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Why Is Infant Mortality Higher in the United States than in Europe?[†]

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The United States has higher infant mortality than peer countries. In this paper, we combine microdata from the United States with similar data from four European countries to investigate this US infant mortality disadvantage. The US disadvantage persists after adjusting for potential differential reporting of births near the threshold of viability. While the importance of birth weight varies across comparison countries, relative to all comparison countries the United States has similar neonatal (<1 month) mortality but higher postneonatal (1–12 months) mortality. We document similar patterns across census divisions within the United States. The postneonatal mortality disadvantage is driven by poor birth outcomes among lower socioeconomic status individuals. (*JEL* I12, I14, I32, J14)

In 2013, the US infant mortality rate (IMR) ranked 51st internationally, comparable to Croatia, despite an almost three-fold difference in gross domestic product (GDP) per capita.[1] One way to quantify the magnitude of this infant mortality disadvantage is to consider that the US IMR is about three deaths per 1,000 greater than in Scandinavian countries. Aggregating 4 million annual US births and taking a standard value of life estimate of US$7 million (Viscusi and Aldy 2003) suggests that reducing the US IMR to that of Scandinavian countries would be worth on the order of US$84 billion annually. By this metric, it would be "worth it" to spend up to $21,000 on each live birth to lower the infant mortality risk to the level in Scandinavia.

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[1] Croatia's IMR in 2013 was 5.96, relative to 5.9 in the United States; GDP per capita was $18,100 in Croatia and $50,100 in the United States (Central Intelligence Agency (CIA) 2013).

While the US IMR disadvantage is widely discussed and quantitatively important, the determinants of this disadvantage are not well understood, hindering policy efforts.[2] A key constraint on past research has been the lack of comparable microdatasets across countries. Cross-country comparisons of aggregate infant mortality rates provide very limited insight, for two reasons. First, a well-recognized problem is that countries vary in their reporting of births near the threshold of viability. Such reporting differences may generate misleading comparisons of how infant mortality varies across countries. Second, even within a comparably-reported sample, the observation that mortality rates differ one year post-birth provides little guidance on what factors are driving the US disadvantage. As a specific example, although a large literature has documented significant inequality in infant mortality outcomes across socioeconomic groups within the United States (i.e., Currie, Shields, and Price 2007; Case, Lubotsky, and Paxson 2002; Miller 2003), it is less clear how much of the cross-country US IMR disadvantage is explained by higher levels of inequality within the United States.

We begin in this paper by relaxing this data constraint. We combine US natality microdata with similar microdata from Finland and Austria. In addition, we use data from the United Kingdom and Belgium which can be restricted to a comparably-reported sample and reported in aggregated cells based on birth weight and age at death. Using these data, we provide a detailed accounting of the US IMR disadvantage relative to these European comparisons, quantifying the importance of differential reporting, some conditions at birth (specifically, birth weight and gestational age), neonatal mortality (deaths in the first month), and postneonatal mortality (deaths in months 1 to 12). To the best of our knowledge, cross-country microdata has not previously been used to undertake this type of exercise.

This exercise yields a number of findings. First, consistent with past evidence (MacDorman and Mathews 2009), differential reporting of births cannot offer a complete explanation for the US IMR disadvantage. However, accounting for differential reporting is quantitatively important. Compared to the average of the five European countries we analyze, limiting to a comparable sample lowers the apparent US IMR disadvantage from 2.5 deaths per 1,000 births to 1.5 deaths. This finding highlights the importance of conducting cross-country comparisons in a setting where reporting differences can be addressed, which is typically not possible in the types of aggregate statistics compiled by the World Health Organization (WHO) and the World Development Indicators (WHO 2006; World Bank 2013).

Second, we explore the importance of differences in health at birth. Worse health at birth is widely cited as *the* major driver of the US IMR disadvantage (MacDorman and Mathews 2009, National Research Council 2013, Wilcox et al. 1995); we are able to investigate this issue after restricting attention to our comparably-reported sample. Consistent with past evidence that has focused on comparing the United States with Scandinavian countries, we find that birth weight can explain around

[2] Economists have not written much on cross-country differences in infant mortality; when they have, it has often focused (most notably, Waldmann 1992) on the relationship with income levels and income inequality across countries. The proximate causes of the US infant mortality disadvantage have been of more interest in the public health literature.

75 percent of the US IMR disadvantage relative to Finland or Belgium. However, birth weight can only explain 30 percent of the US IMR disadvantage relative to Austria or the United Kingdom. Moreover, even normal birth weight infants have a substantial IMR disadvantage—2.3 deaths per 1,000 in the United States, relative to 1.3 in Finland, 1.5 in Austria, 1.6 in the United Kingdom, and 2.0 in Belgium.

Third, our data allow us to distinguish between neonatal and postneonatal deaths in our comparably-reported sample. The neonatal/postneonatal distinction is informative because the relevant causes of death during these two time periods are quite different (Rudolph and Borker 1987). Previous comparisons of neonatal and postneonatal mortality in aggregate data (such as Kleinman and Kiely 1990) are difficult to interpret given the differential reporting concern: specifically, in an unrestricted sample the United States has much higher neonatal mortality than any of the European comparisons we analyze (WHO 2006), whereas our comparably-reported sample suggests that differences in reporting could be driving nearly all of that pattern.

In our comparably-reported sample, the US neonatal mortality disadvantage is quantitatively small and appears to be fully explained by differences in birth weight. In contrast, the United States has a substantial disadvantage relative to all comparison countries during the postneonatal period even in our comparably-reported sample and even conditional on circumstances at birth. A simple illustration for the three countries with microdata (the United States, Finland, and Austria) can be seen in Figure 1, which shows the cumulative probability of death over the first year. The infant mortality rate in the United States is higher at all ages, but this difference accelerates after the first month of life. Importantly, this excess postneonatal mortality does not appear to be driven by the United States "delaying" neonatal deaths: the postneonatal disadvantage appears strongly even among normal birth weight infants and those with high Apgar scores.

Hence, our cross-country analysis points to the importance of the postneonatal period as a driver of the US disadvantage and, on its own, may suggest support for policies which target this period of life. In the second part of the paper, we expand our analysis to consider geographic variation in infant mortality *within* the United States, focusing on the nine US census divisions. If the lowest mortality census division (the Northeast) were a country on its own, it would have a mortality rate very similar to Austria. In contrast, the worst off census division (East South Central) has a one-year mortality rate twice as high as the Northeast. Replicating our cross-country decomposition across US census regions again uncovers an important role for the postneonatal period: only 39 percent of deaths in the lowest-mortality census division occur in the postneonatal period, but deaths during this period account for 67 percent of the geographic differences in mortality. Reducing postneonatal mortality in each census division to the level observed in the lowest-mortality division would reduce mortality rates, on average, by 0.72 deaths per 1,000 births.

