consumption. Except for enumerated capital and labor mobility, all parameters are the same as in Figure 1.

A. "Low" Capital Mobility (q_K^* = 2.92)

Steady-state population ≈ 1.26; Steady-state housing price ≈ 1.26; Steady-state asset wealth ≈ 0.99

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	Labor Mobility	% Hsg Val Gap Clsd at t=0	Minimum Wage		Initial Growth Rates (annual % rate at t=0+)			Avg. Growth Rate, Decade 1			Growth Persistence, Decade 2 vs. Decade 1			Last Year |Growth| Exceeds 0.2%		
			level	year	pop	wage	hsg val	pop	wage	hsg val	pop	wage	hsg val	pop	wage	hsg val
	1/16	17.0	0.997	42.8	0.17	-0.02	0.13	0.16	-0.02	0.55	0.92	0.50	0.21	-	-	-
"low"	1/8	25.4	0.995	34.8	0.28	-0.04	0.19	0.26	-0.03	0.81	0.87	0.45	0.19	24.4	-	-
	1/4	34.6	0.993	27.9	0.46	-0.08	0.26	0.40	-0.05	1.08	0.79	0.36	0.17	37.7	-	12.0
	1/2	43.0	0.990	22.4	0.70	-0.13	0.31	0.57	-0.08	1.32	0.69	0.25	0.15	38.5	-	14.8
	1	49.9	0.987	17.8	1.04	-0.21	0.36	0.76	-0.12	1.50	0.57	0.13	0.13	35.0	0.7	13.5
base	2	55.1	0.984	14.1	1.50	-0.34	0.39	0.95	-0.15	1.61	0.45	-0.01	0.11	31.2	3.0	11.4
	4	58.6	0.981	11.2	2.13	-0.53	0.41	1.10	-0.19	1.68	0.34	-0.12	0.09	28.2	3.9	9.2
	8	61.0	0.979	8.8	2.98	-0.80	0.43	1.21	-0.21	1.72	0.27	-0.20	0.08	26.5	4.0	7.4
	16	62.6	0.977	6.8	4.19	-1.19	0.44	1.27	-0.23	1.73	0.23	-0.24	0.08	25.9	3.7	5.9
"high"	32	63.5	0.975	5.3	5.86	-1.74	0.45	1.30	-0.23	1.74	0.21	-0.25	0.08	25.3	3.2	4.6
	64	64.7	0.974	4.2	8.43	-2.59	0.45	1.33	-0.23	1.75	0.20	-0.25	0.08	25.3	2.6	3.7

B. Base Capital Mobility (q_K^* = 1.48)

Steady-state population ≈ 1.26; Steady-state housing price ≈ 1.26; Steady-state asset wealth ≈ 0.98

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	Labor Mobility	% Hsg Val Gap Clsd at t=0	Minimum Wage		Initial Growth Rates (annual % rate at t=0+)			Avg. Growth Rate, Decade 1			Growth Persistence, Decade 2 vs. Decade 1			Last Year |Growth| Exceeds 0.2%		
			level	year	pop	wage	hsg val	pop	wage	hsg val	pop	wage	hsg val	pop	wage	hsg val
	1/16	17.7	0.998	30.9	0.17	-0.02	0.13	0.16	-0.01	0.57	0.93	0.34	0.21	-	-	-
"low"	1/8	26.9	0.997	25.7	0.29	-0.03	0.20	0.27	-0.02	0.86	0.87	0.29	0.19	28.0	-	-
	1/4	37.1	0.996	21.2	0.47	-0.06	0.27	0.42	-0.03	1.16	0.80	0.21	0.17	40.8	-	14.5
	1/2	46.9	0.994	17.3	0.73	-0.10	0.33	0.61	-0.06	1.43	0.71	0.11	0.15	40.5	-	16.6
	1	55.2	0.991	14.1	1.09	-0.18	0.38	0.82	-0.08	1.64	0.59	-0.01	0.12	36.5	-	15.0
base	2	61.5	0.988	11.4	1.58	-0.30	0.42	1.04	-0.12	1.78	0.48	-0.14	0.10	32.4	1.9	12.6
	4	66.0	0.986	9.1	2.23	-0.47	0.45	1.22	-0.14	1.87	0.37	-0.25	0.08	29.3	3.1	10.4
	8	69.0	0.983	7.3	3.11	-0.73	0.47	1.35	-0.17	1.92	0.30	-0.33	0.07	27.3	3.4	8.6
	16	70.9	0.980	5.8	4.34	-1.11	0.48	1.43	-0.18	1.94	0.26	-0.37	0.07	26.5	3.2	7.3
"high"	32	72.2	0.978	4.5	6.00	-1.65	0.49	1.46	-0.18	1.95	0.24	-0.39	0.07	25.9	2.8	6.4
	64	72.9	0.976	3.5	8.31	-2.40	0.49	1.48	-0.18	1.96	0.23	-0.39	0.07	25.5	2.4	5.8

C. "High" Capital Mobility (q_K^* = 1.12)

Steady-state population ≈ 1.26; Steady-state housing price ≈ 1.26; Steady-state asset wealth ≈ 0.99

