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# Economic Consequences of Demographic Change in the Former USSR: Social Transfers in the Kyrgyz Republic

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**Summary.** — Dramatic demographic changes accompanied the decay and collapse of the Soviet Union. This paper considers their long-run economic effects, particularly with respect to impacts on government budgetary positions due to social transfers. Using a detailed actuarial forecasting model for the Central Asian country of Kyrgyzstan, the paper demonstrates that the effect of the transition will be felt far into the 21st century, as government budget pressures to meet social expenditure needs result in lower savings rates and higher public debt.


*Key words* — Asia, Kyrgyzstan, transitional economies, demography, pensions, fiscal reform

## 1. INTRODUCTION

This paper examines the long-run government budget and hence macroeconomic consequences of the demographic changes that have engulfed the formerly socialist world, with particular reference to social transfers and to the Kyrgyz Republic. That exceptional changes have occurred is well established. It is also generally accepted that economic deterioration and the associated decline in social capital have been largely responsible for these demographic shocks. But, the long-run feedback of deteriorating demographic conditions to lower growth potential, via reduced public finances, is less readily appreciated in the transition environment.

Changing duration and intensity of "demographic gift" and "demographic burden" eras (Bloom & Williamson, 1998; Higgins, 1997) drive the long-run economic consequences of demographic shocks. Demographic structure affects savings rates; more subtly, productivity growth and investment demand are both associated with large cohorts of young adults, especially if labor force entrants are relatively well educated. As demographic structure thus affects both savings and investment, it should affect current account and trade balances, and this also has been found empirically. In (post)-socialist countries and in advanced welfare states, the public sector's redistributive role may well amplify these effects, especially if intergenerational transfers are enabled by pay-as-you-go (*PAYGO*) pension and social insurance schemes.

We argue that this amplification has been dramatic in the former Soviet Union. Economic stagnation during the late Soviet era and near collapse thereafter gave rise to or greatly hastened extraordinary demographic changes. Although recent demographic structures have been relatively favorable to

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economic growth in much of the former USSR, the collapse prevented realization of benefits from what should have been a demographic gift era. Bloom and Williamson (1998) find that as much as half of East and Southeast Asia's exceptional economic growth reflects an unusually favorable "demographic gift" period in which the share of young adults in the population is unusually great, while dependency burdens are unusually small. But they examine the impact of demographic structure on growth exclusively from a supply-side perspective, and presume that aggregate demand is adequate. In the post-Soviet environment with collapsed demand, this framework needs to be modified: favorable demographic structure will generate rapid economic growth in potential capacity, with actual output growth contingent on maintained demand and public sector and institutional structure efficiency.

Thus, a demographic gift era is being replaced by changes that will create public budgetary burdens and macroeconomic stress. The economic crises accompanying transition would have generated great tension even in the absence of demographic change. But because the crises have had a strong demographic component as well, the cumulative effect is greater yet, even threatening the viability of some slowly recovering states that do not curtail social commitments. These demographic shocks also mean that the consequences of social collapse will be felt for decades into the future, likely stunting long-run economic growth potential and reducing government capacity for the first half of the 21st century. This paper emphasizes these consequences in Central Asia, a part of the former USSR that hitherto had been undergoing a very slow demographic transition. While the demographic changes that occurred are even greater elsewhere, the transition appears most starkly in this region.

Section 2 considers the impact of socialist collapse and the ensuing transition on demographic change. Of primary interest are changes in fertility and mortality, which in turn are linked to marriage incidence (Becker & Hemley, 1998). Section 3 then turns to a specific example, the Kyrgyz Republic, and asks how different population structure is likely to be because of the changes that have taken place. Using a large-scale actuarial simulation model (specifically, the World Bank's PROST model, fitted to Kyrgyz data), Sections 4 and 5 then examine the consequences of demographic structural change for public sector deficits. Macroeconomic consequences of the rising debt and likely lower productivity growth are addressed heuristically in Section 6, while lessons are drawn in Section 7.

## 2. THE LATE- AND POST-SOCIALIST DEMOGRAPHIC TRANSITION

Demographic changes across the former USSR and Eastern Europe have not been identical, but there are strong similarities. The onset of these trends did not coincide exactly with the collapse of socialist states, but began during (or even prior to) the economic stagnation of the late socialist era. These trends have been described in detail elsewhere (Becker & Hemley, 1998; DaVanzo, 1996; National Research Council, 1997); official figures are presented summarily in Table 1, while detailed data are restricted to Kyrgyzstan, which serves as our example.

The primary characteristics of the late- and post-socialist demographic transition (hereafter simply referred to as the "socialist transition") include rising mortality, especially for working-age males, and sharply increasing disability incidence. At the same time, the region has witnessed markedly declining fertility, especially for higher-order births, and births to married couples, along with declining crude marriage rates. There also has been accelerated emigration from Central Asia and the Transcaucasus toward countries of original ethnic origin; and migration from secondary to primary cities.

Mortality increases are the most shocking of these phenomena. In Russia, male life expectancy declined from 65.0 years in 1987 to 57.6 years in 1994; since then, it has gradually risen to about 60 years (Table 1). In other former Soviet republics with accurate data, the decline typically ranged from four to seven years. Since virtually none of this decline in life expectancy was due to rising infant mortality, and as the impact of rising elderly mortality was not great, the life expectancy decline must have been driven by increased adult mortality. So it has been: mortality more than doubled for Russian men aged 30–44 during 1987–95, and nearly doubled for those aged 45–54.

Of the Central Asian republics, Kazakhstani data are by far the best. As Becker and Urzhumova (forthcoming) report, recorded life expectancy in Kazakhstan was stagnant over 1965–90 (though this in part likely reflected improved reporting, especially for infant deaths).

Table 1. *Demographic patterns in select former Soviet Republics, 1969–2000, based on official data*

| Year/event | Kyrgyz Republic | Russia | Kazakhstan | Uzbekistan | Ukraine | Belarus | Latvia |
|---|---|---|---|---|---|---|---|
| *Life expectancy at birth, males* | | | | | | | |
| 1969 | 63.60 | 63.20 | 64.10 | 68.50 | 66.50 | 68.50 | 65.50 |
| 1974 | 63.90 | 62.80 | – | – | 66.30 | 68.00 | 65.20 |
| 1979 | 61.10 | 61.50 | 61.60 | 64.00 | 64.70 | 66.30 | 63.60 |
| 1984 | 62.00 | 62.30 | *62.56* | 65.10 | 64.60 | 65.60 | 63.90 |
| 1987 | 64.74 | 65.00 | 64.22 | 65.70 | 66.68 | 67.63 | 66.30 |
| 1989 | 64.33 | 64.20 | 63.93 | 66.00 | 66.17 | 66.79 | 65.30 |
| 1994 | 61.14 | 57.60 | 60.85 | – | 62.44 | 63.48 | 59.29 |
| 1997 | 62.52 | 60.80 | 59.43 | *68.20* | 62.37 | 62.86 | 64.14 |
| 2000 | 63.79 | 59.00 | 60.15 | 68.00 | 62.30 | 63.37 | 65.00 |
| *Life expectancy at birth, females* | | | | | | | |
| 1969 | *71.80* | 73.40 | – | – | *74.30* | 76.30 | 74.20 |
| 1974 | 72.50 | *73.40* | – | – | 74.60 | 76.00 | 74.70 |
| 1979 | 70.00 | 73.00 | 71.90 | 70.70 | 74.00 | 75.90 | 73.90 |
| 1984 | 70.30 | 73.30 | 72.12 | 71.00 | 74.10 | 75.60 | 74.50 |
| 1987 | 72.21 | 74.60 | 72.94 | 71.30 | 74.95 | 76.18 | 75.00 |
| 1989 | 72.48 | 74.50 | 72.27 | 72.10 | 75.27 | 76.41 | 75.20 |
| 1994 | 69.92 | 71.20 | 71.07 | – | 72.97 | 74.61 | 72.62 |
| 1997 | 71.17 | 72.90 | 70.59 | 73.40 | 73.25 | 74.39 | 75.13 |
| 2000 | 72.04 | 72.20 | 71.64 | 73.00 | 73.62 | 74.76 | 76.00 |
| *Total fertility rate (females)* | | | | | | | |
| 1969 | 4.68 | 1.97 | 3.26 | 5.76 | 1.98 | 2.23 | 1.85 |
| 1974 | 4.81 | 2.00 | 3.31 | 5.71 | 2.04 | 2.23 | 1.97 |
| 1979 | 4.41 | 1.90 | 3.03 | 5.10 | 1.96 | 2.06 | 1.86 |
| 1984 | 4.13 | 2.08 | 2.98 | 4.61 | 2.12 | 2.14 | 2.12 |
| 1987 | 4.22 | 2.19 | 3.16 | 4.66 | 2.09 | 2.08 | 2.15 |
| 1989 | 3.81 | 2.01 | 2.88 | 4.02 | 1.90 | 2.03 | 2.05 |
| 1994 | 2.94 | 1.40 | 2.25 | 3.54 | 1.50 | 1.51 | 1.39 |
| 1997 | 2.59 | 1.23 | 2.00 | 3.08 | 1.30 | 1.23 | 1.11 |
| 2000 | 2.44 | 1.21 | 1.80 | 2.70 | 1.10 | 1.30 | 1.20 |
| *Crude marriage rate* | | | | | | | |
| 1970 | 9.2 | 10.1 | 9.5 | 9.1 | 9.8 | 9.3 | 10.2 |
| 1975 | – | 11.1 | – | – | 10.9 | 9.9 | 10.0 |
| 1980 | 10.7 | 10.6 | 10.6 | 10.9 | 9.3 | 10.1 | 9.8 |
| 1985 | 10.1 | 9.7 | 10.0 | 11.0 | 9.6 | 9.9 | 9.3 |
| 1990 | 9.9 | 8.9 | *10.1* | – | 9.3 | 9.7 | 8.9 |
| 1995 | 6.0 | 7.3 | 7.3 | – | 8.4 | 7.6 | 4.5 |
| 1997 | 5.7 | 6.3 | 6.6 | – | 6.8 | 6.9 | 4.0 |
| 2000 | – | 6.2 | 6.1 | – | 5.6 | 6.2 | 3.9 |

*Data sources*: *Naseleniie i obshchestvo* www.demoscope.ru; Kazakhstan Statistical Agency www.stat.kz; National Statistical Agency of the Kyrgyz Republic http://stat-gvc.su; Goskomstat (1989). Data for adjacent years reported in italics if stated year data unavailable.