In the final section of the paper, we use a subset of the cross-country data, together with the within-US variation, to analyze the socioeconomic profile of the postneonatal mortality gaps. It is well known that infant mortality in the United States varies strongly across socioeconomic groups (as documented by, for example, Case, Lubotsky, and Paxson 2002). Given this, a natural question is whether the US

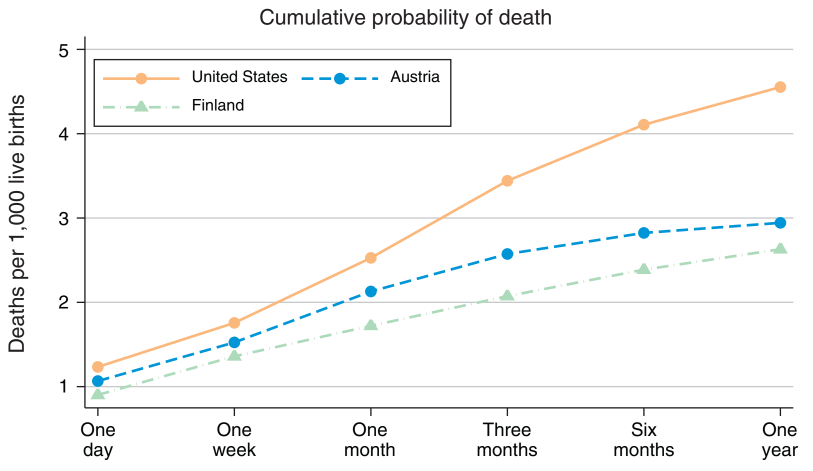


Figure 1. Cumulative Probability of Death, by Country

Notes: This figure shows the cumulative probability of death, by country and timing of death, unconditional on conditions at birth. Data for all countries cover 2000–2005; as described in the text, the sample is limited to singleton births at $\geq$ 22 weeks of gestation and $\geq$ 500 grams with both birth weight and gestational age observed.

IMR disadvantage relative to Europe is accounted for by higher cross-group IMR inequality in the United States relative to Europe, or whether even highly advantaged Americans are in worse health than their counterparts in peer countries (as National Research Council 2013 argues). We can ask a similar question about the cross-regional differences in the United States. Our demographic data in Europe are limited to Austria and Finland so we focus on those two countries as our comparison.

We first approach this question nonparametrically by estimating birthweight-adjusted postneonatal death rates by country (or census division) and demographic group. We find that infant mortality differences, both across countries and across regions within the United States, are driven by lower socioeconomic status groups. To give a concrete example: among the most educated group (college educated in the United States or Austria, upper white collar worker in Finland) we find that the United States has excess postneonatal mortality of 0.04 deaths per 1,000 compared to Finland, and 0.27 deaths per 1,000 compared to Austria. However, among the lowest education group, the United States has excess postneonatal mortality of 1.3 deaths relative to Finland, and 1.8 relative to Austria. A similar pattern appears across census regions within the United States.

We then take a slightly more parametric approach and define a high socioeconomic status group in each country based on education and other demographic characteristics. Infant mortality rates for mothers in our advantaged group are statistically indistinguishable in the United States and elsewhere. However, there are very large differences across countries in infant mortality rates for mothers outside of this group. We see similar patterns across census regions within the United States. Effectively, either across countries or across regions within the United States, we see that the observed geographic variation in postneonatal mortality is heavily driven by variation in health gradients across socioeconomic groups.[3] Notably, when we look at neonatal mortality we do not draw the same conclusions, suggesting that the inequalities we observe emerge especially strongly during the postneonatal period.

The final question we investigate is to what extent the differences in postneonatal mortality gradients by location reflect differences in resource gradients. That is, are the poor more resource-poor in some regions than others, or is it that the relationship between resources and mortality differs across locations? We address this question as follows. Although data availability constraints prevent us from linking individuals in our birth data to their household income, we link individuals to a measure of the average income in their geographic area for individuals with their demographic profile (age, education, race, marital status). We are able to do this for the United States and Finland, in both cases using census data.[4] We use these linked data to divide births into income decile groups, and compare across countries or across regions within a group. Our analysis suggests that income per se explains very little of the difference either between the United States and Finland, or across regions within the United States. It is true, for example, that high postneonatal mortality regions in the United States are also those with lower income on average. However, infants in these regions are more likely to die during the postneonatal period even compared to households with similar income levels in regions with lower mortality. Our decomposition suggests that income differences actually exacerbate the IMR gap between the United States and Finland (since the United States is on average richer), and explain only about 30 percent of the differences across areas in the United States.

This paper relates to two earlier literatures, one in medicine and one in economics. In the medical literature, most analyses have focused on differences in health at birth as the key explanation for the US IMR disadvantage (MacDorman and Mathews 2009, National Research Council 2013, Wilcox et al. 1995). As we note above, our data suggest this explanation is incomplete and that excess postneonatal mortality may be equally important. Consistent with that finding, Kleinman and Kiely (1990) document that the United States had a disadvantage in aggregate postneonatal mortality during the 1980s. This suggests that the disparities in postneonatal mortality we document are long-standing, although those authors did not have access to international microdata, which limits their ability to analyze comparably reported samples.

In the economics literature, this paper relates closely to the work of Case, Lubotsky, and Paxson (2002) who use various US survey datasets to investigate

[3] Given that one of the most striking facts about infant mortality in the United States is the disparity in mortality between black and white infants, it is important to note that the facts we document in this paper are essentially unchanged if we exclude US blacks from the sample. The literature investigating the black-white IMR gap has generally concluded that differential health at birth can account for the vast majority of the black-white gap, and that differences in postneonatal mortality are both less important and can be accounted for by differences in background characteristics (Miller 2003; Elder, Goddeeris, and Haider 2011). In contrast, our findings suggest that differences in postneonatal mortality account for as much or more of the US IMR disadvantage relative to Europe than do differences in health at birth, and that these differences in postneonatal mortality are not eliminated by conditioning on a set of (albeit, limited) background characteristics. Taken together, the prior literature and our analysis thus suggest that the mechanisms explaining the black-white IMR gap within the United States may be different from the mechanisms explaining the US IMR disadvantage relative to Europe.

[4] Unfortunately, similar data for Austria are not easily available.

the changing relationship between health status and family income as children age (examining age ranges starting at 0–3 and ending at 13–17). They document that health erodes more quickly with age for children from lower socioeconomic status families; as in our study, this fact is not altered by conditioning on measures of health at birth. Currie and Stabile (2003) document a similar finding in Canadian survey data, as do Case, Lee, and Paxson (2008) (revisiting an earlier analysis by Currie, Shields, and Price 2007) in UK data.[5] Our analysis suggests that the health gradient in the United States largely emerges after the first month of life, which accords with Case and coauthors' conclusion that the gradient increases with age in the United States. However, our data from Europe provide stark evidence that no similar gradient emerges during the first year of life in those countries.

In terms of policy implications, these new facts together suggest that a sole focus on improving health at birth (for example, through expanding access to prenatal care) will be incomplete, and that policies which target disadvantaged groups during the postneonatal period may be a productive avenue for reducing infant mortality in the United States. Further, our income evidence suggests that simply increasing resources may not be sufficient to achieve this goal. As we discuss more in the conclusion, one policy lever deserving of future research attention is home nurse visiting programs, which have been shown to reduce postneonatal mortality rates in randomized trials (Olds et al. 2007).

I. Data

A. *Data Description*

Birth, *Death*, *and Demographic Data.*—Our cross-country analysis relies on two types of data. For the United States, Austria, and Finland, we have access to microdata. The US data come from the National Center for Health Statistics (NCHS) birth cohort linked birth and infant death files. Austrian data are provided by Statistics Austria, and Finnish data are extracted from the Finland Birth Registry and Statistics Finland. As in prior research that has focused on comparing the mortality outcomes of US infants with infants from Scandinavian countries such as Norway (Wilcox et al. 1995), Finland provides a sense of "frontier" infant mortality rates. We chose Austria as a second point of comparison because of the availability of microdata. Notably, over the time period of our study, Austria's IMR is similar to much of continental Europe.