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	Labor Mobility	% Hsg Val Gap Clsd at t=0	Minimum Wage		Initial Growth Rates (annual % rate at t=0+)			Avg. Growth Rate, Decade 1			Growth Persistence, Decade 2 vs. Decade 1			Last Year |Growth| Exceeds 0.2%		
			level	year	pop	wage	hsg val	pop	wage	hsg val	pop	wage	hsg val	pop	wage	hsg val
	1/16	18.2	0.999	19.6	0.17	-0.01	0.14	0.16	0.00	0.59	0.93	0.12	0.21	-	-	-
"low"	1/8	27.9	0.999	16.6	0.30	-0.02	0.20	0.28	-0.01	0.89	0.88	0.07	0.19	30.1	-	1.2
	1/4	39.0	0.998	14.1	0.49	-0.04	0.28	0.44	-0.02	1.21	0.81	0.00	0.17	41.9	-	15.6
	1/2	50.0	0.997	11.9	0.77	-0.07	0.35	0.65	-0.03	1.51	0.71	-0.10	0.14	40.5	-	17.2
	1	59.6	0.996	9.9	1.16	-0.13	0.40	0.89	-0.04	1.75	0.60	-0.21	0.11	32.8	-	14.9
base	2	67.4	0.994	8.3	1.70	-0.22	0.45	1.15	-0.06	1.93	0.48	-0.34	0.09	30.1	0.4	12.2
	4	73.2	0.991	6.7	2.42	-0.38	0.48	1.39	-0.08	2.04	0.37	-0.45	0.07	23.4	1.8	9.8
	8	77.2	0.988	5.5	3.37	-0.61	0.50	1.57	-0.10	2.11	0.28	-0.54	0.05	23.3	2.4	8.0
	16	79.8	0.986	4.5	4.64	-0.96	0.52	1.69	-0.11	2.14	0.23	-0.59	0.04	21.5	2.5	6.7
"high"	32	81.5	0.983	3.6	6.36	-1.48	0.53	1.75	-0.11	2.16	0.20	-0.61	0.04	20.6	2.3	5.7
	64	82.5	0.980	2.8	8.74	-2.23	0.53	1.78	-0.11	2.16	0.20	-0.66	0.04	15.7	2.0	5.2

Supplemental Table 4: Change in Quality of Life, Alternative Parameterizations and Shocks

Base Scenario: $\mu = 2$; $q_K^* = 1.48$; $\alpha = 0.33$; $\zeta = 0.15$; Equivalent Variation (EV) = 3.5%

(1) Change from base scenario	(2) Steady-State Levels (relative to large economy)	(3)	(4)	(5)	(6) % Hsg Val Gap Clsd at t=0	(7) Minimum Wage	(8)	(9) Initial Growth Rates (annual % rate at $t=0^+$)	(10)	(11)	(12) Avg. Growth Rate, Decade 1	(13)	(14)	(15) Growth Persistence, Decade 2 vs. Decade 1	(16)	(17)	(18) Last Year |Growth| Exceeds 0.2%	(19)	(20)
	pop	wage	hsg val	assets		level	year	pop	wage	hsg val	pop	wage	hsg val	pop	wage	hsg val	pop	wage	hsg val
none	1.26	1.00	1.26	0.98	61.5	0.99	11.4	1.58	-0.30	0.42	1.04	-0.12	1.78	0.48	-0.14	0.10	32.4	1.9	12.6
$\zeta = 0.30$	1.12	1.00	1.12	0.99	73.2	0.99	9.5	1.26	-0.27	0.25	0.71	-0.09	1.01	0.33	-0.26	0.06	16.4	1.2	2.1
$\alpha = 0.67$	1.27	1.00	1.26	0.98	52.1	0.97	13.4	1.42	-0.64	0.38	0.88	-0.27	1.54	0.46	-0.03	0.12	33.0	5.6	11.7
EV = 7%	1.58	1.00	1.57	0.97	60.1	0.98	11.3	3.12	-0.57	0.78	2.05	-0.22	3.53	0.48	-0.14	0.10	47.6	4.7	26.7
EV = 14%	2.44	1.00	2.40	0.94	57.5	0.96	11.2	6.09	-1.06	1.36	4.02	-0.41	6.94	0.47	-0.14	0.09	62.3	6.7	41.0

Supplemental Table 5: Negative Capital Shock

Numerical results for a shock to small economy physical capital stock that causes small economy wages to fall to 90% of their steady-state level. Except for enumerated capital and labor mobility, all parameters are the same as in Figure 1.