During 1990–95, recorded life expectancy then declined by 6.5 years for men and 5.6 years for women, with the main mortality increases occurring among working-age adults. For the main city, Almaty, and the new capital, Astana, age-specific mortality rates have already fallen to late Soviet levels. A second group of provinces (*oblasts*) contains those still experiencing very high mortality, but with clear indications that recovery is underway for most age groups. Finally, several *oblasts* show no clear sign of recovery. Overall, it appears that Kazakhstan's growing economic inequality is being accompanied by a demographic dualism, in which prosperous regions quickly come to resemble their counterparts in upper-middle income countries,

Table 2. *Age-specific adult mortality rates, Kyrgyzstan, 1987–97 (deaths per thousand population)*

| Year | 20–24 | 25–29 | 30–34 | 35–39 | 40–44 | 45–49 | 50–54 | 55–59 | 60–64 | 65–69 | 70+ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Men* | | | | | | | | | | | |
| 1987 | 1.49 | 2.32 | 2.89 | 3.78 | 5.23 | 8.63 | 10.68 | 17.51 | 25.23 | 37.42 | – |
| 1990 | 1.99 | 2.94 | 3.81 | 4.59 | 7.26 | 9.92 | 13.95 | 18.90 | 26.91 | 39.07 | 99.45 |
| 1992 | 1.86 | 2.91 | 3.33 | 4.40 | 6.76 | 9.68 | 14.63 | 18.86 | 29.68 | 40.09 | 104.22 |
| 1994 | 1.90 | 3.23 | 4.65 | 6.42 | 10.03 | 13.90 | 20.03 | 25.59 | 38.02 | 48.24 | 119.20 |
| 1995 | 2.29 | 3.32 | 4.90 | 6.41 | 10.23 | 14.27 | 19.29 | 25.21 | 38.43 | 49.66 | 108.65 |
| 1996 | 2.02 | 3.36 | 4.26 | 5.68 | 8.27 | 13.16 | 17.87 | 23.22 | 36.24 | 46.95 | 103.50 |
| 1997 | 2.14 | 2.99 | 4.48 | 5.95 | 7.95 | 12.72 | 15.55 | 23.00 | 33.83 | 48.68 | 96.08 |
| *Women* | | | | | | | | | | | |
| 1987 | 1.07 | 1.50 | 1.46 | 1.68 | 2.97 | 3.77 | 5.90 | 8.91 | 13.38 | 21.15 | – |
| 1990 | 0.92 | 1.19 | 1.57 | 1.89 | 2.76 | 4.13 | 6.07 | 9.27 | 13.89 | 21.18 | 71.30 |
| 1992 | 0.99 | 1.28 | 1.57 | 1.93 | 2.89 | 3.97 | 6.85 | 9.87 | 15.72 | 22.77 | 76.95 |
| 1994 | 1.00 | 1.20 | 1.74 | 2.57 | 3.71 | 5.43 | 8.82 | 11.81 | 19.90 | 29.13 | 90.43 |
| 1995 | 1.03 | 1.29 | 1.99 | 2.49 | 3.50 | 5.95 | 9.76 | 13.30 | 19.21 | 28.24 | 86.13 |
| 1996 | 1.05 | 1.13 | 1.76 | 2.59 | 3.39 | 5.26 | 7.51 | 12.27 | 16.87 | 27.17 | 81.31 |
| 1997 | 0.88 | 1.33 | 1.62 | 2.17 | 3.03 | 4.77 | 6.81 | 11.11 | 17.59 | 25.93 | 78.19 |

*Source*: Becker and Ukaeva (1999a).

while other regions continue to experience mortality rates rarely seen outside very poor or socially shattered countries.

The Kyrgyz experience is somewhat similar to that of Kazakhstan. Severe underreporting, especially of infant deaths outside the capital city, Bishkek, and especially in southern Kyrgyzstan, appears to account for the less dramatic national patterns (Becker, Bibosunova, Holmes, & Ibragimova, 1998). Despite underreporting, recorded mortality increased dramatically between 1990 and 1994–95 (Table 2). For males between 35 and 70, age-specific mortality rose roughly 35–45%. Comparably large percentage increases were recorded for women aged 40–70, albeit from much smaller levels. Mortality rates since 1995 based on published data appear to be falling, however, especially for women. Whether this decline can be sustained remains to be seen. Since the economic recovery of 1996–97 halted abruptly in mid-1998, and has resumed only sporadically thereafter, it would not be surprising if the mortality recovery has been quite modest—especially since mortality recovery is very slow in the depressed parts of Russia and Kazakhstan. [1] Life expectancies calculated by Guillot (2002) from raw data also fail to find evidence of recovery. [2]

Fertility declines have been sharp as well, and even more universal than rising mortality. The most striking declines have been in the more economically advanced and ethnically European parts of the former socialist bloc. In Russia, for example, the total fertility rate (TFR) declined from 2.01 in 1989—already below replacement—to 1.17 in 1999 (Goskomstat, 2001). But marked declines also have been recorded in the less socially conservative states of Central Asia. Kazakhstan's total fertility rate fluctuated without a clear pattern from 2.9 to 3.1 during the period 1978–89 (Urzhumova & Becker, 1999). Since 1990, the fertility rate has fallen consistently and rapidly, reaching a level of 1.80 in 2000. By the standards of Kazakhstan, or non-Soviet Central Asian Mongolia (MNSO, 2000), Kyrgyzstan's fertility decline has been moderate (Table 3). [3] During 1980–88, Kyrgyzstan's TFR fluctuated from 4.00 to 4.20, with the peak coming during the pronatalist early Gorbachev era. Kyrgyzstan's urban TFRs ranged from 2.52 (1982–83) to 2.76 (1987); rural TFRs ranged from 5.24 (1988) to 5.54 (1986–87). By 1997, while still well above replacement, Kyrgyzstan's TFR had declined from its late 1980s peak by 1.5 births per woman, and Bishkek's fertility was similar to that of urban Kazakhstan. While some decline would have been likely even in the absence of social upheaval, the pace must have been greatly accelerated.

A reduced incidence of marriage is the third feature of the socialist demographic transition. This has been widely observed in former Soviet Republics (Becker & Hemley, 1998), as well as in Eastern Europe and Mongolia. In an already low-fertility country such as Bulgaria, the crude marriage rate (marriages per thousand popula-

Table 3. *Total fertility rates, Kyrgyzstan, 1990–97*

| Year | Kyrgyz Republic | Bishkek | Issyk Kul | Jalal-Abad | Naryn | Osh | Talas | Chui |
|---|---|---|---|---|---|---|---|---|
| 1990 | 3.68 | 1.74 | 3.92 | 4.60 | 4.70 | 4.51 | 4.34 | 2.93 |
| 1992 | 3.61 | 1.61 | 3.85 | 4.45 | 4.91 | 4.44 | 4.34 | 2.76 |
| 1994 | 3.12 | 1.31 | 3.07 | 3.98 | 3.91 | 3.91 | 3.66 | 2.36 |
| 1995 | 3.31 | 1.26 | 3.29 | 4.18 | 3.74 | 4.22 | 3.70 | 2.42 |
| 1996 | 2.93 | 1.45 | 2.94 | 3.60 | 3.30 | 3.78 | 3.26 | 2.21 |
| 1997 | 2.78 | 1.33 | 2.43 | 3.45 | 3.24 | 3.50 | 2.96 | 1.96 |
| *Absolute change* | | | | | | | | |
| 1997–90 | −.90 | −.41 | −1.49 | −1.15 | −1.46 | −1.01 | −1.38 | −.97 |
| Percentage change from 1990 | −24 | −24 | −38 | −25 | −31 | −22 | −32 | −33 |

*Source*: National Statistical Agency of the Kyrgyz Republic, unpublished data.

tion) declined from 7.2 in 1987 to 4.2 in 1997. To put this in perspective, Bulgaria actually had more marriages in 1910 (and in every year since) than it had in 1997 (BNSI, 1998). In Kazakhstan, the crude marriage rate declined from 9.8 in 1987 to 6.4 in 1998; in that year, the number of marriages was fewer than at any time since the 1950s.

As Table 4 indicates, the proportionate decline in the crude marriage rate has been astoundingly high in Kyrgyzstan, especially given that its population did not age greatly during the 1990s. Indeed, it appears that the crude marriage rate decline was greater in Kyrgyzstan than in any other former Soviet republic outside the Baltic states (Table 1). In view of the corresponding decline in fertility, much of the marriage rate decline is almost certainly real; however, reduced state administrative capacity in rural areas may have led to increased undercounting (that is, to a rise in marriages celebrated in religious ceremonies, but not registered with civil authorities). But such undercounting is likely to be fairly modest in importance—the continued presence of an extensive public welfare system, along with well-defined spousal rights, make civil registration desirable. Moreover, the decline in marriage rates is universally great, and includes regions with strong European cultural influences (Bishkek and Chui Valley), a conservative urban area (Osh), and rural areas of varying degrees of remoteness.

The consequences of reduced marriage incidence during the past decade will be permanent for at least for a moderately-sized cohort, in which a high proportion of women will never marry, further reducing future fertility. As marriage in Kyrgyzstan is highly age-concentrated, especially for women, that those who do not marry between ages 18 and 24 are unlikely ever to marry (Table 5). Moreover, the impact on fertility for those not marrying during the 1990s has just begun. Unmarried women have lower fertility than married women in Kyrgyzstan, while the largely unmarried group that

Table 4. *Crude marriage and divorce rates, Kyrgyzstan 1990–97 (marriages and divorces per thousand persons)*

| | 1990 | | 1993 | | 1995 | | 1997 | |
|---|---|---|---|---|---|---|---|---|
| | Marriages | Divorces | Marriages | Divorces | Marriages | Divorces | Marriages | Divorces |
| Kyrgyz Rep. | 9.9 | 1.8 | 8.2 | 1.6 | 6.0 | 1.3 | 5.7 | 1.4 |
| Jalal-Abad | 10.0 | 1.1 | 8.5 | 1.0 | 6.1 | 0.7 | 6.1 | 0.7 |
| Issyk-Kul | 9.4 | 1.5 | 7.3 | 1.4 | 5.7 | 1.0 | 5.0 | 1.0 |
| Naryn | 9.1 | 0.5 | 9.3 | 0.7 | 6.0 | 0.5 | 6.5 | 1.2 |
| Osh | 10.4 | 1.1 | 8.8 | 1.0 | 5.9 | 0.7 | 5.9 | 0.7 |
| Talas | 9.2 | 1.1 | 9.3 | 0.9 | 6.3 | 0.6 | 6.1 | 0.8 |
| Chui | 9.4 | 2.8 | 7.6 | 2.7 | 6.0 | 2.3 | 5.2 | 2.4 |
| Bishkek | 10.3 | 3.6 | 7.3 | 3.3 | 6.0 | 3.4 | 5.6 | 3.5 |

*Source*: National Statistical Agency of the Kyrgyz Republic, unpublished data.