The data for each of these three countries consists of a complete census of births from years 2000–2005, linked to infant deaths occurring within one year of birth.[6] While birth and death certificates in the United States and Finnish data are centrally linked, we link the Austrian records using a unique identifier constructed from the 36 variables common to both the birth and death records.[7] Each country's birth

[5] A broader literature has examined the relationship between health and socioeconomic status at older ages, such as Ford et al. (1994) and Power and Matthews (1997).

[6] The years 2000–2005 are the most recent available years with full data from all three countries from which we were able to obtain microdata.

[7] All deaths are matched to a unique birth in the data.

records provide information on a rich set of covariates, including the infant's conditions at birth (such as birth weight and gestational age), and some information on demographics of the mother. For infants who die within one year of birth, we observe age and cause of death.[8] We exclude from our analyses observations which are missing data on birth weight or gestational age (1.0 percent in the United States, none in Austria, 0.4 percent in Finland). For the analysis of variation by socioeconomic status, we exclude observations which are missing any of our socioeconomic status covariates (2.2 percent in United States, none in Austria, 10.9 percent in Finland). The higher share in Finland is primarily due to missing occupation data.

To complement this three-country comparison, we use the best available—albeit more aggregated—data from two additional countries: the United Kingdom and Belgium. It is possible to do the core of our analysis with somewhat aggregated data: we require that the data be limited to our comparable sample (as discussed in Section IIA, this is singleton births at or after 22 weeks of gestation and at least 500 grams in birth weight), and that birth and death counts be reported by 500 gram birth weight bins and detailed ages at death.

Data from the United Kingdom were generated through a special request to the UK Office of National Statistics. They limited the data to singleton births, at or after 22 weeks of gestation and at least 500 grams in birth weight and provided us with data on births by 500 gram bins matched to deaths at less than 1 day, 1 day to 1 week, 1 week to 1 month, 1 to 3 months, 3 to 6 months, and 6 to 12 months. The birth weight cells are capped at 4,000 grams.

Data for Belgium were downloaded from online records through the Centre for Operational Research in Public Health. Data are provided in 100 gram bins with counts of births and deaths and the ability to limit to singleton births. Belgian reporting standards limit the data to gestational ages of at or after 22 weeks, and the birth weight cells allow us to restrict attention to births at least 500 grams in birth weight. Information is provided on deaths in the first week, 1 week to 1 month, 1 to 6 months, and 6 to 12 months.

For the within-US analysis we use the same NCHS linked files described above. These analyses use data from 2000 through 2003; the 2004 and 2005 NCHS data do not report sufficient geographic detail to be useful for this analysis.[9]

Income Data.—In Section IV, we present analyses that rely on having some measure of household income matched to the birth data. Unfortunately, it is not possible to directly match household income to the natality files in the United States, or in any of the European countries. As an alternative, we match to income measures

[8] To code cause of death as consistently as possible across years, we use the NCHS General Equivalence Mappings (GEMs) to cross-walk across ICD9 and ICD10 codes. After converting all ICD9 codes to ICD10 codes, we use the NCHS recode of the ICD10—specified in the NCHS birth cohort linked birth and infant death documentation—to consistently code causes of death across all countries and all years. The GEM files are available here: ftp://ftp.cdc.gov/pub/Health_Statistics/NCHS/Publications/ICD10CM/2010/2010_DiagnosisGEMs.zip. For Austria, causes of death prior to 2002 are ICD9 codes, and from 2002–2005 are ICD10 codes. For Finland, causes of death are ICD10 codes. For the United States, the original cause of death variable is the NCHS ICD10 recode. A handful of observations have multiple matches from the ICD9 coding to the NCHS ICD10 recode; for these observations, we randomly select one NCHS recode value from the set of possible matches.

[9] Specifically, the 2004 and 2005 data do not report state or county so we cannot use them for the income analysis. Rather than changing samples, we simply exclude these years from the main analysis as well.

based on subnational geographic groups crossed with demographics. We are able to do this for Finland and for the United States; the data for the United States can be used to extend the income analysis to within-US cross-region comparisons.

For the United States, we use income data from the Integrated Public Use Microdata Series (IPUMS) combined for 2000 and 2005. We generate measures of median income for bins defined by the following characteristics of the mother: public use microdata area (PUMA), ten year age groups (< 30, 31–40, 41–50, over 50), education (less than high school, high school degree, some college, college degree or more), marital status (married or not), and race. We link PUMAs to counties using a crosswalk, since county is reported in the NCHS files. In some cases, the NCHS files do not report county (small counties within a state are jointly reported). In these cases, we create a "residual" geography for each state that aggregates the median income for PUMAs associated with counties that are not reported individually in the NCHS files. We collapse the IPUMS data to these geographic-demographic cells and merge with the NCHS data at the cell level. For the within-US comparisons we collapse to median income. When we compare the United States to Finland, we collapse to median income, adjusted to after-tax income for the United States using the NBER TaxSim algorithm for comparability with our Finnish data (which reports after-tax income).

For Finland, we use data for 2000 through 2005 provided by Statistics Finland based on their household budget survey. The data are provided in summary cells of mothers' characteristics: region, education (basic, upper secondary and lower tertiary, undergraduate or more), ten year age groups, and marital status. The income measure provided is median after-tax income. We merge these data with the Finnish birth data, matching the three education bins to the three occupation bins available in the Finnish birth data.

B. *Summary Statistics*

Summary statistics are shown in Table 1 for our cross-country data and Table 2 for our cross-census division data. As expected, Table 1 documents that the United States has the highest mortality among the countries considered. Panel A reports mortality, gestation (for Finland, Austria, and the United States), and birth weight in our restricted sample of singleton births at least 22 weeks of gestation and weighing at least 500 grams (this sample restriction is discussed in more detail in Section IIA). This sample restriction lowers the death rates in all five countries. In terms of birth weight, arguably the most reliable estimate of conditions at birth (Dietz et al. 2007), the United States looks similar to Austria, the United Kingdom, and Belgium. Finland has much higher average birth weight than any of the other countries, with infants an average of 200 grams heavier than elsewhere.

In panel B, we focus on the subsample for which we observe demographics and provide summary statistics on demographic covariates (available only for the United States, Austria, and Finland). This further sample restriction does not substantially change death rates, birth weight, or gestational age. Mother's age is lowest in the United States at 27 years, and closer to 29 years in Austria and Finland. Fifteen percent of births in the United States are to black mothers; race is reported only

Table 1—Cross-Country Summary Statistics

	United States (1)	Austria (2)	Finland (3)	United Kingdom* (4)	Belgium* (5)
Death within 1 year, per 1,000 births, full sample	6.78	3.98	3.21	5.33	4.40
Number of births	24,484,028	466,227	339,312		
Panel A. Main sample					
Death within 1 year, per 1,000 births, restricted sample	4.65	2.94	2.64	3.43	3.67
Gestational age (weeks)	38.8	38.6	39.4		
Birth weight (grams)	3,332	3,345	3,550	3,368	3,310
Number of births	23,411,153	451,920	327,732	3,942,209	667,697
Panel B. Demographic sample					
Death within 1 year, per 1,000 births, restricted sample	4.55	2.94	2.63		
Gestational age (weeks)	38.8	38.6	39.4		
Birth weight (grams)	3,333	3,345	3,553		
Male infant (%)	51.2%	51.2%	51.3%		
Mother's age (years)	27.40	28.75	29.51		
Mother is black [US] or immigrant [AU] (%)	14.9%	23.9%	—		
Mother is married (%)	65.3%	65.3%	59.9%		
Mother has at least college degree (%)	25.7%	11.9%			
Mother is "upper white collar" worker (%)			21.8%		
Number of births	23,113,240	451,920	292,786		

Notes: Race is reported only in the US data. Data cover 2000 through 2005. The first row contains the full (unadjusted) sample. Panel A is limited to singleton births at $\geq$ 22 weeks of gestation and $\geq$ 500 grams with birth weight and gestational age observed. Panel B limits to observations with no missing demographic covariates.