A. "Low" Capital Mobility (q_K^* = 2.92)

Steady-state population ≈ 1.017; Steady-state housing price = 1; Steady-state asset wealth ≈ 0.92

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	Labor Mobility	Initial Hsg Value	Population Minimum		Initial Growth Rates (annual % rate at $t=0^+$)			Avg Growth, Decade 1 (% rate from $t=0^-$ to t=10)			Growth Persistence, Decade 2 vs. Decade 1			Last Year |Growth| Exceeds 0.2%		
			level	year	pop	wage	hsg val	pop	wages	hsg val	pop	wages	hsg val	pop	wage	hsg val
	1/16	0.967	0.987	30.1	-0.12	0.63	-0.03	-0.09	-0.59	-0.35	0.43	-0.43	-0.01	-	18.7	-
"low"	1/8	0.962	0.977	27.0	-0.23	0.65	-0.04	-0.16	-0.58	-0.41	0.38	-0.44	-0.02	2.0	18.6	-
	1/4	0.955	0.965	23.4	-0.42	0.69	-0.07	-0.27	-0.55	-0.49	0.30	-0.45	-0.05	7.7	18.0	-
	1/2	0.947	0.949	19.7	-0.73	0.77	-0.10	-0.44	-0.52	-0.57	0.20	-0.46	-0.09	10.4	17.2	-
	1	0.938	0.932	16.4	-1.22	0.91	-0.13	-0.64	-0.48	-0.65	0.08	-0.47	-0.14	10.7	15.7	-
base	2	0.931	0.915	13.2	-1.96	1.13	-0.16	-0.86	-0.42	-0.70	-0.05	-0.44	-0.18	29.3	13.9	-
	4	0.924	0.899	10.7	-3.05	1.46	-0.18	-1.07	-0.38	-0.73	-0.16	-0.39	-0.22	35.6	11.8	-
	8	0.919	0.885	8.5	-4.60	1.95	-0.20	-1.21	-0.34	-0.75	-0.23	-0.33	-0.24	36.3	9.8	0.0
	16	0.915	0.873	6.7	-6.85	2.68	-0.22	-1.29	-0.32	-0.75	-0.27	-0.28	-0.25	36.1	7.9	11.8
"high"	32	0.912	0.864	5.2	-10.04	3.73	-0.23	-1.32	-0.32	-0.75	-0.28	-0.26	-0.25	35.6	6.3	12.3
	64	0.910	0.856	4.0	-14.58	5.23	-0.24	-1.33	-0.32	-0.76	-0.28	-0.26	-0.24	30.9	4.9	12.2

B. Base Capital Mobility (q_K^* = 1.48)

Steady-state population ≈ 1.012; Steady-state housing price = 1; Steady-state asset wealth ≈ 0.93

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	Labor Mobility	Initial Hsg Value	Population Minimum		Initial Growth Rates (annual % rate at $t=0^+$)			Avg Growth, Decade 1 (% rate from $t=0^-$ to t=10)			Growth Persistence, Decade 2 vs. Decade 1			Last Year |Growth| Exceeds 0.2%		
			level	year	pop	wage	hsg val	pop	wages	hsg val	pop	wages	hsg val	pop	wage	hsg val
	1/16	0.978	0.993	20.2	-0.09	1.00	-0.01	-0.06	-0.42	-0.22	0.21	-0.59	-0.04	-	16.9	-
"low"	1/8	0.976	0.988	18.8	-0.18	1.01	-0.02	-0.10	-0.41	-0.25	0.17	-0.59	-0.06	-	16.7	-
	1/4	0.972	0.980	17.0	-0.34	1.05	-0.03	-0.18	-0.40	-0.29	0.11	-0.60	-0.11	4.0	16.4	-
	1/2	0.966	0.968	14.8	-0.61	1.12	-0.05	-0.31	-0.38	-0.34	0.02	-0.60	-0.16	6.9	15.9	-
	1	0.960	0.953	12.7	-1.05	1.23	-0.07	-0.47	-0.35	-0.38	-0.09	-0.60	-0.22	8.0	15.0	-
base	2	0.954	0.936	10.6	-1.75	1.41	-0.09	-0.66	-0.32	-0.42	-0.20	-0.57	-0.29	26.7	13.7	-
	4	0.948	0.919	8.7	-2.82	1.73	-0.11	-0.84	-0.28	-0.44	-0.31	-0.52	-0.33	31.3	12.1	-
	8	0.944	0.902	7.0	-4.40	2.21	-0.13	-0.97	-0.26	-0.45	-0.38	-0.46	-0.36	32.0	10.3	-
	16	0.940	0.888	5.6	-6.68	2.93	-0.15	-1.05	-0.25	-0.45	-0.42	-0.41	-0.38	32.0	8.7	11.3
"high"	32	0.937	0.875	4.4	-9.93	3.98	-0.16	-1.07	-0.25	-0.45	-0.43	-0.40	-0.38	31.9	7.1	11.8
	64	0.935	0.865	3.5	-14.52	5.48	-0.16	-1.08	-0.25	-0.45	-0.43	-0.39	-0.38	31.3	5.8	11.8

C. "High" Capital Mobility (q_K^* = 1.12)

Steady-state population ≈ 1.008; Steady-state housing price = 1; Steady-state asset wealth ≈ 0.96