Table 5. *Marriages per thousand people, by age: Kyrgyzstan 1978–96*

| Age group | Women | | | Men | | |
|---|---|---|---|---|---|---|
| | 1978–79 | 1988–89 | 1996 | 1978–79 | 1998–89 | 1996 |
| 16–19 | 70.1 | 76.8 | 52.1 | 8.1 | 5.3 | 6.8 |
| 20–24 | 109.7 | 107.5 | 58.5 | 133.9 | 125.1 | 65.7 |
| 25–29 | 28.2 | 26.6 | 14.8 | 56.8 | 58.5 | 41.2 |
| 30–34 | 13.9 | 12.0 | 6.2 | 23.4 | 17.8 | 12.0 |
| 35–39 | 7.9 | 7.2 | 3.6 | 14.5 | 10.5 | 5.6 |

*Source*: National Statistical Agency of the Kyrgyz Republic, unpublished data.

came of age in the 1990s will remain fecund until 2015–25. [4] Thus, age-specific birth rates for older women almost certainly will decline in the coming two decades, and even were a complete reversal in marriage incidence to occur today, it would take several years to offset the low-marriage fertility effects that have already been incurred. Worse, the most recent data available from Kyrgyzstan's National Statistics Committee (hereafter, *Goskomstat*) and from the Russian journal *Naselenie i Obshchestvo* (www.demoscope.ru) suggest continued depressed fertility in Kyrgyzstan, and no systematic recovery in marriage rates throughout the region. Most likely, some of this decline will eventually be reversed by delayed marriages, along with eventual social recovery, but the now decade-long duration of depressed marriage makes a complete offset most unlikely.

Accounting for remarriages of divorced and widowed women, the age-specific marriage rates in Table 5 imply only about 58% of Kyrgyz women can ever expect to marry if 1996 rates persist. [5] While there was a modest rise of about 0.7 years in the mean age of first marriage for Kyrgyz women over 1989–96, the male-female age of first marriage differential also grew from 2.6 years to 3.2 years during this period, indicating considerable social resistance to rapid growth in marriage rates for older women.

A fourth major demographic feature has been emigration, which clearly antedated the Soviet Union's collapse. During 1989–97, *net* emigration from Kyrgyzstan was 377,610 persons, some 8.7% of the 1990 population (IOM, 1997), and reducing population increase during this period by nearly two-thirds. Moreover, while net emigration was less than 25,000 during the short-lived recovery of 1996–97 (as opposed to a net loss of nearly 200,000 during 1992–93), and declined to below 16,000 during the Russian crisis year of 1998, it has since grown to outflows of about 32,000, the vast majority of whom are heading to Russia (*Goskomstat* website: http://stat-gvc.bishkek.su). These continued losses are not surprising in view of the far higher economic growth rates in Russia and Kazakhstan.

Much of this emigration reflects an ethnic partitioning taking place throughout the former Soviet Union. During 1989–99, the Kyrgyzstani population of Kyrgyz ethnicity rose by 40%, from 2.23 million to 3.13 million, from 52.4% of the population to 64.9%. In contrast, the numbers of ethnic Germans declined from 101,309 to 21,471 (that is, from 2.4% of the population to 0.4%), and the numbers of Russians, Ukrainians, and Tartars declined from 1.095 million (25.7% of the population) to 0.699 million (14.5%). While a small portion of the rising Kyrgyz share reflects higher birth rates, most is due to migration. Most years have witnessed very high emigration rates of "Westernized" ethnic groups (including Moslem Kazakhs and Tartars, and Jews, as well as those of Slavic ethnicities), and modest net immigration of ethnic Kyrgyz. There has also been net emigration of ethnic Uzbeks, though high birth rates have more than compensated for this, and their population share rose from 12.9% in the 1989 census to 13.8% in the 1999 census.

This large emigration has resulted in a considerable loss of skilled labor, although the impact has been obscured by the collapse in production in Kyrgyzstan that accompanied the collapse of the USSR. GDP fell by roughly 60% over 1991–95, before recovering about 13% in 1996–97, and has grown very slowly since; consequently, there has been a great deal of labor redundancy. Indeed, it is obvious that Kyrgyzstan's poor economic performance has been a main reason for emigration. Since, in practice, pension eligibility tends to be conferred upon elderly persons returning to the republic in which one's ethnicity dominates (specifically, most Russians who retire in neighboring republics tend to be able to collect pensions in Russia if they return "home"), there has been substantial elderly emigration as well, and age-specific emigration patterns are far less pronounced than is usually the case.

The fifth demographic feature noted is a rise in disability incidence and an associated rise in premature retirement. The number of premature retirees should have been declining, since the wartime generation born during 1941–45 is extremely small, and comprised much of the population likely to retire prematurely in the early 1990s. Nonetheless, despite very strong efforts by the Kyrgyz Social Fund to limit disability pensions and premature retirements, the share of disability pensioners among all pensioners rose from 9.0% in 1993 to 9.8% in 1997. While we do not have detailed Kyrgyzstani premature retirement data, evidence from Kazakhstan suggests that there was a marked surge in these numbers during 1991–95, with a stabilized situation since then (Becker & Urzhumova, 1998). It appears that premature pensions were authorized very liberally during the economic collapse following Independence, and that a crackdown ensued—a sequence likely to have taken place in Kyrgyzstan and other former Soviet republics as well.

Finally, significant internal migration also took place, with large movements from dying towns to thriving cities, in the Chui Valley to rural areas, and to both the "near" (former USSR) and "far" abroad. In a country such as Kyrgyzstan, inhabitants of dying towns whose enterprises virtually all have closed face the options of (a) striking out for relatively prosperous cities (in the Kyrgyz context, Bishkek), or emigrating; (b) rejoining relatives on farms, where at least one has access to food, or (c) staying put, and depending on odd jobs and public transfers.

1989 and 1999 census data presented in Table 6 show these patterns. Bishkek's population grew at 2.1% per annum in the intercensal period, well above the national 1.25% population growth rate. Kyrgyzstan's rural population grew at 1.8% during this period, implying significant de-urbanization. In fact, since rural Kyrgyzstan is disproportionately ethnically Kyrgyz, who have both higher birth rates and lower emigration rates, much if not all of the increase in population share was due to natural growth differences rather than inmigration. Only the agriculturally prosperous Chui Valley, which experienced net migration inflows but declining urban population, clearly had rural inmigration.

The system of population registration enables *Goskomstat* to keep track of moves, and hence to document migration independently. In 1996, for example, Bishkek received net in-migration of 1,260 persons, *despite* net emigration of 3,326 people abroad, and net out-migration of both children and elderly adults (leading to an increase of 2,048 in the working-age population). Barring highly different patterns in other years (in fact, years with different patterns generally had higher emigration), it also appears that at least some of Bishkek's population growth is due to natural causes. Since Bishkek has lower fertility than other Kyrgyz cities, and since other Kyrgyz cities are losing

Table 6. *Kyrgyzstan: population distribution, 1989–99*

| | 1989 | | 1999 | |
|---|---|---|---|---|
| | Population (000) | % of total | Population (000) | % of total |
| Rural | 2.633 | 61.8 | 3.144 | 65.2 |
| Urban, *of which* | 1.625 | 38.2 | 1.679 | 34.8 |
| Batkenskaya *oblast* | 0.081 | 1.9 | 0.073 | 1.5 |
| Jalal-Abad | 0.221 | 5.2 | 0.201 | 4.2 |
| Issyk-Kul | 0.129 | 3.0 | 0.125 | 2.6 |
| Naryn | 0.052 | 1.2 | 0.046 | 1.0 |
| Osh | 0.268 | 6.4 | 0.272 | 5.6 |
| Talas | 0.031 | 0.7 | 0.034 | 0.7 |
| Chui | 0.225 | 5.3 | 0.169 | 3.5 |
| Bishkek | 0.617 | 14.5 | 0.758 | 15.7 |
| *Urban, excluding Bishkek* | 1.008 | 23.7 | 0.921 | 19.1 |

*Source*: National Statistical Agency of the Kyrgyz Republic, unpublished data. Batkenskaya is a newly formed oblast, and detailed demographic data of the sort presented in Table 4 are not readily available.

population, and since the levels of internal migration recorded into Bishkek are less than total internal migration, it must be the case that some of those leaving Kyrgyzstan's other cities and towns went to rural areas. It also appears, however, that emigration abroad is much larger than net urban–rural migration.

## 3. KYRGYZSTAN WITH AND WITHOUT A POST-SOCIALIST DEMOGRAPHIC TRANSITION

The next task is to ask how much these changes mattered in the aggregate. Most immediately, what would have been Kyrgyzstan's population structure today if these changes had not occurred? We begin by simulating Kyrgyzstan's population in a no fertility decline (and, hence, no marriage decline), no mortality rise, and no migration environment. Data limitations do not permit us to consider counterfactual disability simulations, while the economic effects of a declining urban population share are discussed in Section 5.

The combined effects of the mortality, migration, fertility, and, indirectly, marriage shocks are considerable (Table 7). The reference is a BASELINE scenario that captures our best guess of Kyrgyzstan's actual demographic trajectory. [6] This scenario incorporates the events of 1989–97 (the last year for which we have a complete database), assumes further TFR declines that slowly weaken, and that gradually converge asymptotically to a TFR slightly above replacement. This scenario also assumes that Kyrgyzstani mortality recovers to late Soviet levels by 2010, and that life expectancy gradually rises thereafter. Male life expectancy in this scenario thus rises from 63 years in 1997 to 65 in 2010, and to 70.7 years by 2050. Net emigration is assumed to be zero throughout the forecast period, mainly because the majority of the high migration risk population already has left, and because refugees and economic emigrants from Tajikistan and Uzbekistan seem likely to offset further outflows of Kyrgyzstan's European population.

The BASELINE scenario can then be contrasted with a "constant demographic environment" *CDE* scenario that maintains the late Soviet era demographic environment (Table 8). A more realistic contrast is given by *CDE*_MORT, in which mortality remains constant for 1989–2010, and then declines by the same amount as in BASELINE. This low mortality means both that more people survive during 1989–97, and that more are expected to survive for the 13 years following the benchmark year, 1997. *CDE*_FERT assumes that high fertility rates do not persist indefinitely, and revert to *Baseline* age-specific fertility values after 2010. While this implies a very large discontinuity, the contrast with *CDE* enables one to isolate the effect of an additional 21 years of high fertility. *CDE*_VITAL offers what might be the fairest contrast with *Baseline*, as it provides a counterfactual simulation with late Soviet fertility and mortality through 2010, and then assumes BASELINE values. Net emigration is assumed to be zero in all of the *CDE* simulations, and in any case is not a major demographic force after 2010. Finally, Kyrgyzstan's population is alternately tracked under the assumptions of gradual fertility decline, and delayed but then sharp fertility decline.