*For the United Kingdom and Belgium, the unadjusted death rates come directly from the World Development Indicators database; gestational age and demographic data are not available in the tabulations we obtained for these countries.

in the United States. The share of births to married women is approximately 60 to 65 percent in all three countries. Twenty-six percent of women in the United States have a college degree or more, versus 12 percent in Austria. For Finland, we observe only occupation rank: we consider "upper white collar" workers as the highest socioeconomic status group; they make up 22 percent of the sample.

Table 2 shows the same summary statistics across census divisions within the United States. There is wide variation in death rates, birth weight, and demographics across divisions. The Northeast has the lowest mortality rates and the highest birth weights.

II. Results: United States versus Europe

Our accounting exercise investigates four potential sources of the US IMR disadvantage: reporting, birth weight, neonatal mortality, and postneonatal mortality.

A. *Reporting Differences*

A well-known issue with cross-country comparisons of infant mortality is possible reporting differences for infants born near the threshold of viability. Extremely preterm births recorded as a live birth in some places may be considered

Table 2—Cross-Census Division Summary Statistics

	Northeast (1)	Mid-Atlantic (2)	East North Central (3)	West North Central (4)	South Atlantic (5)
Death within 1 year, per 1,000 births, full sample	5.27	6.36	7.60	6.66	7.96
Number of births	689,261	2,052,697	2,472,299	1,074,249	2,917,487
Panel A. Main sample					
Death within 1 year, per 1,000 births, restricted sample	3.16	4.15	5.06	4.68	5.29
Gestational age (weeks)	39.0	38.9	38.9	38.9	38.8
Birth weight (grams)	3,402	3,349	3,355	3,386	3,309
Number of births	657,149	1,968,975	2,380,996	1,034,506	2,814,862
Panel B. Demographic sample					
Death within 1 year, per 1,000 births, restricted sample	3.08	3.95	4.98	4.61	5.15
Gestational age (weeks)	39.0	39.0	38.9	38.9	38.8
Birth weight (grams)	3,403	3,351	3,356	3,387	3,310
Male infant (%)	51.3%	51.2%	51.2%	51.2%	51.1%
Mother's age (years)	33.78	32.29	32.27	32.39	32.27
Mother is black [US] or immigrant [AU] (%)	8.8%	18.1%	15.1%	8.0%	26.3%
Mother is married (%)	71.2%	66.1%	65.4%	69.5%	63.4%
Mother has at least college degree (%)	38.8%	30.4%	26.5%	29.6%	25.9%
Number of births	651,851	1,799,490	2,354,809	1,025,991	2,787,062

	East South Central (6)	West South Central (7)	Mountain (8)	Pacific (9)
Death within 1 year, per 1,000 births, full sample	8.85	6.60	6.09	5.37
Number of births	953,341	2,107,572	1,204,992	2,747,287
Panel A. Main sample				
Death within 1 year, per 1,000 births, restricted sample	6.30	4.90	4.47	3.78
Gestational age (weeks)	38.6	38.7	38.8	39.0
Birth weight (grams)	3,277	3,303	3,304	3,389
Number of births	919,404	2,033,140	1,167,269	2,532,336
Panel B. Demographic sample				
Death within 1 year, per 1,000 births, restricted sample	6.26	4.83	4.35	3.68
Gestational age (weeks)	38.6	38.7	38.8	39.0
Birth weight (grams)	3,277	3,304	3,305	3,389
Male infant (%)	51.2%	51.1%	51.2%	51.2%
Mother's age (years)	31.18	31.49	32.06	32.32
Mother is black [US] or immigrant [AU] (%)	24.9%	15.1%	3.1%	5.5%
Mother is married (%)	63.2%	65.4%	68.2%	68.1%
Mother has at least college degree (%)	20.3%	18.9%	21.7%	23.3%
Number of births	917,058	2,007,779	1,145,742	2,405,124

Notes: Race is reported only in the US data. Data cover 2000 through 2003. The first two rows summarize data for the full (unadjusted) sample. Panel A is limited to singleton births at ≥ 22 weeks of gestation and ≥ 500 grams with birth weight and gestational age observed. Panel B limits to observations with no missing demographic covariates.

miscarriages or stillbirths in other countries (Golding 2001, Graafmans et al. 2001, Sachs et al. 1995, Wegman 1996). Since survival before 22 weeks or under 500 grams is very rare, categorizing these births as live births would inflate reported infant mortality rates (which are reported as a share of live births).

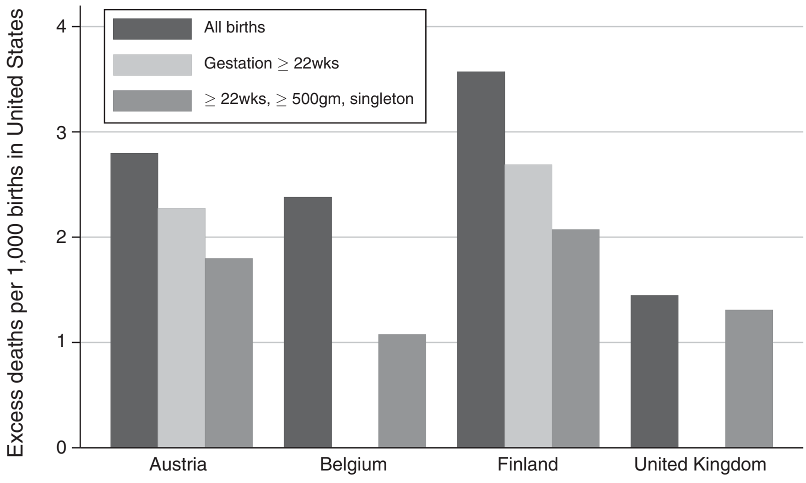


Figure 2. US IMR Disadvantage: Full Sample and Restricted Samples

Notes: This figure shows the number of excess US deaths per 1,000 births compared to Austria and Finland overall (the first set of bars), in the sample restricted to births ≥ 22 weeks of gestation (second set of bars), and in the sample restricted to singleton births ≥ 22 weeks of gestation and ≥ 500 grams (third set of bars). For the United Kingdom and Belgium the first set of bars come directly from the World Development Indicators database; the second set of bars cannot be calculated for these countries because gestational age data are not available in the tabulations we obtained for these countries.

Past literature (notably MacDorman and Mathews 2009) has addressed this concern by limiting the sample to infants born after 22 weeks of gestation. Although previous literature has largely focused on the fact that this restriction does not substantially change the rank of the US IMR relative to other countries, it is nonetheless quite quantitatively important. This can be seen by comparing the first and second bars for Austria and Finland in Figure 2. The first bar shows the excess deaths in the United States relative to other countries in the full sample. The second bar limits to infants born at or after 22 weeks of gestation. The US disadvantage declines once we impose this additional restriction.