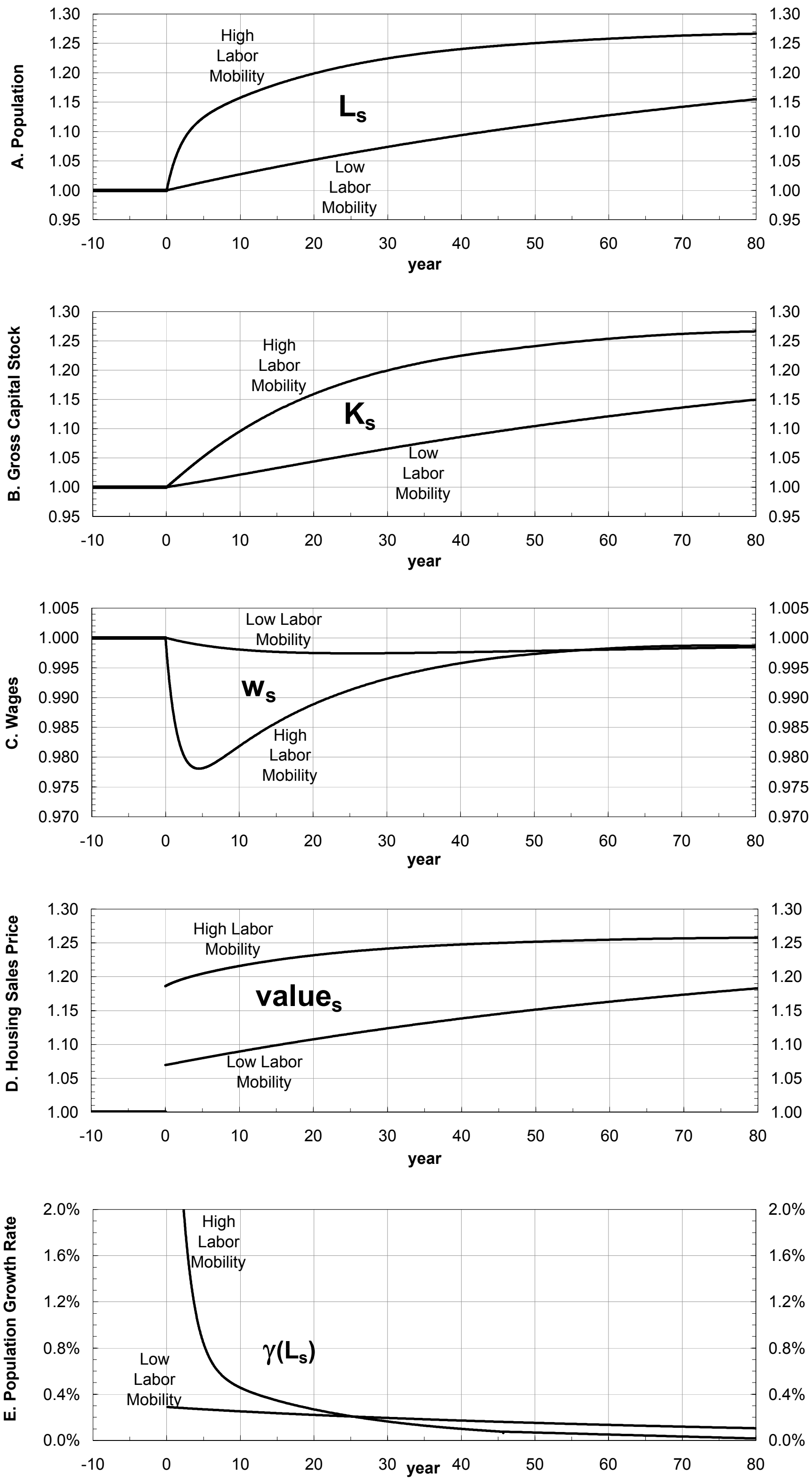
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	Labor Mobility	Initial Hsg Value	Population Minimum		Initial Growth Rates (annual % rate at $t=0^+$)			Avg Growth, Decade 1 (% rate from $t=0^-$ to t=10)			Growth Persistence, Decade 2 vs. Decade 1			Last Year |Growth| Exceeds 0.2%		
			level	year	pop	wage	hsg val	pop	wages	hsg val	pop	wages	hsg val	pop	wage	hsg val
	1/16	0.989	0.998	11.4	-0.06	1.91	0.00	-0.02	-0.19	-0.11	-0.16	-0.81	-0.06	-	12.6	-
"low"	1/8	0.988	0.996	11.1	-0.11	1.91	0.00	-0.04	-0.18	-0.11	-0.18	-0.81	-0.11	-	12.6	-
	1/4	0.987	0.992	10.6	-0.22	1.93	-0.01	-0.08	-0.18	-0.12	-0.22	-0.81	-0.17	0.5	12.5	-
	1/2	0.984	0.986	9.7	-0.41	1.97	-0.01	-0.14	-0.17	-0.14	-0.28	-0.81	-0.24	3.0	12.3	-
	1	0.981	0.977	8.7	-0.76	2.05	-0.02	-0.23	-0.17	-0.15	-0.36	-0.80	-0.34	4.6	12.0	-
base	2	0.978	0.964	7.5	-1.36	2.20	-0.04	-0.35	-0.15	-0.17	-0.46	-0.77	-0.43	5.2	11.4	-
	4	0.974	0.949	6.4	-2.32	2.44	-0.05	-0.47	-0.14	-0.18	-0.56	-0.72	-0.51	21.5	10.7	-
	8	0.970	0.932	5.3	-3.80	2.85	-0.06	-0.57	-0.14	-0.18	-0.63	-0.66	-0.57	23.0	9.8	-
	16	0.967	0.915	4.3	-6.00	3.50	-0.07	-0.62	-0.14	-0.18	-0.68	-0.63	-0.60	23.1	8.8	6.1
"high"	32	0.964	0.899	3.5	-9.28	4.51	-0.08	-0.64	-0.14	-0.17	-0.69	-0.62	-0.61	23.0	7.9	7.6
	64	0.962	0.884	2.8	-13.91	5.99	-0.09	-0.65	-0.14	-0.17	-0.70	-0.62	-0.62	23.0	7.2	7.8