Were Kyrgyzstan to maintain late Soviet demographic characteristics indefinitely, and were it to avoid net emigration, then by 2050 its population would exceed 15 million—and would exceed 16 million if fertility remained high and mortality declined. Such numbers would give Kyrgyzstan a larger population than that of Kazakhstan (though it would still be dwarfed by an Uzbekistani population likely to be in the neighborhood of 40–50 million). In reality, though, Kyrgyzstan's population in 2050 is likely to be less than half of the numbers in those projections. Nor is it necessary to wait that long to witness large demographic effects. The projections on which Table 7 is based show that, absent demographic changes of 1989–2000 that have already occurred, current (2001) population in Kyrgyzstan would be about 650,000 persons greater—some 13% of today's population.

As noted, the fairer comparison with the BASELINE actual projection is *CDE*_VITAL, or one of the alternate fertility decline scenarios. This comparison enables us to witness the medium- and long-term effects of a 20-year differential in demographic events. During this period, mortality increases in BASELINE and then returns to initial levels, and is followed by gradual gains. In fact, the contrast here is an understatement, since in the absence of the post-Soviet crisis, it seems likely that slow mortality improvements characteristic of the 1980s would have continued. On the other hand, fertility also might have declined during 1989–2010 even without the economic and social disruption that occurred, perhaps most plausibly

Table 7. *Kyrgyzstan's population structure under different scenarios, 1997–2050*

| | 1997 | 2005 | 2015 | 2025 | 2035 | 2050 |
|---|---|---|---|---|---|---|
| *Population (thousands)* | | | | | | |
| Baseline simulation | 4,635 | 5,218 | 5,982 | 6,608 | 7,121 | 7,684 |
| *CDE* (constant 1989 late Soviet demographic environment) | 5,122 | 6,083 | 7,587 | 9,584 | 11,518 | 15,598 |
| *CDE*_mort (*CDE* through 2010; then Baseline mortality gains) | 5,122 | 6,083 | 7,597 | 9,646 | 11,705 | 16,154 |
| *CDE*_fert (*CDE* through 2010; then Baseline fertility declines) | 5,122 | 6,083 | 7,524 | 8,293 | 8,904 | 9,655 |
| *CDE*_vital (*CDE* through 2010, then Baseline mortality + fertility) | 5,122 | 6,083 | 7,534 | 8,343 | 9,047 | 10,228 |
| Steady Fertility Decline simulation | 5,122 | 5,887 | 6,894 | 7,888 | 8,870 | 10,286 |
| Sharp, Delayed Fertility Decline simulation | 5,122 | 6,007 | 7,119 | 8,089 | 8,929 | 9,993 |
| *Retirement age population (percent of total)* | | | | | | |
| Baseline simulation | 9.7 | 9.1 | 11.2 | 14.5 | 17.8 | 25.1 |
| *CDE* (constant 1989 late Soviet demographic environment) | 10.1 | 9.4 | 10.1 | 11.3 | 11.6 | 12.0 |
| *CDE*_mort (*CDE* through 2010; then Baseline mortality gains) | 10.1 | 9.4 | 10.1 | 11.4 | 11.9 | 12.7 |
| *CDE*_fert (*CDE* through 2010; then Baseline fertility declines) | 10.1 | 9.4 | 10.5 | 13.1 | 15.0 | 19.3 |
| *CDE*_vital (*CDE* through 2010, then Baseline mortality + fertility) | 10.1 | 9.4 | 10.5 | 13.2 | 15.4 | 20.4 |
| Steady Fertility Decline simulation | 10.1 | 9.7 | 11.2 | 13.7 | 15.7 | 19.9 |
| Sharp, Delayed Fertility Decline simulation | 10.1 | 9.5 | 10.8 | 13.3 | 15.6 | 20.5 |
| *Pension recipients/effective contributors (percent)* | | | | | | |
| Baseline simulation | 95.4 | 81.4 | 86.0 | 99.6 | 113.8 | 163.5 |
| *CDE* (constant 1989 late Soviet demographic environment) | 95.4 | 89.7 | 90.8 | 96.4 | 94.7 | 97.2 |
| *CDE*_mort (*CDE* through 2010; then Baseline mortality gains) | 95.4 | 89.7 | 91.1 | 97.5 | 97.5 | 103.2 |
| *CDE*_fert (*CDE* through 2010; then Baseline fertility declines) | 95.4 | 89.7 | 90.8 | 95.8 | 97.8 | 121.8 |
| *CDE*_vital (*CDE* through 2010, then Baseline mortality + fertility) | 95.4 | 89.7 | 91.0 | 97.0 | 100.7 | 129.7 |
| Steady Fertility Decline simulation | 95.4 | 89.6 | 90.8 | 100.4 | 107.8 | 136.1 |
| Sharp, Delayed Fertility Decline simulation | 95.4 | 89.7 | 90.8 | 98.4 | 103.8 | 132.2 |
| *Labor force participation rate (percent)* | | | | | | |
| Baseline simulation | 26.7 | 30.1 | 32.3 | 33.1 | 33.5 | 31.1 |
| *CDE* (constant 1989 late Soviet demographic environment) | 26.5 | 27.6 | 27.7 | 27.5 | 27.6 | 27.5 |
| *CDE*_mort (*CDE* through 2010; then Baseline mortality gains) | 26.5 | 27.6 | 27.6 | 27.3 | 27.4 | 27.2 |
| *CDE*_fert (*CDE* through 2010; then Baseline fertility declines) | 26.5 | 27.6 | 28.7 | 31.8 | 33.5 | 33.4 |
| *CDE*_vital (*CDE* through 2010, then Baseline mortality + fertility) | 26.5 | 27.6 | 28.6 | 31.6 | 33.2 | 32.8 |
| Steady Fertility Decline simulation | 26.5 | 28.5 | 30.4 | 31.1 | 31.5 | 30.6 |
| Sharp, Delayed Fertility Decline simulation | 26.5 | 28.0 | 29.5 | 31.2 | 32.6 | 32.3 |

in a manner similar to the Steady Fertility Decline simulation (which, however, is quite similar to *CDE*_vital).

In the Baseline projection comparison with *CDE*_vital, the 2015 population is reduced by some 21% by the demographic crisis; the 2050

Table 8. *Simulation modeling assumptions for Kyrgyzstan, various scenarios*

| | 1997 | 2005 | 2015 | 2025 | 2035 | 2050 |
|---|---|---|---|---|---|---|
| *Total fertility rate* | | | | | | |
| Baseline simulation | 2.8 | 2.4 | 2.1 | 2.1 | 2.1 | 2.1 |
| *CDE* (constant 1989 late Soviet demographic environment) | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 |
| *CDE*_mort (*CDE* through 2010; then Baseline mortality gains) | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 | 3.8 |
| *CDE*_fert (*CDE* through 2010; then Baseline fertility declines) | 3.8 | 3.8 | 2.1 | 2.1 | 2.1 | 2.1 |
| *CDE*_vital (*CDE* through 2010, then Baseline mortality + fertility) | 3.8 | 3.8 | 2.1 | 2.1 | 2.1 | 2.1 |
| Steady Fertility Decline simulation | 3.4 | 2.9 | 2.5 | 2.5 | 2.5 | 2.5 |
| Sharp, Delayed Fertility Decline simulation | 3.8 | 3.2 | 2.5 | 2.1 | 2.1 | 2.1 |
| *Life expectancy at birth (male)* | | | | | | |
| Baseline simulation | 63.0 | 64.2 | 65.8 | 67.4 | 69.1 | 70.7 |
| *CDE* (constant 1989 late Soviet demographic environment) | 65.0 | 65.0 | 65.0 | 65.0 | 65.0 | 65.0 |
| *CDE*_mort (*CDE* through 2010; then Baseline mortality gains) | 65.0 | 65.0 | 65.9 | 67.4 | 69.1 | 70.7 |
| *CDE*_fert (*CDE* through 2010; then Baseline fertility declines) | 65.0 | 65.0 | 65.0 | 65.0 | 65.0 | 65.0 |
| *CDE*_vital (*CDE* through 2010, then Baseline mortality + fertility) | 65.0 | 65.0 | 65.9 | 67.4 | 69.1 | 70.7 |
| Steady Fertility Decline simulation | 65.0 | 65.0 | 65.9 | 67.4 | 69.1 | 70.7 |
| Sharp, Delayed Fertility Decline simulation | 65.0 | 65.0 | 65.9 | 67.4 | 69.1 | 70.7 |
| *Life expectancy at birth (female)* | | | | | | |
| Baseline simulation | 74.3 | 75.7 | 77.6 | 79.6 | 81.7 | 83.8 |
| *CDE* (constant 1989 late Soviet demographic environment) | 76.0 | 76.0 | 76.0 | 76.0 | 76.0 | 76.0 |
| *CDE*_mort (*CDE* through 2010; then Baseline mortality gains) | 76.0 | 76.0 | 77.6 | 79.6 | 81.7 | 83.8 |
| *CDE*_fert (*CDE* through 2010; then Baseline fertility declines) | 76.0 | 76.0 | 76.0 | 76.0 | 76.0 | 76.0 |
| *CDE*_vital (*CDE* through 2010, then Baseline mortality + fertility) | 76.0 | 76.0 | 77.6 | 79.6 | 81.7 | 83.8 |
| Steady Fertility Decline simulation | 76.0 | 76.0 | 77.6 | 79.6 | 81.7 | 83.8 |
| Sharp, Delayed Fertility Decline simulation | 76.0 | 76.0 | 77.6 | 79.6 | 81.7 | 83.8 |

population is some 25% smaller. In the present and near future, the demographic shocks lower old age dependency burdens (defined as the ratio of all pensioners to contributors), both because pensioners suffer higher mortality, and because fewer middle-aged workers survive to retirement. As the crisis reduces retirement-age populations, it also leads to a rise in the aggregate labor force participation rate (LFPR), both because there are fewer children, and because higher elderly mortality has a larger impact on total numbers than does the proportionately greater increases in working-age adult mortality. These factors more than offset adult emigration and increased adult mortality. [7]

Eventually, however, these effects are reversed. The collapse in fertility leads to a relatively much smaller working-age adult population by 2030, and hence to higher old age dependency burdens and relatively lower labor force participation rates in Baseline. By 2050, there are only 8% fewer pensioners in Baseline than in *CDE*_vital, despite the large differences in total population; the Baseline old-age dependency ratio is some 34 percentage points higher. In short, the effects of the post-socialist demographic transition will be felt throughout the 21st century, even assuming that it is only a two-decade aberration.