Our data allow us to address two related issues, which prior literature has not explored. First, many countries also have reporting requirements related to birth weight and may not report infants under 500 grams as live births (MacDorman and Mathews 2009). Second, the presence of assisted reproductive technologies has increased the frequency of multiple births, which have higher mortality rates. Because the use of assisted reproductive technologies is a choice that we need not aim to fix via changes in policy or behavior, it seems appropriate to limit the sample to singleton births. The third column within each country in Figure 2 adds both of these sample restrictions. Adding these restrictions we are also able to look at the comparison with the United Kingdom and Belgium.

The US disadvantage shrinks further with these additional restrictions. Overall, limiting to a sample of singleton births at birth weights and gestational ages where reporting is not a concern reduces the excess US infant mortality in both magnitude and share terms. In the unrestricted samples, the US excess mortality ranges from

1.4 to 3.6 deaths per 1,000, or between a 27 percent and a 110 percent increase in death rates relative to the European baseline. In the restricted sample, the magnitude range is 1.1 to 2.1 excess deaths per 1,000 births, or between a 27 percent to 76 percent increase. However, even in this restricted sample there is significant excess mortality in the United States.

B. *Conditions at Birth*

In contrast to the dismissal of reporting differences as a complete explanation, past literature has argued that high preterm birth rates in the United States are the major contributor to higher infant mortality rates (MacDorman and Mathews 2009, Wilcox et al. 1995). This literature has generally compared the United States to Scandinavian countries, which have among the lowest infant mortality rates in Europe, and has generally focused on gestational age (which is more readily available in aggregate datasets) rather than birth weight. Our data are able to expand this previous literature in two ways. First, it incorporates comparisons with Austria, the United Kingdom, and Belgium, which are more representative of the European distribution but still much better off than the United States. Second, we add comparisons based on birth weight, which is typically more precisely measured than gestational age (Dietz et al. 2007).

As noted in the summary statistics, in our comparably-reported sample, birth weight (and gestational age) in the United States is worse than in Finland but close to the other countries considered. For the three countries with microdata, Appendix Figures A1, panels A and B show the full distribution of birth weight and gestational age. Similar to our observation based on the means, the most striking feature of these distributions is the difference between Finland and either the United States or Austria.[10]

To be more concrete, we consider how the US disadvantage relative to the comparison countries changes once we adjust for birth weight; this is done by comparing columns 1 and 2 of Table 3. Each panel of this table compares the United States to each European country in our data separately. The first column estimates regressions which limit to the comparable sample but include no covariates, only an indicator variable for the United States. The coefficients therefore represent the baseline difference in infant mortality between the United States and the other countries considered. In column 2 of each panel, we add birth weight controls (specifically, indicator variables for 500 gram birth weight bins). The coefficient in this column therefore represents the US infant mortality disadvantage once we adjust flexibly for birth weight. Conceptually, this follows the previous literature by calculating the excess mortality in the United States if the birth weight distribution were the same as in Europe (MacDorman and Mathews 2009). Relative to this existing literature, we adjust more precisely with birth weight bins rather than just indicators for normal or low birth weight (or indicators for preterm versus full term). The reduction in the

[10] Although the United States and Austria look almost identical in this figure, in fact Austria has a slightly more favorable birth weight distribution. This is driven by differences in the two countries in the lowest birth weight categories—under 1,000 grams—which are too small to see in the distribution but matter for survival.

Table 3—Cross-Country Differences in Mortality

Sample, controls:	Comparable sample, no controls	Comparable sample, birth weight controls	Comparable sample, birth weight controls	Comparable sample, birth weight controls	Comparable sample, birth weight controls
Mortality (in 1,000s):	First year (1)	First year (2)	< 1 week (3)	1 week to 1 month (4)	1 to 12 months (5)
Panel A. United States versus Finland					
United States	2.008***	0.533***	−0.276***	0.164***	0.647***
	(0.091)	(0.088)	(0.063)	(0.033)	(0.054)
Cumulative effect, United States			−0.276	−0.112	0.535
Observations	23,738,885	23,738,885	23,738,885	23,695,461	23,677,125
Finland mortality level			1.352	0.351	0.938
Cumulative mortality, Finland			1.352	1.703	2.641
Panel B. United States versus Austria					
United States	1.704***	1.140***	−0.019	0.068*	1.083***
	(0.082)	(0.077)	(0.056)	(0.036)	(0.043)
Cumulative effect, United States			−0.019	0.049	1.132
Observations	23,863,073	23,863,073	23,863,073	23,819,403	23,800,909
Austria mortality level			1.525	0.605	0.816
Cumulative mortality, Austria			1.525	2.130	2.943
Panel C. United States versus United Kingdom					
United States	1.214***	0.781***	0.043**	0.091***	0.648***
	(0.033)	(0.031)	(0.021)	(0.014)	(0.020)
Cumulative effect, United States			0.043	0.134	0.782
Observations	27,353,362	27,353,362	27,353,362	27,304,313	27,283,696
UK mortality level			1.539	0.609	1.289
Cumulative mortality, United Kingdom			1.539	2.148	3.437
Panel D. United States versus Belgium					
United States	0.983***	0.252***	−0.264***	0.042	0.458***
	(0.075)	(0.072)	(0.048)	(0.030)	(0.047)
Cumulative effect, United States			−0.264	−0.222	0.236
Observations	24,078,850	24,078,850	24,078,850	24,034,786	24,016,169
Belgian mortality level			1.622	0.594	1.453
Cumulative mortality, Belgium			1.622	2.216	3.669

Notes: This table shows differences across countries in mortality, using Finland (panel A), Austria (panel B), the United Kingdom (panel C), or Belgium (panel D) as the omitted country. Columns 1 and 2 analyze overall one-year mortality. Column 1 limits to the comparable sample but includes no controls. Column 2 adjusts for 500 gram birth weight category cells. Columns 3 through 5 include birth weight controls and look at deaths in various periods of life. The regression results in these columns are conditional on reaching the minimum age: deaths up to one week; deaths from one week to one month, conditional on surviving to one week, etc. Coefficients are in units of 1,000 deaths: a coefficient of 1 indicates an increase of 1 death in 1,000 births. For columns 3 through 5, each panel also shows the cumulative effect by country (the sum of the coefficients up to that point). Robust standard errors are in parentheses. Data for all countries cover 2000–2005; as described in the text, the sample is limited to singleton births at $\geq$ 22 weeks of gestation and $\geq$ 500 grams with birth weight and gestational age observed.

***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

coefficient moving from column 1 to column 2 in each panel tells us the share of the mortality difference across countries, which is accounted for by birth weight.

The importance of birth weight varies across the comparison country. Birth weight accounts for about 75 percent of the gap between the United States and Finland (panel A of Table 3) or between the United States and Belgium (panel D of Table 3). However, it only accounts for about 30 percent of the gap between the United States and Austria or the United Kingdom. This evidence confirms existing arguments that birth weight matters for the US infant mortality disadvantage, although it suggests that the prior literature's focus on Scandinavian countries may have overstated the importance of this explanation.

Even without this calibration, simple summary statistics make it clear that the conditions-at-birth explanation is incomplete. Among normal birth weight infants in the United States, the infant mortality rate is 2.3 deaths per 1,000 births, versus just 1.3 for Austria, 1.5 for Finland, 1.6 for the United Kingdom, and 2.0 for Belgium.