Supplemental Table 6: Negative Capital Shocks, Alternative Parameterizations and Shocks

Base Scenario: $\mu = 2$; $q_K^* = 1.48$; $\alpha = 0.33$; $\zeta = 0.15$; $w(0)/w^* = 0.90$

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Change from base scenario	Steady-State Levels (relative to large economy)				Initial Hsg Value	Population Minimum		Initial Growth Rates (annual % rate at $t=0^+$)			Avg Growth, Decade 1 (% rate from $t=0^-$ to $t=10$)			Growth Persistence, Decade 2 vs. Decade 1			Last Year |Growth| Exceeds 0.2%		
	pop	wage	hsg val	assets		level	year	pop	wage	hsg val	pop	wages	hsg val	pop	wages	hsg val	pop	wage	hsg val
None	1.02	1.00	1.00	0.94	0.95	0.94	10.6	-1.75	1.41	-0.09	-0.66	-0.32	-0.42	-0.20	-0.57	-0.29	26.7	13.7	-
$\zeta = 0.30$	1.01	1.00	1.00	0.97	0.97	0.96	8.5	-1.20	1.30	-0.04	-0.37	-0.36	-0.21	-0.41	-0.55	-0.39	5.7	14.4	-
$\alpha = 0.67$	1.01	1.00	1.00	0.97	0.96	0.95	12.6	-1.26	1.31	-0.09	-0.53	-0.37	-0.43	-0.07	-0.46	-0.18	8.0	13.1	-
$w(0)/w^* = 0.80$	1.03	1.00	1.00	0.89	0.91	0.88	10.6	-3.56	3.14	-0.19	-1.33	-0.65	-0.84	-0.21	-0.58	-0.29	47.0	19.7	24.0
$w(0)/w^* = 0.60$	1.07	1.00	1.00	0.78	0.83	0.76	10.5	-7.20	8.16	-0.38	-2.70	-1.33	-1.66	-0.21	-0.60	-0.29	63.6	26.6	42.1

Supplemental Figure 1: High vs. Low Labor Mobility Dynamics from a Positive Quality-of-Life Change