## 4. THE POST-SOCIALIST DEMOGRAPHIC TRANSITION AND SOCIAL EXPENDITURES

The next step is to assess the economic consequences of demographic structural change. These effects turn out to be large and complex. Since the demographic transition is driven by economic and social change, our message is that medium-term economic crisis is transmitted to the long-run via its impact on demographic variables. How much did the demographic collapse affect the Kyrgyzstani economy's long-run macro stability? To answer this question, we emphasize government revenue and expenditure implications, and distinguish four consequences. The most direct concerns social expenditures relative to tax contributions. Section 5 then discusses the impact of reduced urbanization both on aggregate GDP (since productivity is generally higher in urban areas) and on government social revenues and expenditures (since rural inhabitants collect lower payments than their urban counterparts, but contribute even less). Moreover, Kyrgyzstan has a very limited capacity to fund public debt, and those who hold Kyrgyz Treasury bills issued by the National Bank are very sensitive to the overall level of debt. Market-clearing interest rates rise quickly with the level of public debt relative to GDP, so that a run of short-term deficits could easily be destabilizing, even if ultimate solvency would not be threatened otherwise. This problem is addressed heuristically in Section 6. These effects complement the "demographic gift" effects on productivity and economic growth of having a rapidly growing young adult population: we can only note that this effect will now have minimal impact in Kyrgyzstan, since it requires high levels of aggregate demand and job creation.

In Kyrgyzstan and other former Soviet nations, the main discretionary social expenditure consists of transfers by the Social Fund (or its successor). The Kyrgyz Social Fund provides payments from its Social Insurance Fund, Employment Fund, Medical Insurance Fund, and Pension Fund (which accounts for 85–90% of the total). Pensioners are declared eligible mainly on the basis of age and years of employment, but there are also disability and survivorship categories, and certain groups receive early or supplemental payments based on employment or exposure to hazard. The national government also funds education and an array of public health services, but these are not direct transfers to individuals based on specified rules, and therefore are far less sensitive to the sizes of eligible populations. We therefore restrict attention to direct social transfers, recognizing that there are other public services that also may move fairly strongly with demographic structural changes.

To examine social revenues and expenditures, we employ the World Bank's large-scale macro actuarial model, PROST (Pension Reform Options Simulation Tool-Kit). PROST provides a detailed actuarial and demographic accounting for a wide range of pension types. Its parameterization for Kyrgyzstan is described in detail in Paltsev (1999); actuarial forecasts themselves under different scenarios are described in Becker and Paltsev (2001); the general structure of an actuarial forecasting model is described briefly in Appendix A.

Neither the Baseline nor the various *CDE* constant demographic environments simulated here are intended to provide an accurate forecast of Kyrgyzstan's future. Rather, the contrast highlights the impact of demographic structural change, abstracting from direct economic effects (and, in any event, the pace of economic change over the past six years has been extremely slow). Thus, all economic variables, including per capita income, are held constant at 1997 real levels. The policy environment is also maintained across the simulations and, generally, over time. The most important feature is retirement age, which starts off at 55 for women and 60 for men, gradually (over a nine-year period) increasing by three years for both genders, in accordance with legislation passed in 1998. Real social payment rates are also kept constant in the simulation. Parameters relating to disability and other demo-economic phenomena are maintained, though improved compliance during the coming decade is assumed.

The budgetary consequences of Kyrgyzstan's demographic shock are shown in Table 9. It is obvious that the deficits and expenditures forecast could never be realized—social transfers ranging from 18% to 24% of GDP are hardly possible in an economy with per capita income of US$330. Indeed, given the difficulty of funding current deficit levels, it is unlikely that deficits in the range of 4–6% of GDP could be sustained for any lengthy period. Thus, in reality, Kyrgyzstan will end up reforming its current social transfer scheme, which is quite extensive for such a poor country. Possible reforms include reducing benefits, raising retirement ages, or moving from a PAYGO to a defined contribution scheme. Indeed, Kyrgyzstan has formally committed to a notional defined contribution scheme (NDC), though it remains to be implemented. [8]

The immediate effect of the demographic crisis is to reduce the relative size of the pension-eligible population. Social Fund deficits in the current decade are virtually unaffected by the demographic transition, since it involves near proportionate reductions in both contributors and pension recipients. By 2015, however, demographic costs become apparent, as the number of new labor force entrants shrinks. In the coming decades, Baseline diverges from all of the *CDE* and standard conditions' fertility decline variants.

It is evident from Table 9 that Kyrgyzstan's generous and comprehensive PAYGO system would have generated reasonably modest

Table 9. *Kyrgyzstan: social expenditures under differing scenarios, 1997–2050*

| | 1997 | 2005 | 2015 | 2025 | 2035 | 2050 |
|---|---|---|---|---|---|---|
| *Social fund deficit as a share of GDP (percent)* | | | | | | |
| Baseline simulation | 2.46 | 2.05 | 2.43 | 3.98 | 6.38 | 14.55 |
| *CDE* (constant 1989 late Soviet demographic environment) | 2.13 | 2.01 | 1.92 | 2.17 | 2.21 | 3.50 |
| *CDE*_mort (*CDE* through 2010; then Baseline mortality gains) | 2.13 | 2.01 | 1.94 | 2.24 | 2.42 | 4.10 |
| *CDE*_fert (*CDE* through 2010; then Baseline fertility declines) | 2.13 | 2.01 | 2.18 | 3.35 | 4.72 | 11.07 |
| *CDE*_vital (*CDE* through 2010, then Baseline mortality + fertility) | 2.13 | 2.01 | 2.19 | 3.41 | 5.01 | 12.27 |
| Steady Fertility Decline simulation | 2.13 | 2.14 | 2.47 | 3.58 | 5.41 | 11.65 |
| Sharp, Delayed Fertility Decline simulation | 2.13 | 2.08 | 2.29 | 3.39 | 5.29 | 12.21 |
| *Social fund deficit as a share of revenue (percent)* | | | | | | |
| Baseline simulation | 71.63 | 45.00 | 40.79 | 53.56 | 76.21 | 173.66 |
| *CDE* (constant 1989 late Soviet demographic environment) | 56.23 | 41.02 | 29.84 | 26.50 | 20.93 | 24.59 |
| *CDE*_mort (*CDE* through 2010; then Baseline mortality gains) | 56.23 | 41.02 | 30.21 | 27.28 | 22.83 | 28.18 |
| *CDE*_fert (*CDE* through 2010; then Baseline fertility declines) | 56.23 | 41.02 | 33.90 | 40.90 | 46.23 | 97.07 |
| *CDE*_vital (*CDE* through 2010, then Baseline mortality + fertility) | 56.23 | 41.02 | 34.06 | 41.67 | 46.85 | 105.32 |
| Steady Fertility Decline simulation | 56.23 | 43.47 | 38.55 | 44.88 | 56.26 | 107.23 |
| Sharp, Delayed Fertility Decline simulation | 56.23 | 42.30 | 35.73 | 41.87 | 53.05 | 107.76 |
| *Social fund expenditures as a share of GDP (percent)* | | | | | | |
| Baseline simulation | 6.92 | 6.95 | 8.61 | 11.24 | 14.82 | 22.96 |
| *CDE* (constant 1989 late Soviet demographic environment) | 6.98 | 7.26 | 8.54 | 10.49 | 12.82 | 17.77 |
| *CDE*_mort (*CDE* through 2010; then Baseline mortality gains) | 6.98 | 7.26 | 8.56 | 10.56 | 13.11 | 18.69 |
| *CDE*_fert (*CDE* through 2010; then Baseline fertility declines) | 6.98 | 7.26 | 8.80 | 11.67 | 15.02 | 22.51 |
| *CDE*_vital (*CDE* through 2010, then Baseline mortality + fertility) | 6.98 | 7.26 | 8.81 | 11.74 | 15.37 | 23.96 |
| Steady Fertility Decline simulation | 6.98 | 7.39 | 9.09 | 11.67 | 15.10 | 22.55 |
| Sharp, Delayed Fertility Decline simulation | 6.98 | 7.33 | 8.92 | 11.63 | 15.34 | 23.59 |

deficits for the coming half-century had the demographic environment retained late Soviet patterns. Indeed, with modest economic growth, the deficits simulated in the *CDE* counterfactual would quickly disappear. Even in contrasting Baseline with *CDE*_vital, it is clear that the demographic crisis has imposed significant long-run costs. Social transfer expenditures are ultimately greater in *CDE*_vital, since a higher proportion of people survive to retirement throughout the next half-century. But Social Fund deficits are smaller—and if they were further reduced by economic growth, as almost certainly would have been the case in the event of a constant demographic environment, the relative contrast would be far greater.

To summarize, the demographic cataclysm of 1990–95, and the slow recovery since, will impose a further burden on an already very fragile Kyrgyz Government. Annual public deficits from pensions and related transfers at a minimum will be more than one percent of GDP greater by 2025 than in the absence of a demographic crisis; by mid century, this added cost will exceed 2% of GDP—and may well be far more.

## 5. DEMOGRAPHICS, DEFICITS, DE-URBANIZATION, AND PRODUCTIVITY GROWTH

An obvious question is whether the large deficits forecast under both Baseline and various *CDE* scenarios reflect at least partially Kyrgyzstan's low level of economic development or the system's large initial deficits. To address these issues, Table 10 shows simulations in which *CDE* scenarios maintain the Kyrgyz Solidarity System rules and the *CDE* demographic structures, but in which (a) per capita GDP remains at late Soviet levels, and (b) contribution rates and Republican Government transfers are increased to ensure Social Fund balance in the benchmark year, 1997. Pension payments of various types are kept in fixed proportions to real wages, in accordance with Soviet law and Kyrgyzstani policy objectives. By comparing the *CDE* simulations in Tables 9 and 10 (which omits less key variations, as patterns are identical), it is clear that economic levels and initial transfers matter little in the long-run. By 2025 there is virtually no difference in the two sets of constant demographic environment runs. Over time, population expansion means that a

Table 10. *Kyrgyzstan: social expenditure deficits without post-Soviet economic collapse and initial social fund deficit, 1997–2050*

| | 1997 | 2005 | 2015 | 2025 | 2035 | 2050 |
|---|---|---|---|---|---|---|
| *Social fund deficit as a share of GDP (percent)* | | | | | | |
| BASELINE simulation | 2.46 | 2.05 | 2.43 | 3.98 | 6.38 | 14.55 |
| *CDE* (constant 1989 late Soviet demographic environment) | 0.00 | 0.83 | 1.43 | 2.13 | 2.10 | 3.49 |
| *CDE*_VITAL (*CDE* through 2010, then BASELINE mortality + fertility) | 0.00 | 0.83 | 1.68 | 3.37 | 4.98 | 12.26 |
| *Social fund deficit as a share of revenue (percent)* | | | | | | |
| BASELINE simulation | 71.63 | 45.00 | 40.79 | 53.56 | 76.21 | 173.66 |
| *CDE* (constant 1989 late Soviet demographic environment) | 2.57 | 14.58 | 21.53 | 25.62 | 20.61 | 24.49 |
| *CDE*_VITAL (*CDE* through 2010, then BASELINE mortality + fertility) | 2.57 | 14.58 | 25.30 | 40.48 | 48.05 | 104.92 |
| *Social fund expenditures less transfers as a share of GDP (percent)* | | | | | | |
| BASELINE simulation | 6.92 | 6.95 | 8.61 | 11.24 | 14.82 | 22.96 |
| *CDE* (constant 1989 late Soviet demographic environment) | 4.72 | 6.02 | 8.05 | 10.45 | 12.80 | 17.76 |
| *CDE*_VITAL (*CDE* through 2010, then BASELINE mortality + fertility) | 4.72 | 6.02 | 8.30 | 11.69 | 15.35 | 23.95 |

fixed transfer becomes relatively less important, and is overwhelmed by the system's general unsustainability and by demographic structural shifts. Nor is viability affected by per capita income or the size of the economy—this is simply a matter of scaling as long as rules, compliance, and demographics remain unaffected. The huge deficits recorded by 2025 in part reflect the constant per capita income assumption of the simulations. Maintained economic growth that expands contributions relative to payouts is essential to preserve all pyramid schemes, and this includes PAYGO social transfer systems.