C. *Timing of the US IMR Disadvantage: Neonatal and Postneonatal Mortality*

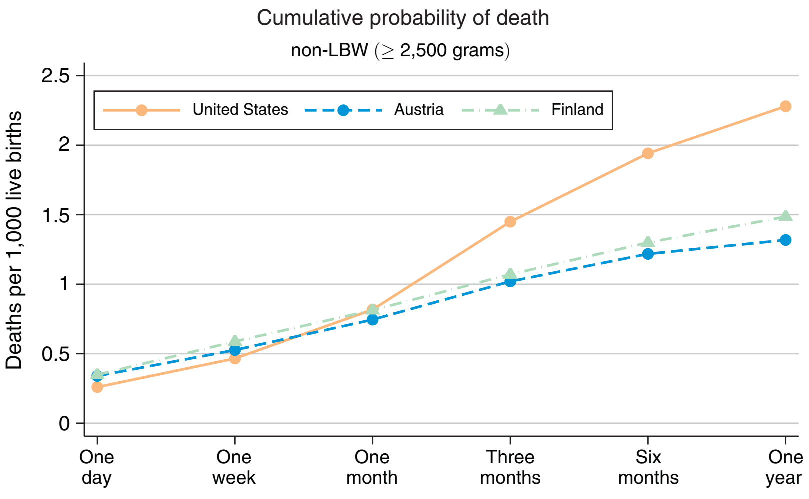
We turn now to examine the timing of the US IMR disadvantage. It is here that the value of having disaggregated data—ideally, microdata—becomes even clearer. The previous literature has been unable to compare mortality timing within the first year across countries in nonaggregate data, which is crucial in light of the reporting differences highlighted above. In unrestricted 2005 data from the World Development Indicators, neonatal mortality in the European countries considered varied from 2.1 per 1,000 live births (Finland) to 3.5 (the United Kingdom), whereas the United States reports a neonatal mortality rate of 4.5 (World Bank 2013). Postneonatal mortality differs less in this sample: 2.3 per 1,000 live births in the United States, versus a range of 1.3 to 2.0 in the European countries. However, differences in reporting could be an important driver of these trends—particularly for neonatal mortality—and from a policy perspective it is also important to understand whether these differences persist when comparing across infants with the same measured health at birth.

For the three countries with detailed microdata, it is possible to show evidence on the timing of the US IMR disadvantage graphically. Figures 1 and 3 document the cumulative probability of death by age by country.[11] In the full comparably-reported sample (Figure 1) the US 1-day IMR (in deaths per 1,000 live births) is 0.23 higher than Austria and 0.40 higher than Finland. Within the first week these differences increase only slightly—to 0.31 and 0.48. However, between 1 month and 1 year these differences accelerate: the differences at 1 year are 1.70 and 2.00 for the comparisons with Austria and Finland, respectively.

This postneonatal mortality disadvantage is even more striking in Figure 3, which graphs the cumulative probability of death over the first year separately for normal ($\geq$ 2,500 grams) and low ($<$ 2,500 grams) birth weight infants. As expected, within each group mortality rates at one year in the United States are higher than in

[11] It is not possible to add the United Kingdom or Belgium to these graphs since the data on timing are not as fine. We will be able to use data from these countries in the tables when we aggregate to the first week, 1 week to 1 month, and 1 to 12 months.

Panel A. Normal birth weight only (≥ 2,500 grams)



Panel B. Low birth weight only (< 2,500 grams)

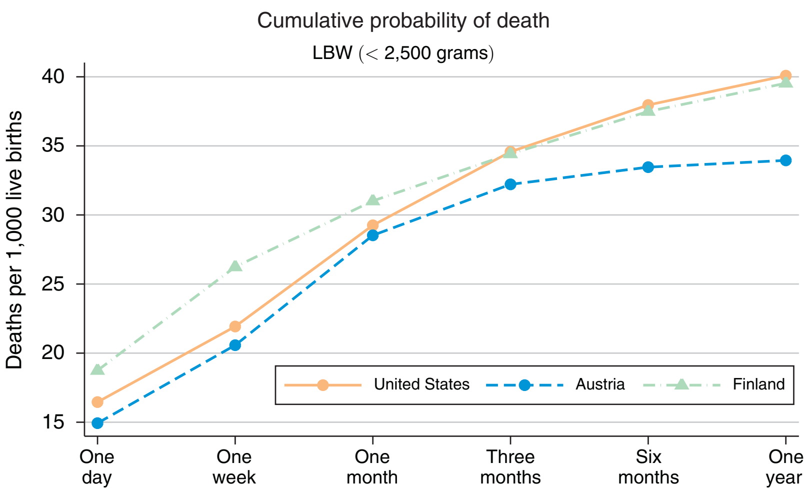


Figure 3. Cumulative Probability of Death, by Country, by Birth Weight

Notes: These figures show the cumulative probability of death, by country, timing of death, and birth weight. In panel A, the sample includes normal birth weight babies (≥ 2,500 grams). In panel B, the sample includes low birth weight babies (2,500 grams). Data for all countries cover 2000–2005; as described in the text, the sample is limited to singleton births at ≥ 22 weeks of gestation and ≥ 500 grams with both birth weight and gestational age observed. In total, 94.1 percent of births are in the normal birth weight category shown in panel A, and 5.9 percent are in the low birth weight category in panel B.

Austria and Finland. Figure 3, panel A clearly suggests that the US IMR disadvantage arises in the postneonatal period: the United States has virtually identical mortality rates to Austria and Finland up to one month, and then much higher mortality after one month. The pattern of mortality differences among low birth weight infants in Figure 3, panel B looks very similar to Figure 3, panel A, the only difference being that the United States actually seems to have *lower* mortality than Finland during the first month of life.

Columns 3 through 5 of Table 3 quantify the patterns in these figures, and adds analyses of the UK data and Belgium data. In these estimates we focus on cross-country differences in marginal (noncumulative) death rates at various ages over the first year, and condition on detailed measures of birth weight (as in column 2, we use 500 grams bins).[12]

We estimate impacts in three timing bins: < 1 week, 1 week to 1 month, and 1–12 months. The United States has, on average, a mortality advantage in the earliest period. Over the first week of life, the United States has significantly lower mortality rates than Finland or Belgium, and is roughly even with Austria and the United Kingdom. The first-week differences with respect to Finland and Belgium are reasonably large: a survival advantage of 0.3 deaths per 1,000 births in the United States. However, in the postneonatal period (from one month to one year) the United States has a significant disadvantage relative to any of the comparison countries. The excess mortality in this period ranges from 0.45 deaths per 1,000 (relative to Belgium) to 1.1 deaths per 1,000 (relative to Austria). This postneonatal period explains between 30 and 65 percent of the overall US IMR disadvantage (i.e., as shown in column 1), comparable on average to the importance of birth weight.

There are of course a number of open questions about these timing of death results, some of which we can address with the microdata from Finland and Austria. Appendix Table A1 documents a series of robustness checks. The pattern we observe is not driven by very small infants: in Appendix Table A1 (row 2) we show similar patterns if we exclude births less than 1,000 grams. These patterns are also not driven by differences in average demographics across the three countries: in Appendix Table A1 (row 3), we replicate these regressions controlling for maternal age, child sex, and maternal demographics, with identical conclusions.

One possible theory is that the observed elevation in postneonatal mortality is driven by a delay of deaths in the United States. If hospitals in the United States are better at keeping very low birth weight newborns alive for a slightly longer period of time, this could show up in the data as low neonatal mortality and excess postneonatal mortality. It is clear from the fact that we see elevated US infant mortality at one year that this is not a complete explanation. In addition, this type of substitution will be less important among groups which have low rates of neonatal mortality, such as normal birth weight infants or infants with a high Apgar score. Yet these groups also have much elevated postneonatal mortality, as can be seen in Figure 3 for normal birth weight infants, and row 4 of Appendix Table A1 for infants with Apgar scores of 9 or 10. This suggests that this concern is unlikely to be quantitatively important.