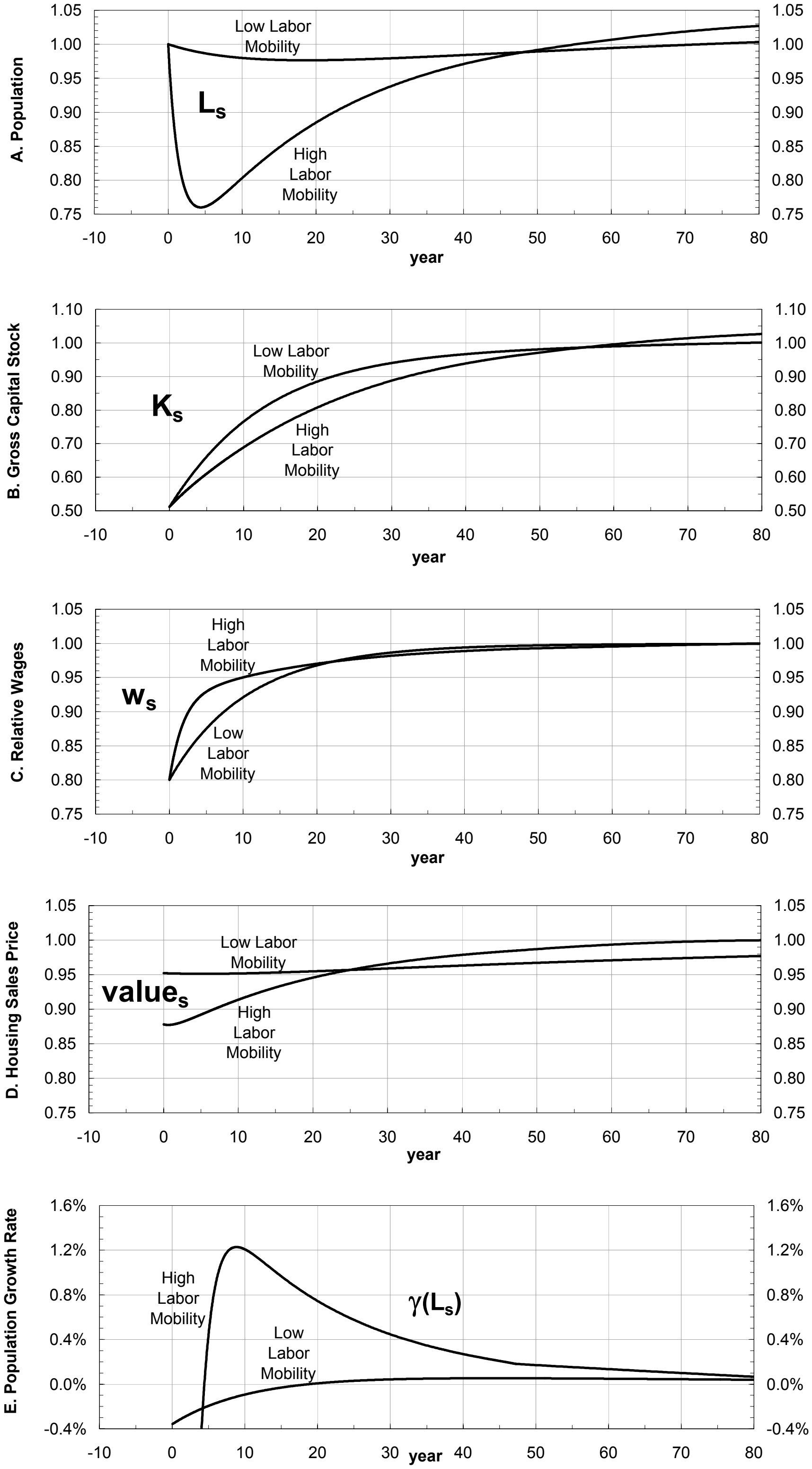


Calibration

Figure assumes an increase in small-economy quality of life equivalent to 3.5% of large-economy consumption. Except for labor mobility, parameters repeated below are the same as in Figures 1 and 3.

Capital Share	$\alpha = 0.33$
Capital Depreciation Rate	$\delta = 0.06$
Housing Share	$\zeta = 0.15$
Time Preference	$\rho = 0.03$
Steady-State Shadow Value of Capital	$q_K^* = 1.48$
Net Migration Response to 1% Wage Differential	$\mu_{Low} = 1/8$ $\mu_{High} = 32$

Supplemental Figure 2: High vs. Low Labor Mobility Dynamics from a Negative Capital Shock