Kyrgyzstan's economy has not exhibited sufficiently stable recovery to forecast with any confidence its future growth trajectory. The advantage of assuming constant per worker income is that the viability of the social welfare system under current circumstances becomes clear. But one can examine demographic change in an environment where economic growth is sufficient to achieve current account balance under a PAYGO system, holding current real pension payments constant. These simulations appear in Table 11, which assumes economic growth sufficient to balance receipts and expenditures under conditions of a constant demographic environment through 2010, with BASELINE fertility and mortality changes thereafter.

It is instructive to ask what sort of economic growth environment is needed to maintain Social Fund Solidarity system viability. The answer is deeply pessimistic, especially given that the Table 9 simulations assume constant real pension and other social payments per recipient. Given that per capita GDP rises by 319% over 1997–2050 in this high growth environment, it is obvious that replacement rates (loosely defined here as equal to the ratio of average pension to average wage) plummet, and that most of the "effort" to contain expenditures happens because of this rather than because of high growth. But even with constant unit social payments, considerable growth is required. For the entire period, annual growth of 4.1% is necessary to ensure Social Fund balances. By subperiod, the two decades 1997–2016 would need annual growth of 4.12%, followed by 3.07% annual growth during 2017–26 and 3.35% annual growth during 2027–36, and finally by 5.45% annual growth during 2037–49. The years 2017–36 are relatively favorable because the demographic structure remains favorable under the maintained late-Soviet environment; thereafter, shrinking labor force and rising pension populations require faster growth.

What this tells us is that the Kyrgyz social welfare system was not indefinitely viable even if the Soviet economic environment (which was neither growing rapidly, nor accelerating) and demographic environment had been maintained. Contrasting *CDE* and $CDE_{VITAL}$, it is apparent that even the modest demographic changes after 2010 have a marked impact on system viability, since without such changes the high growth environment would generate large surpluses.

The 1991–97 demographic crisis (and assumed gradual 13-year recovery) has only a modest net effect prior to 2030. During this initial period, higher mortality among pensioners

Table 11. *Kyrgyzstan: social expenditure deficits with and without sufficient GDP growth to ensure Social Fund balance, 1997–2050*

| | 1997 | 2005 | 2015 | 2025 | 2035 | 2050 |
|---|---|---|---|---|---|---|
| *Social fund deficit as a share of GDP (percent)* | | | | | | |
| Baseline simulation | 2.46 | 2.05 | 2.43 | 3.98 | 6.38 | 14.55 |
| Baseline with high GDP growth | 0.57 | −0.19 | −0.34 | 0.03 | 0.87 | 2.09 |
| *CDE* (constant 1989 late Soviet demographic environment) | 2.13 | 2.01 | 1.92 | 2.17 | 2.21 | 3.50 |
| *CDE* with high GDP growth | 0.05 | −0.04 | −0.05 | 0.02 | −0.31 | −2.65 |
| *CDE*_vital (*CDE* through 2010, then Baseline mortality + fertility) | 2.13 | 2.01 | 2.19 | 3.41 | 5.01 | 12.27 |
| *CDE*_vital with high GDP growth | 0.05 | −0.04 | −0.04 | −0.01 | −0.05 | −0.01 |
| *Social fund deficit as a share of total social revenue (percent)* | | | | | | |
| Baseline simulation | 53.31 | 41.91 | 39.43 | 52.63 | 75.51 | 172.89 |
| Baseline with high GDP growth | 8.99 | −3.57 | −5.43 | 0.34 | 10.30 | 24.89 |
| *CDE* (constant 1989 late Soviet demographic environment) | 43.87 | 38.37 | 28.91 | 26.09 | 20.78 | 24.52 |
| *CDE* with high GDP growth | 0.65 | −0.73 | −0.72 | 0.22 | −2.89 | −18.56 |
| *CDE*_vital (*CDE* through 2010, then Baseline mortality + fertility) | 43.87 | 38.37 | 32.99 | 41.03 | 48.28 | 104.99 |
| *CDE*_vital with high GDP growth | 0.65 | −0.73 | −0.57 | −0.09 | −0.44 | −0.06 |
| *Social fund expenditures less transfers as a share of GDP (percent)* | | | | | | |
| Baseline simulation | 6.92 | 6.95 | 8.61 | 11.24 | 14.82 | 22.96 |
| Baseline with high GDP growth | 6.92 | 5.03 | 5.84 | 7.39 | 9.31 | 10.51 |
| *CDE* (constant 1989 late Soviet demographic environment) | 6.98 | 7.26 | 8.54 | 10.49 | 12.82 | 17.77 |
| *CDE* with high GDP growth | 6.98 | 5.55 | 6.58 | 8.34 | 10.31 | 11.62 |
| *CDE*_vital (*CDE* through 2010, then Baseline mortality + fertility) | 6.98 | 7.26 | 8.81 | 11.74 | 15.37 | 23.96 |
| *CDE*_vital with high GDP growth | 6.98 | 5.55 | 6.59 | 8.32 | 10.32 | 11.68 |

offsets fewer contributors due to higher working-age mortality and lower fertility. Eventually, though, the labor force losses dominate, and by mid-century a large deficit emerges in the Baseline scenario. This Social Fund deficit stems exclusively from the post-Independence demographic shock. This shock has already happened; the only matter of speculation is whether recovery will take place as envisioned. Even if economic recovery comes swiftly, Kyrgyzstan will face large fiscal consequences more than half of a century later—depending on the noncrisis scenario one prefers to contrast with Baseline, by 2050 the demographic burden will range from 2.1% to 4.6% of GDP.

The analysis thus far treated Kyrgyzstan as a unified economy. This simplification masks a deep economic dualism likely to increase Social Fund deficits. The reason is that Kyrgyzstan is a predominately rural society with a predominately urban economy. In 1997, about 64% of the population lived in rural areas (official data for 2003 indicate that Kyrgyzstan is 65% rural); at least 57% of GDP was produced in urban areas. Moreover, Kyrgyzstan is a somewhat democratic, pluralistic society, and political leaders are unwilling to oppose demands for transfers from relatively wealthy urban to poor rural areas. In the case of social spending, this means that Soviet-era rules have been maintained. While rural Kyrgyz pensioners are entitled to a minimum pension, their contributions are based on a quarter share of the (quite low) land tax, which tends to be paid communally.

Social Fund estimates reported by Kadyrkanova (1999) are that farming households contributed 51.4 million *som* to the Social Fund in 1997, while the "organized" agricultural sector (agricultural enterprises organized on the basis of old collective and cattle farms) contributed 126.0 million *som*. While there are some contributing nonagricultural enterprises and individuals in rural areas, it is obvious that rural contributions are nowhere near the total payments to rural pensioners, which were approximately 1.2 billion *som* in 1997.[9] Picking midpoint values of the estimates, the rural Social Fund deficit in 1997 amounted to roughly 3% of national GDP and 7% of rural GDP. Meanwhile, urban Kyrgyzstan generated a smaller but healthy PAYGO surplus on its social balance in 1997. Indeed, even the very conservative Becker and Paltsev (2001) simulations, based on constant urban/rural population and GDP shares, show a healthy urban Solidarity system for several decades along with crushing rural deficits.

Indeed, the essence of Kyrgyzstan's social payments deficits is that the system is driven by vast transfers from urban to rural areas. There is great political pressure to maintain this transfer system; at the same time, it is difficult to imagine substantially increasing contributions from Kyrgyzstan's semi-subsistence agricultural economy. Moreover, the economic structure in both cities and countryside has characteristics that make the projections in Tables 9–11 appear optimistic.

If Kyrgyzstan were urbanizing, one would expect a tax yield elasticity with respect to GDP in excess of unity—over time, and as the economy grows (primarily in cities), social tax contributions will increase disproportionately rapidly. But, Kyrgyzstan's urban population share is at best stagnant, with rural natural population increase and lower rates of international net emigration since Independence more than offsetting the modest levels of internal rural-urban migration. For example, in 1997 predominately rural Jalal-Abad *oblast* lost 0.185% of its population to internal migration and 0.121% to external migration (emigration); Bishkek lost 0.249% of its population to emigration, but gained 0.373% from in-migration from other parts of Kyrgyzstan. Given a low total fertility rate (TFR) of 1.51 and an older population, Bishkek experienced natural population growth of only 0.33%, while Jalal-Abad (1997 TFR = 3.91) had natural population growth of 2.04%. Nationally, in 1997 urban Kyrgyzstan experienced natural population growth of 0.79%; rural Kyrgyzstan grew by 1.81%. Since no other urban area beyond Bishkek had substantial population gain due to migration, the proportion of Kyrgyzstanis living in urban areas declined from 38% in 1989 to 35% in 2003. If the share of the population receiving large net social transfers continues to increase, the forecasts above will be unrealistically optimistic. Put differently, Kyrgyzstan's public finances naturally benefit from urbanization, and the reversal that has occurred does further damage to an already shaky tax structure.

More importantly, this tax asymmetry implies that economic growth is beneficial to Social Fund balances, even if Solidarity income elasticities with respect to individuals' wages are roughly unity, and even if replacement rates are kept constant. In a stagnant or slow-growth economic environment, further urbanization is unlikely; indeed, urban population shares may well decline, and total Solidarity system income will fall as well. The opposite is true if we consider a high growth scenario, as in Table 11. Assuming that rural GDP is unlikely to grow by more than 1.5% annually, in order for per capita income to grow at 4.14%, then urban earnings (through a combination of in-migration and wage increases) must grow at an annual rate of 6.13%. An average of the simulation scenarios implies that only 25% (and probably far less) of Social Fund revenue is generated by rural areas. Even if both urban and rural areas have revenue elasticities of unity, then, in the high growth scenarios that differentiate between urban and rural sectors, the Social Fund will enjoy annual revenue growth of 4.97%, implying a revenue elasticity of 1.20.