The next section will focus on decomposing these results by demographic group, but it is important to note that our estimates are not driven by the mortality outcomes of black infants (who have long been observed to have relatively poor birth outcomes in the United States): Appendix Table A1 (row 5) excludes blacks from our US sample, and a similar postneonatal disadvantage is still evident.[13]

[12] Replacing the 500 gram birth weight bins with 100 gram birth weight bins yields virtually identical results.

[13] An additional possibility is that the results could be driven by first births, if first-time mothers are less informed about appropriate care for newborns. The data suggest this explanation does not account for the patterns in the data: Appendix Table A1 (row 6) excludes first births, and the resulting estimates are quite similar. Finally, row 7 of Appendix Table A1 adds multiple births back into the sample, with again very similar results.

Relative to the average death rates, the US disadvantage in the postneonatal period is very large. Over the period from 1 to 12 months, the death rate in Austria was 0.81 per 1,000. Based on the coefficients, the predicted death rate in the United States given the same birth weight distribution would be 1.89 per 1,000 births, more than twice as large. This is especially striking since Austria is very close to the United States on birth weight distribution (see Appendix Figure A1, panel B) and also quite similar on neonatal mortality. Effectively, despite starting with very similar birth weight and very similar neonatal mortality outcomes, Austria vastly outpaces the United States starting at one month of age.

Together, this evidence suggests that aggregate comparisons are misleading. Whereas in the aggregate data the US disadvantage appears to be more important during the neonatal period than during the postneonatal period, in fact the opposite appears to be true.

D. *Causes of Death*

A natural question, following on the results above, is which causes of death account for the US disadvantage in the postneonatal period. In the Austrian, US, and Finnish data we observe cause of death codes. A central issue—difficult to resolve—is differences in cause of death coding across countries. For example, Austria codes many postneonatal deaths as being due to low birth weight; virtually no deaths in either the United States or Finland use this code during this time period. In all three countries a very large share of deaths—perhaps as much as a third—are in small categories which aggregate to "other" but are not very informative on their own. Further, because correct coding of sudden infant death syndrome (SIDS) deaths is difficult (Kim et al. 2012; Pearson, Ward-Platt, and Kelly 2011) this cause may be difficult to interpret.

With these caveats, Table 4 shows postneonatal death rates in six cause of death categories. We calculate the postneonatal death rate (per 1,000) for each cause group for each country and then calculate the US-Finland difference and the US-Austria difference. We also calculate the percent increase over the Finnish or Austrian death rate.

These cause of death results are similar for Austria and Finland. In raw difference terms SIDS and other sudden deaths are the most important, although this is largely because these causes account for the largest number of deaths. Accidents seem to play an important role in both raw and share terms. As a share, deaths from assault and respiratory infections (largely pneumonia) are much higher in the United States, although these represent a small number of deaths. Taken together, there is no clear smoking gun from this table.

III. Results: Within-US Evidence

Our analysis thus far suggests that postneonatal mortality plays an important role in driving differences between the United States and a number of countries in Europe. In this section we ask whether this result is paralleled when we consider geographic variation within the United States.

TABLE 4—POSTNEONATAL CAUSE OF DEATH, BY COUNTRY

Cause of death:	Congenital abnormalities and low birth weight (1)	Respiratory (2)	SIDS and other sudden deaths (3)	Accident (4)	Assault (5)	Other (6)
United States	0.380	0.068	0.699	0.208	0.064	0.613
Finland	0.325	0.021	0.226	0.044	0.003	0.287
Austria	0.377	0.007	0.185	0.030	0.013	0.175
United States-Finland						
Raw difference	0.055	0.047	0.473	0.164	0.061	0.326
As share of Finland	17%	224%	209%	373%	2,033%	114%
United States-Austria						
Raw difference	0.003	0.061	0.514	0.178	0.051	0.438
As share of Austria	1%	871%	278%	593%	392%	250%

Notes: This table shows the difference in postneonatal mortality from each cause of death across countries. All means are computed on the sample of infants alive at one month. Means are in units of 1,000 deaths. Data for all countries cover 2000–2005; as described in the text, the sample is limited to singleton births at $\geq$ 22 weeks of gestation and $\geq$ 500 grams with birth weight and gestational age observed.

We begin by noting, based on the summary statistics in Table 2, that there is tremendous variation in infant mortality rates across the United States. This is true even though the geographic units we consider are census divisions, which are quite broad; it would be even more true if we considered state-level or county-level variation. Considering the comparable sample reported in panel A of Table 2, one-year infant mortality in the Northeast is 3.16 deaths per 1,000 live births, whereas in the East South Central region (Oklahoma, Arkansas, Louisiana, and Texas) this figure is 6.30 per 1,000. Both the Northeast and the Pacific divisions have overall infant mortality rates within the distribution of the European countries considered. If the Northeast were a country, it would be similar to Austria.

As a first look at the role of timing, we replicate Figures 1 and 3 for the census divisions in Figures 4 and 5. As with the cross-country data, it is evident that the gaps across divisions grow in the postneonatal period. In the overall sample, if we compare the lowest mortality (Northeast) to the highest mortality (East South Central) divisions, we find that between one day and one week of life, the difference in mortality rates only grows by 0.40 deaths per 1,000 births. Between 1 and 12 months, this difference increases by 2.41 deaths per 1,000 births.

Table 5 replicates Table 3 but with indicator variables for census division rather than country. The omitted division is the Northeast. Column 1 estimates the baseline differences across divisions and column 2 adds controls for birth weight. Columns 3 through 5 retain the birth weight controls and estimate effects by timing of death within the first year. Similar to the cross-country analysis, we would like to use these estimates to make summary statements about the importance of birth weight, and the relative importance of the various periods within the first year. To do this, we use the coefficient estimates in Table 5 to calculate the share of the cross-division differences, which are explained by various factors. We calculate these shares for each division pair, and then average to produce an overall conclusion about the importance of each.