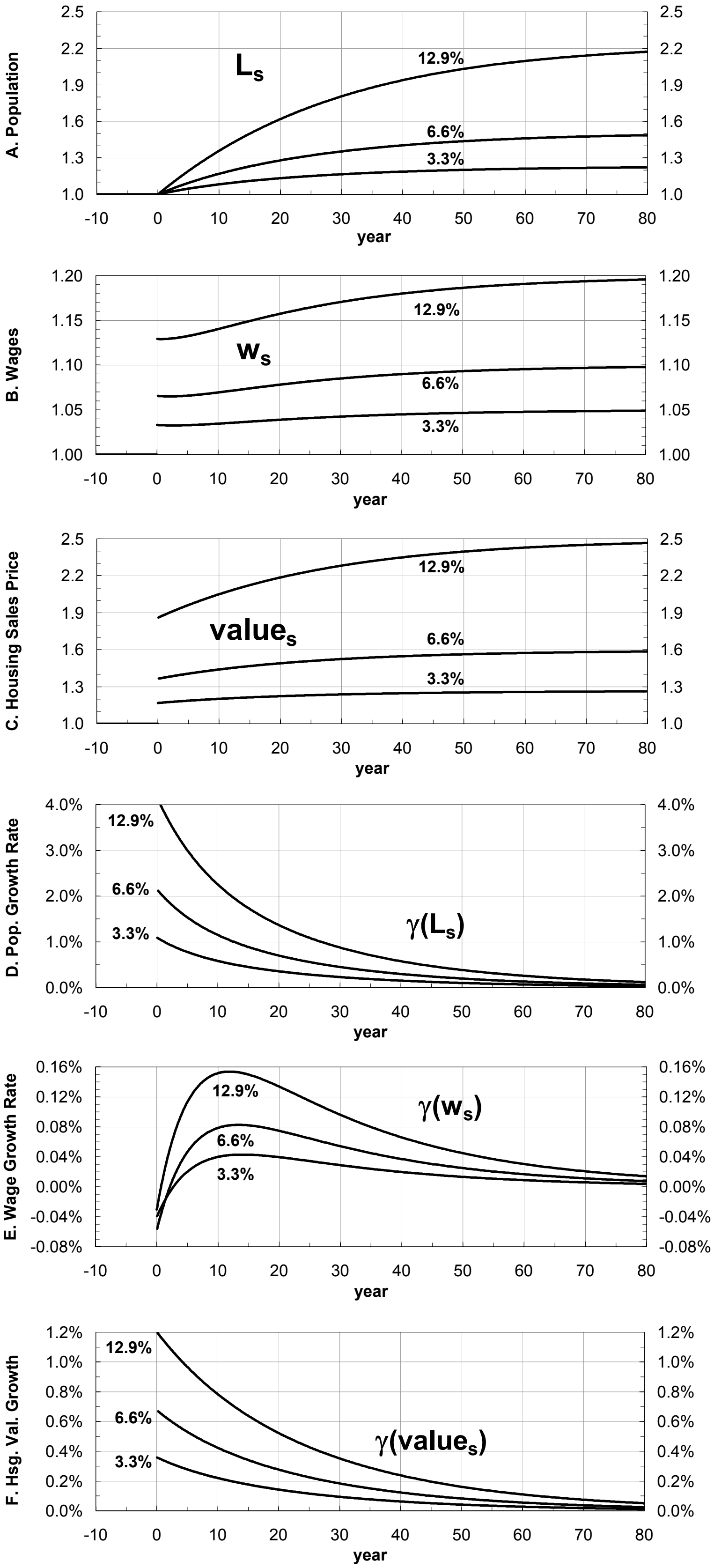


Calibration

Figure assumes a shock to initial small-economy physical capital stock such that initial small-economy wages are 80% their steady-state level. Except for labor mobility, parameters repeated below are the same as in Figures 1, 3, and 4.

Capital Share	$\alpha = 0.33$
Capital Depreciation Rate	$\delta = 0.06$
Housing Share	$\zeta = 0.15$
Time Preference	$\rho = 0.03$
Steady-State Shadow Value of Capital	$q_K^* = 1.48$
Net Migration Response to 1% Wage Differential	$\mu_{Low} = 1/8$ $\mu_{High} = 32$

Supplemental Figure 3: Different-Sized Productivity Changes

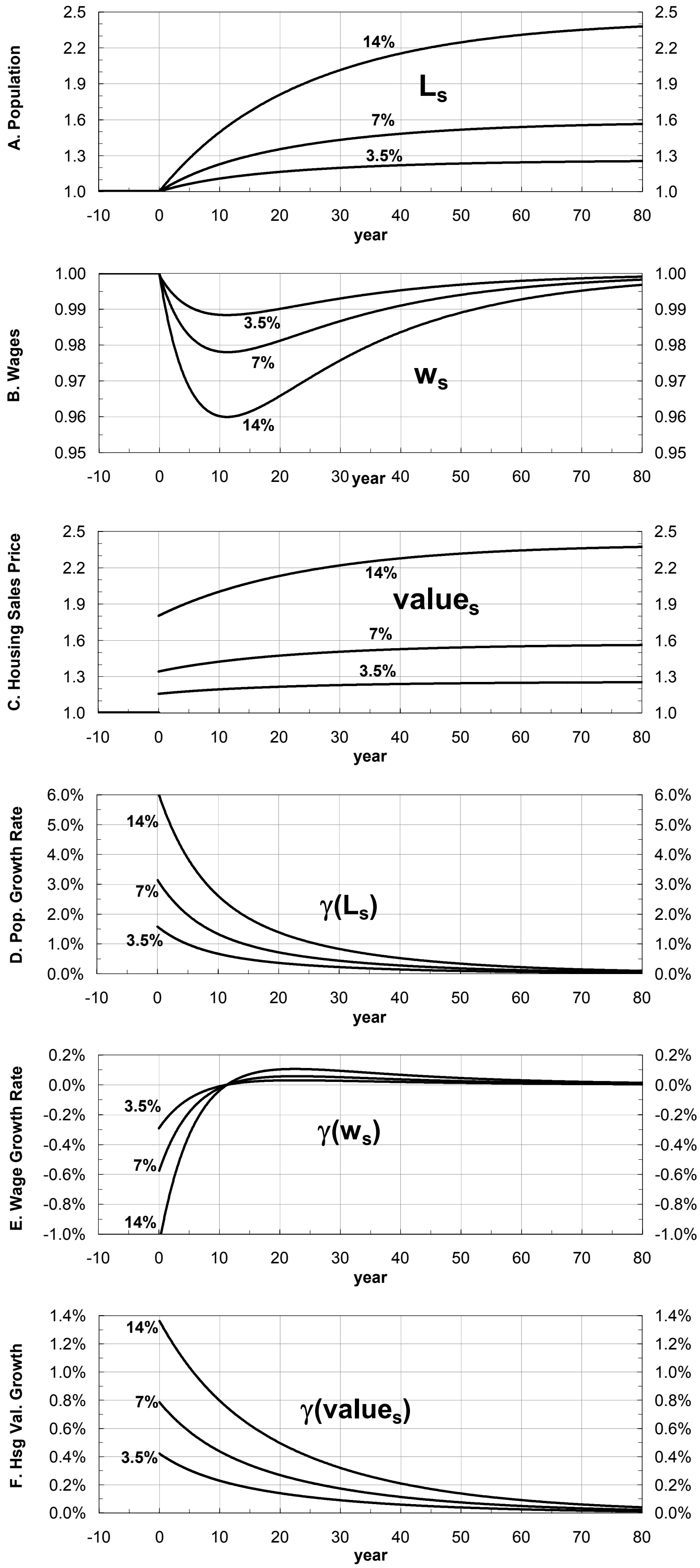


Calibration

Figure assumes increases in total factor productivity such that steady-state wages increase by 5%, 10%, and 20%. These imply 3.3%, 6.6% and 12.9% rises in TFP. Parameters repeated below are the same as in Figure 1.