Having a buoyant revenue structure makes life easy when the economy is growing; during an economic crisis, it implies even more rapid implosion of state finances than economic activity in general. In Kyrgyzstan, the high social revenue elasticity reflects the combination of (de) urbanization that accompanies economic (decline) growth, together with very different rules for the urban and rural populations. To see in isolation the impact of the de-urbanization that accompanied the economic crisis, consider what would have happened if the Kyrgyzstan had retained its peak urbanization rate (39%) instead of the current 34% rate. Since the Social Fund enjoyed a surplus of just less than 100 *som* per capita in urban areas while suffering a deficit of 300 *som* per capita in rural areas, the 1997 Social Fund deficit would have been

12% lower (0.3% of GDP) had de-urbanization not taken place.

## 6. MACROECONOMIC AND DEMOGRAPHIC INTERACTION

Thus far, we have seen that Kyrgyzstan's demographic shock has created strong adverse effects both in the long-run (through changing dependency ratios) and in the nearer term (via de-urbanization and declining Solidarity system contributions). These events have already taken place, and cannot be undone, but will be felt for decades to come. But, while these demographic consequences are simulated in the absence of interaction with economic forces, in reality there is considerable interaction. Of these, two forces in particular stand out. In the short run, poor countries with limited financial markets may find that even small, uncovered deficits lead to macroeconomic chaos. Second, in the long-run, demographic structures have been shown to have important effects on accumulation and investment, and hence on economic growth (Bloom & Williamson, 1998; Higgins, 1997).

In Kyrgyzstan and other poor transition economies (that is, former Soviet Republics excluding Russia, Kazakhstan, and the Baltic states), the only ways to run a large government budget deficit are to print money or to attract international loans at concessionary rates. Domestic savings in formal financial institutions are quite limited, and the domestic market for government debt is tiny. Nor is the foreign private sector likely to be willing to hold substantial amounts of government debt, even if—as in Kyrgyzstan's case—the sovereign issuer is a WTO member (and especially if, as a referee has noted, the issuer is *already* a highly indebted country: National Statistics Committee data indicate that in 2002 the nation's external debt of US$1.785 billion was 109% of its GDP of US$1.635 billion). In practice, then, the vast social spending deficits forecast above can never be realized, as there is no way of funding them. Benefits cannot be maintained, eligibility must be made more stringent, and contributions must be increased to keep the Social Fund deficit prior to Republican budget transfers very close to the 3.5% of GDP estimated for 1997 (or 2.5% including standard government contributions). [10]

Thus, even the small differences in budget deficits between the BASELINE and the demographic counterfactual simulations (for example, the high growth simulations in Table 11) can be crucial. The initial impact of Kyrgyzstan's demographic shocks, as recorded in the 1997 base year for the simulations, is to raise deficits by 0.3–0.5% of GDP, or to 0.8%, allowing for the effect of declining urbanization. This US$7.5 million increase is a tiny amount by global standards (after all, Kyrgyzstan's entire GDP is approximately equal to the *daily* US trade deficit), but funding it is a serious matter when there are virtually no sources. Moreover, these deficits are annual, and as they accumulate, the debt burden will become increasingly unmanageable for a government with few options.

For the next three decades, losses in contributions are roughly offset by reduced social payments due to demographic changes. But by 2035, the changes create a gap of roughly 1.2% of GDP, an extremely serious matter in the Kyrgyz context. The political pressure to maintain expenditures is intense, as is the pressure to maintain replacement rates. If this pressure continues (as it surely will, given recent large increases in pensions in Kazakhstan and Russia), the demographic events of the early 1990s are likely to create pressures for inflationary finance in the mid-21st century that are highly destabilizing. The alternative will be for the government to impose rigid forced savings schemes that crowd out investment and encourage tax evasion.

The fragility of the weaker transition economies makes them susceptible to macroeconomic crises due to growing fiscal pressures induced by changing demographic structures. In principle, determined policy steps could maintain macroeconomic balances. Yet rising social expenditure deficits due to the 1990s demographic shock approaches 5% of GDP by 2050, and this almost certainly will create a severe drop in domestic savings as the Kyrgyz Government raises taxes or cuts public investment. These moves in turn are likely to discourage foreign capital inflows, thereby reducing overall rates of capital formation and economic growth. Perhaps the most serious consequence is that the Kyrgyz Government is likely to feel pressured to redirect resources away from education and public health, thereby reducing productivity for generations to come.

These social spending pressures make any "demographic gift era" gains even more remote. A baby-boom cohort of young adults is now entering the labor market. But they come with poorer skills than would have been the case in the Soviet era, and encounter an economic situation with little new investment and employment opportunities—the core demand-side features of East Asia's boom. While it is possible that Kyrgyzstan will resume economic growth before the entire gift period has passed (if only because its new geopolitical and military significance is leading to a large jump in external demand and capital inflows), the demographic changes that have occurred add greatly to the urgency. Conditions for rapid growth will be far less favorable in the following decade; by the second quarter of the century, Kyrgyzstan risks becoming a poor but demographically mature society.

Economists tend to see demographic gift eras as belonging to the past, to times shortly following the onset of demographic fertility-mortality transitions. This is not an accurate depiction of most transition countries, however, since the combination of small WWII cohorts and demographic shocks following the breakup of the USSR have combined to create a renewed gift era, with a large young adult population and low dependency ratios—and have also made an ensuing burden era inevitable. The structure of social payments (essentially, the continuation of Soviet welfare state policies) will add further to this future burden. In consequence, the coming decade is unusually critical for Kyrgyzstan and other relatively poor transition countries. Failure to achieve rapid economic growth greatly increases the risk of prolonged poverty, and growing gaps with its northern neighbors and with the rest of the world.

## 7. CONCLUDING REMARKS: VICIOUS AND VIRTUOUS CYCLES

Following Independence, Kyrgyz officials commonly argued that the break-up of the USSR hurt them worst of all. Their concrete losses—loss of a stable currency; of a market for their car door or torpedo factories, for which there was no domestic demand; of substantial revenue transfers from Moscow—were acutely real. What neither they nor external observers at the time realized was the extent to which the initial shock would reverberate, creating aftershocks that would make recovery all the more difficult.

Part of the aftershock transmission mechanism is direct: economic growth leads to stability, new investments, and healthy public finances—of particular importance in a low-income welfare state. As this paper emphasizes, a variety of demographic conduits are important as well. The economic shocks of the 1990s quickly translated into demographic shocks, and, once set in motion, it is very difficult to reverse these effects. The short-run effects are modest, being limited largely to a deteriorated urban tax base, which is offset in large part by smaller young and elderly dependent populations. But the long-run effects are large, especially when the impacts of increased dependency ratios merge with reduced tax buoyancy due to slow urban population growth.

These demographic consequences are also qualitatively different from many economic shocks. Shocks, both positive and negative, regularly pound economies. Most are fairly transitory in nature, affecting values and flows. But demographic and investment shocks are different, as they tend to have impacts that translate into altered values of stocks—human and physical capital, and populations. Demographic trends reverse far more slowly than economic trends, and by altering stock values, they irrevocably affect economic potential many decades into the future.

In the case of Kyrgyzstan and several other transition countries, the demographic paths strengthen vicious (and virtuous) cycles. Sharp economic deterioration leads to fertility decline, emigration, de-urbanization, and to increased mortality and disability. When recovery occurs, mortality and disability diminish (with the net effect being to raise social expenditures), but the loss of a potential tax base will have stunting effects for decades to come. These demographic structural changes create burdens after the direct economic effects have worn off, threatening macroeconomic balances, and thereby reducing long-run growth potential.

For a country such as Kyrgyzstan, the real problem is slow economic growth: the demographic patterns are derivative. Moreover, while the scope for positive economic policy that would help reverse adverse demographic patterns is limited, it is not nonexistent. An obvious measure would be steps to encourage citizens, especially of minority ethnic groups, to remain in Kyrgyzstan. Efforts to maintain and improve schooling are also critical, since many emigrants leave because of deteriorating education standards. Removal of marriage and birth registration fees is another small but obvious measure. Ultimately, the big prize is to achieve economic integration with Kazakhstan, an economy some 15 times larger. Bishkek then becomes a very low-wage city with decent infrastructure within a few hours of Almaty, and as such should be poised for reasonable if not exceptional growth.

## NOTES

1. Recorded life expectancies did not decline markedly everywhere in Eastern Europe, and parts of Central Asia and the Transcaucasus. In the former case, this recorded stability probably reflects reality; in the latter case, rising undercounting of deaths seems far more likely. For a country such as Bulgaria, male life expectancy exhibited no systematic pattern during 1960–97; female life expectancy has been roughly constant since 1970 (BNSI, 1998). Kyrgyzstan's recorded mortality patterns suggest substantial and growing rural undercounting, and this is likely to be replicated in other poor Central Asian and Transcaucasian republics (in particular, Uzbekistani data reported in Table 1 lack credibility). For example, recorded 1994 mortality during the first week of life is 4–9 times as high in Bishkek as in the country's very poor and medically ill-equipped rural areas; these regions also have recorded very modest mortality increases, despite marked deterioration in economic conditions (Becker & Ukaeva, 1999a). Growing infant mortality underreporting also bolsters life expectancy gains—for Kyrgyzstan, only 53% (23%) of the 1.27 (0.87) year male (female) life expectancy gain during 1997–2000 is due to above age 15 mortality reductions (www.demoscope.ru), suggesting an overstatement in the improvement. Kyrgyzstan's economic "recovery" after the Russian crisis of 1998 is also a matter of some debate. Northern Kyrgyzstan almost certainly has benefited in real terms from Kazakhstan's rapid recovery, and from its new foreign military bases. According to official data from the National Statistics Committee (http://stat-gvc.bishkek.su), real GDP grew by 17.5% between the end of 1997 and the end of 2002, implying an annual growth rate of 3.3% (2.5% in per capita terms); during 1998–2002, the share of wages in GDP declined from 33% to 27%. Since most of the economic growth almost certainly occurred in northern Kyrgyzstan, it is difficult to imagine that living standards rose outside of Bishkek, the Chui Valley, and the Issyk-Kul beach resorts.

2. Guillot (2002) also reports life expectancies for 1988–89 and 1998–89 by ethnicity, gender, and rural/urban residence. These figures are somewhat unsettling, as the life expectancy increases for rural ethnic Kyrgyz seem implausible, as does stability in urban male Kyrgyz life expectancies while urban Kyrgyz women suffered a 5.3-year life expectancy decline.

3. Unless noted, Kyrgyzstani data reported in tables and in the text are taken from unpublished files of the National Statistical Committee of the Kyrgyz Republic.

4. An imperfect confirmation of fertility outside registered marriages is provided by the 1999 Kyrgyzstan census (NSCKR, 2001), which reports that the average number of live births per woman is 3.5 for married women, 4.3 for divorced women, and 1.5 for women in "unregistered marriages." Unfortunately, this measure is not age-standardized (that is, it is not a TFR), and since the incidence of nonmarital fertility is increasing, women in unregistered marriages are on average younger, and hence have a lower average number of births. Nonetheless, the differences are sufficiently great (especially as the average number of live births per woman above 15 who has "never entered into marriage" is only 0.04, implying an average of 0.31 live births for all unmarried women) that it is almost certain that unmarried Kyrgyz women have lower TFRs than those who marry.