Capital Share	$\alpha = 0.33$
Capital Depreciation Rate	$\delta = 0.06$
Housing Share	$\zeta = 0.15$
Time Preference	$\rho = 0.03$
Steady-State Shadow Value of Capital	$q_K^* = 1.48$
Net Migration Response to 1% Wealth Differential	$\mu = 2$

Supplemental Figure 4: Different-Sized Quality-of-Life Changes

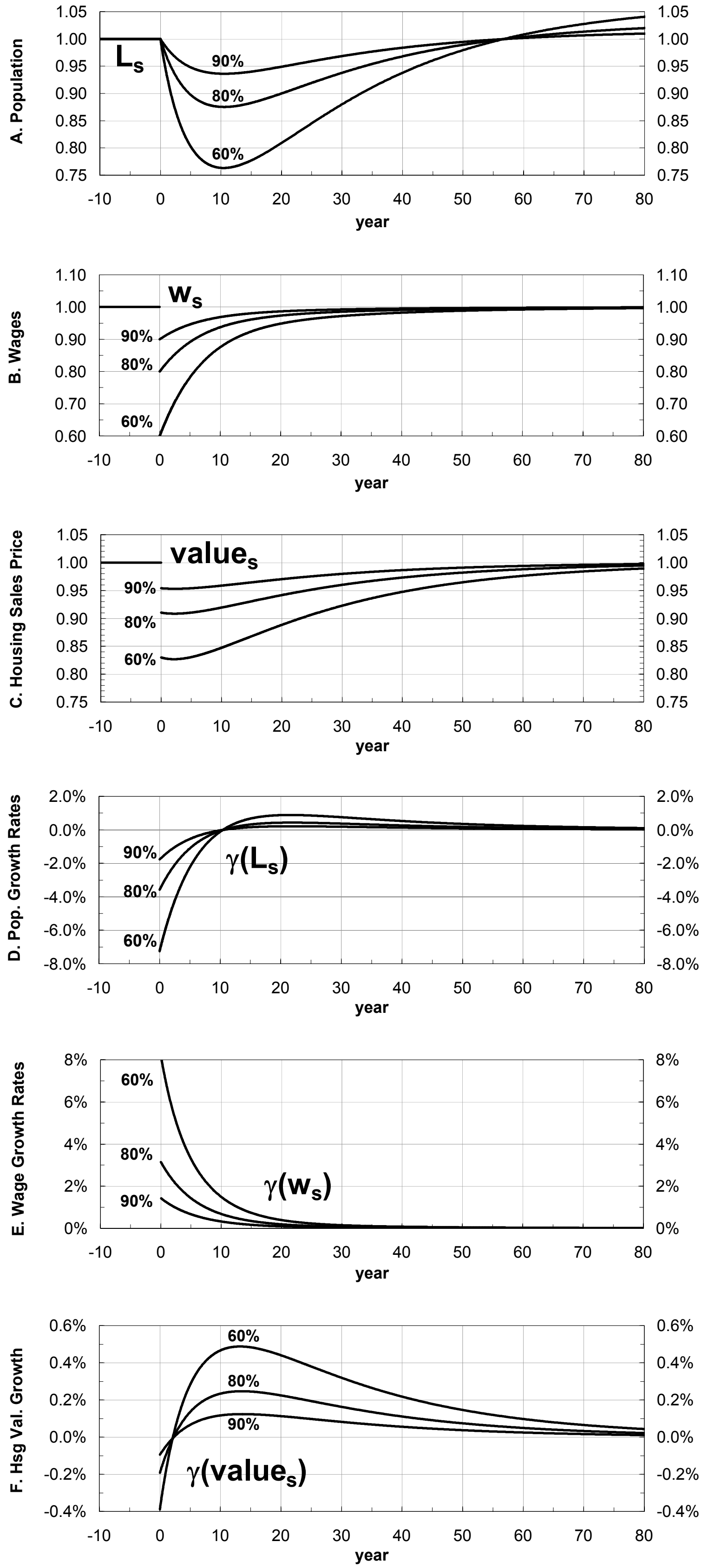


Calibration

Figure assumes increases in small-economy quality of life equivalent to 3.5%, 7%, and 14% of large-economy consumption. Parameters repeated below are the same as in Figures 1 and 3.

Capital Share	$\alpha = 0.33$
Capital Depreciation Rate	$\delta = 0.06$
Housing Share	$\zeta = 0.15$
Time Preference	$\rho = 0.03$
Steady-State Shadow Value of Capital	$q_K^* = 1.48$
Net Migration Response to 1% Wealth Differential	$\mu = 2$

Supplemental Figure 5: Different-Sized Negative Capital Shocks



Calibration

Figure assumes shocks to initial small-economy physical capital stock such that initial small-economy wages are 90%, 80%, and 60% their steady-state level. Parameters repeated below are the same as in Figures 1, 3, and 4.

Capital Share	$\alpha = 0.33$
Capital Depreciation Rate	$\delta = 0.06$
Housing Share	$\zeta = 0.15$
Time Preference	$\rho = 0.03$
Steady-State Shadow Value of Capital	$q_K^* = 1.48$
Net Migration Response to 1% Wealth Differential	$\mu = 2$