5. The data in Table 5 imply that, given constant age-specific rates, there would be 624 marriages per thousand women who survive from age 16 until age 40 (to see this, multiply the age 16–19 rate by four, and the other rates by five, and then sum). This probability is an upper bound, since some women will divorce and remarry, and some women will die before age 40 without marrying. For 1978–79 and 1988–89, there were 1,079 and 1,074 marriages per thousand women, respectively. Since even then some women never married, and some died without marrying, a re-marriage rate of 7.5% can be taken as a lower bound. Applying it to 1996 data, 624/1.075 = 580 marriages per thousand should be first marriages.

6. The demographic assumptions in this scenario were constructed by the authors and Ms. Umit Ukaeva for actuarial forecasting purposes, and served as the basis for forecasts used by the Asian Development Bank and, subsequently, the World Bank. Detailed rationale and descriptions of the assumptions appear in Paltsev (1999), and Becker and Ukaeva (1999a, 1999b). These BASELINE forecasts are extremely close to those of the UN (2001), even though they were made without reference to one another. In our BASELINE projections, Kyrgyzstan's year 2050 population is projected to equal 7.684 million, a tiny 1.9% difference from the UN's 7.538 million

forecast. The largest difference in our and the UN's forecasts appears to be for 2015, when the BASELINE projection for total population is 2.5% greater. The economic assumptions were modified to keep GDP per worker constant in this and all other scenarios, thereby abstracting from the effects of (direct) economic change.

7. Kyrgyzstan's demographic structure will become increasingly favorable from the mid-1990s during 2007–10, and then slowly reverse (Table 7). During this period, the growth in labor force entrants will be high, reflecting high fertility through the 1980s. At the same time, elderly populations will be falling rapidly, as cohorts born in the 1920s and 1930s die off and are "replaced" by small war-year retirement populations. This effect is stretched out in Kyrgyzstan and other former Soviet republics because women retire five years earlier than men. In the BASELINE simulation, the LFPR rises very rapidly between 1997 (26.7% of the total population) and 2010 (31.7%), and then increases more slowly to peak in the year 2032, when 33.6% of the population is in the labor force. The reduced dependency effect is delayed in the *CDE*_VITAL and other constant demographic environment simulations, since fertility is maintained and mortality does not rise. In this setting, the aggregate LFPR rises gradually, by 2.1 percentage points, during 1997–2015; then surges by 4.3 points in the next 15 years. The LFPR then peaks at 33.2% in 2035 before starting a very gradual decline.

8. The NDC reform was agreed to prior to the economic slowdown in mid-1998 that quickly became an effective recession with an accompanying financial crisis as shock waves from the Russian crisis spread in the latter half of 1998. In effect, NDC remains a stated goal, but its practical impact is very limited, as its implementation remains incomplete, and individual accounts are not credited with a competitive rate of return. As an anonymous referee noted, Kyrgyzstan in one sense is ideally suited for redistributive policies—it has a small prosperous population that is geographically concentrated, and a large number of very poor citizens. But, its wealthy citizens are also mobile, thereby constraining redistributive efforts.

9. Data reported in Kadyrkanova (1999) indicate 1,176 million *som* in rural pension expenditures against 177.4 million *som* in revenue based on the sources noted—implying that 85% of rural pensions must be covered by urban PAYGO contributions and Republican Government transfers. Moreover, projected 1998 rural contributions were only 155.6 million *som*. Actuarial projections that serve as the basis for Asian Development Bank simulations, Becker and Paltsev (2001), and this paper assume total 1997 rural contributions of 523 million *som* (surely an upper bound) and expenditures of 1,347 million *som* (including some rural, nonagricultural payments, but overstated because average payments in urban and rural areas are assumed to be equal). Thus, the 1997 rural Social Fund deficit is likely to have been at least 824 million *som* (1,347–523; not including 144 million *som* in budgeted transfers), or 2.7% of national GDP (and 6.3% of rural GDP). Kadyrkanova's figures imply nearly a one billion *som* deficit equal to 3.3% of national GDP and 7.6% of rural GDP.

10. The 1997 draft public investment project (PIP) budget assumed that foreign sources (virtually all bilateral or multilateral official entities) would cover 91.8% of 1997 financing needs (MFKR, 1998). Domestic sources were thus expected to cover only 0.35% of the Kyrgyz Government's capital expenditure needs.

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## APPENDIX A. CREATING A BASIC ACTUARIAL PENSION MODEL

Pension forecasting models crucially depend on macroeconomic and demographic assumptions. The economic and demographic sides of the model are not generally linked during estimation, giving rise on occasion to some implausible implications. These models are usually run for up to 50 years, mainly because today's demographic events and changes in current policy have impacts that will not be entirely felt for decades. Macroeconomic assumptions are crucial because they determine the pace of economic recovery, and hence system contributions. These assumptions are usually taken from economic forecasting models, and alternate pension forecasts are made based on a range of optimistic to slightly less optimistic economic forecasts.

Macro actuarial models consider many variables related to pension forecasts, but are structurally simple. Forecasts are built on data for a particular "benchmark" year. Future values of exogenous parameters also must be chosen. Common practices in choosing future parameters include assuming that current values remain constant forever; that recent past trends are maintained forever; or that convergence to long-term trends occurs. Forecasts based on formal econometric estimation are also possible, but virtually nonexistent in analysis of transition pension systems.

The current generation of actuarial forecasting models was developed in 1996–98. The World Bank initially created several models, including for Ukraine, Hungary, and Poland, while USAID sponsored models of Romania and Kazakhstan (Gray, 1998; James, 1997; Riboud & Chu, 1997). These models are often criticized as being country-specific. But, all of these models have similar structures, with Macroeconomic, Population, Labor, and Pension "blocks." They differ in their usage of country-specific accounting formulas for pension systems, assumptions about interaction among macroeconomic variables, and reform scenarios. These models have largely been superseded by the World Bank's PROST model, a universal model intended for applications in different countries, and which is becoming increasingly flexible. Ironically, the PROST is often criticized for being too general.

A typical pension forecasting model contains both an aggregate component, which projects pension fund performance, and an individual statement designed to estimate contributions and benefits under different options for a participating individual. The aggregate module starts from demographic projections; annual pension expenditures and pension fund revenue forecasts then follow. Calculations are based on system averages.

Despite the conceptual simplicity of a pension forecasting model, a user has to obtain a vast amount of age- and gender-specific data. Data for population, fertility, mortality, and immigration are needed for the Population block. The Labor block requires age and gender-specific labor participation rates, unemployment rates, and earnings profiles. The Pension block stores benchmark year information about a pension system, and also contains projections of contributors; old-age pensioners; disability, survivor, evasion and exemption rates; and replacement rates. The Macroeconomic block requires information on the following data for the base year: GDP, pension fund balance, wages, and pension payments. It also requires forecasts of real GDP growth, inflation, real interest rates, budget transfers to the state pension fund, wage growth elasticity with respect to GDP growth, and retirement ages.

To calculate a pension fund balance, one starts with data on payroll contribution rate $T$, average wage $w$, the number of contributors $L$, average pension $A$, and the number of pensioners $P$. For a system to be in balance in year $t$, contributions must equal pension payments:

$$\sum_{it} T_t w_{it} L_{it} = \sum_{it} A_{it} P_{it}, \tag{A.1}$$

where $i$ denotes age group. The number of pensioners is given by

$$P_{it} = \sum_{g} (k1_{itg} + k2_{itg} + k3_{itg}) N_{itg}, \tag{A.2}$$

where $N_{itg}$ is the number of people of gender $g$ (=male, female) of age $i$ at the beginning of a year $t$; $k1_{itg}$ is a retirement coefficient, $k2_{itg}$ is a disability pension coefficient, and $k3_{itg}$ is a survivor (loss of breadwinner) pension coefficient.

The basic formula for average pension benefits of new pensioners in a PAYGO system is

$$A_{it} = LOS_{it} Z_t W_{it}, \tag{A.3}$$

where $LOS_{it}$ denotes length of service at retirement for age group $i$ in a year $t$; $Z$ is the replacement rate (defined as the average pension/wage ratio); and $W$ is final average wage. LOS for people retiring at standard retirement age(s) is determined by pension system rules. The model calculates average LOS for those who retire earlier based on age-specific labor force participation rates. If half of persons age 25 are active, then a basic pension actuarial model will assume that only one-half year of LOS is accumulated on average at age 25. $W$ takes into account the wage profile, so the average wage of a person retiring at age 60 is different than the average wage of the person retiring at the age of 55, even though in simple models the economy-wide average wage (usually broken down by gender, but not age) is the basis of the calculation. Pension benefits to existing pensioners are typically, though not invariably, adjusted for inflation and real wage growth. For estimation of funded system liabilities, calculations are based on standard actuarial techniques.

$T$ is determined exogenously by pension system rules in forecasting models. Typically, wage rates also are set exogenously, and then move according to the GDP growth rate.

$$L_{it} = \sum_{g} [LFPR_{itg}(1 - U_{itg})](1 - EE_{itg}) N_{itg} \tag{A.4}$$

gives the number of effective contributors, where $LFPR$ is age and gender specific labor force participation rate; $U$ is the unemployment rate (age and gender specific); $EE$ gives the exemption and evasion rate (age and gender specific); and $N_{itg}$ gives a gender- and age-specific population.

Demographic projections for population of age 1 and older are simply

$$N_{t+1,i+1,g} = N_{t,ig} S_{t,i+1,g} + IM_{t,i+1,g}, \tag{A.5}$$

where $N_{t,i,g}$ is the population of gender $g$ and age $i$ at the beginning of year $t$; $S_{t,i,g}$ is the proportion of the population of gender $g$ and age $i$ that survives between year $t$ and $t + 1$; $IM_{t,i,g}$ is the net immigration level of age $i$ between year $t$ and $t + 1$. The equation for newborn ($i = 0$) is

$$N_{t+1,0,g} = \sum_i f_{t,i}F_{t,i}S_{t,0,g}mk_{t,g} + IM_{t,0,g}, \qquad \text{(A.6)}$$

where $N_{t+1,0,g}$ is the population of gender $g$ that is "less than a year old" in year $t + 1$; $f_{t,i}$ is the birth rate in year $t$ of women age $i$; $F_{t,i}$ is the number of women of age $i$ in year $t$; and $mk_{tg}$ is the male/female birth coefficient. As discussed, $S$, $f$, and $IM$ are usually treated as constants over time in actuarial models, while in our forecasts we permit these demographic parameters to vary.