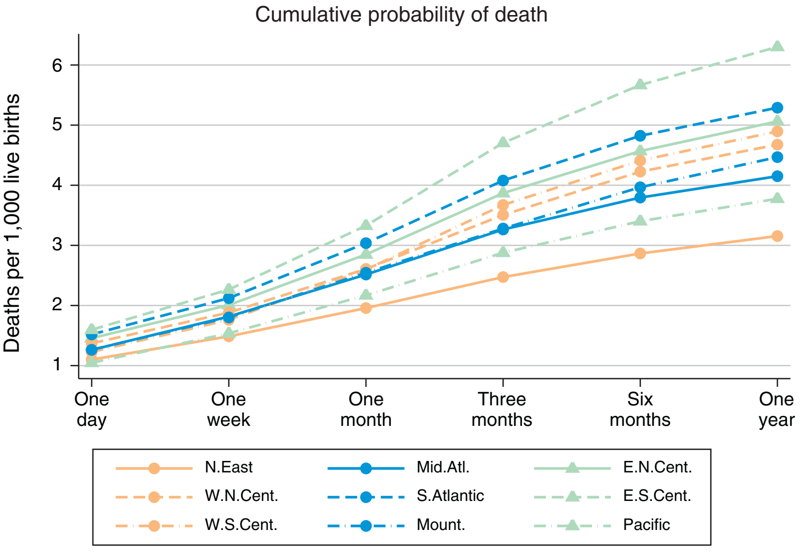


Figure 4. Cumulative Probability of Death, within United States

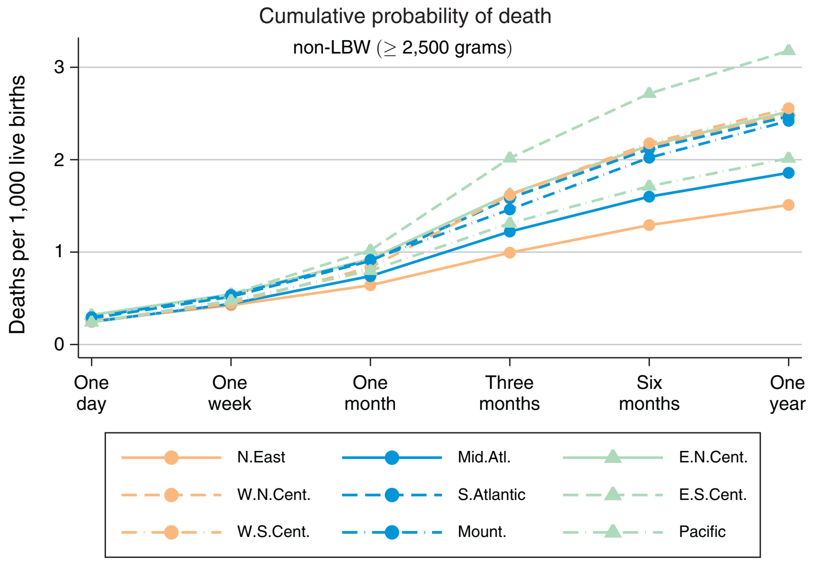
Notes: This figure shows the cumulative probability of death, by US census division and timing of death, unconditional on conditions at birth. Data cover 2000 through 2003; as described in the text, the sample is limited to singleton births at $\geq$ 22 weeks of gestation and $\geq$ 500 grams with both birth weight and gestational age observed.

We consider first birth weight, comparing columns 1 and 2 of Table 5. The importance of birth weight varies across the division-pairs. For some division-pairs controlling for birth weight increases the baseline gap. In others, the gap is in the opposite direction once we control for birth weight. As a summary measure, we calculate the share of the cross-division variation accounted for by birth weight differences for the median division-pair. This figure is 45 percent.

Turning to the timing of deaths in columns 3 through 5, a simple analysis of the coefficient magnitudes suggests that the postneonatal period accounts for a larger share of differences than the earlier periods; the coefficient magnitudes are much larger. By comparing column 2 to columns 3 through 5 we can assess what share of the birth-weight adjusted gaps are accounted for by the first week of life, one week to one month of life, and the postneonatal period. These figures are shown in the last row of Table 5. The first week of life accounts on average for about 17 percent of the gap, the period from a week to a month accounts for 16 percent, and the postneonatal period accounts for 67 percent. The second-to-last row reports the share of deaths that occur in this period in the Northeast census division, as a point of reference. A comparison of the two final rows makes clear that the postneonatal period accounts for an outsize share of the cross-division gap relative to its importance in the first year.

The relative performance of US census divisions is similar across the first year of life. That is, unlike the European comparisons, we do not see evidence that the worst off areas do *better* early on. However, similar to the European comparison, we find the postneonatal period accounts for an outsize share of the geographic differences.

Panel A. Normal birth weight only (≥ 2,500 grams)



Panel B. Low birth weight only (< 2,500 grams)

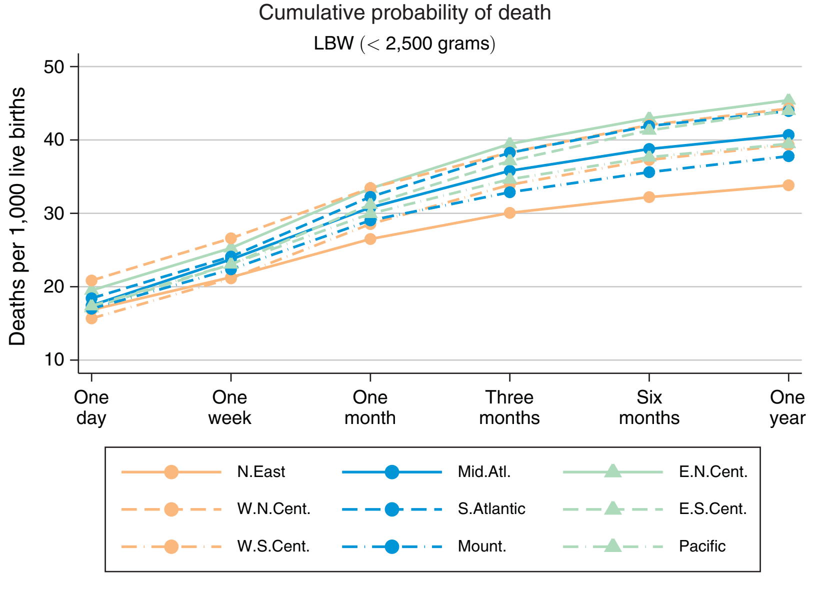


Figure 5. Cumulative Probability of Death, within United States, by Birth Weight

Notes: These figures show the cumulative probability of death, by US census division, timing of death, and birth weight. In panel A, the sample includes normal birth weight babies (≥ 2,500 grams). In panel B, the sample includes low birth weight babies (< 2,500 grams). Data cover 2000 to 2003; as described in the text, the sample is limited to singleton births at ≥ 22 weeks of gestation and ≥ 500 grams with both birth weight and gestational age observed.

Table 5—Cross-Census Division Differences in Mortality

Sample, controls:	Comparable sample, no controls	Comparable sample, birth weight controls	Comparable sample, birth weight controls	Comparable sample, birth weight controls	Comparable sample, birth weight controls
Mortality (in 1,000s):	First year (1)	First year (2)	< 1 week (3)	1 week to 1 month (4)	1 to 12 months (5)
Mid-Atlantic	0.996***	0.547***	0.072	0.163***	0.320***
	(0.097)	(0.093)	(0.058)	(0.040)	(0.065)
East North Central	1.907***	1.521***	0.296***	0.311***	0.931***
	(0.095)	(0.091)	(0.056)	(0.039)	(0.063)
West North Central	1.521***	1.496***	0.374***	0.256***	0.874***
	(0.108)	(0.103)	(0.064)	(0.044)	(0.072)
South Atlantic	2.135***	1.201***	0.105*	0.272***	0.831***
	(0.093)	(0.089)	(0.055)	(0.038)	(0.062)
East South Central	3.146***	1.926***	0.092	0.360***	1.475***
	(0.110)	(0.105)	(0.065)	(0.045)	(0.073)
West South Central	1.741***	1.160***	−0.0237	0.256***	0.920***
	(0.097)	(0.093)	(0.057)	(0.040)	(0.064)
Mountain	1.313***	1.240***	0.315***	0.294***	0.653***
	(0.105)	(0.101)	(0.062)	(0.043)	(0.070)
Pacific	0.621***	0.870***	0.198***	0.215***	0.467***
	(0.094)	(0.090)	(0.056)	(0.039)	(0.063)
Observations	15,508,637	15,508,637	15,508,637	15,480,699	15,468,224
Share of total explained		45.3%			
Share of deaths, Northeast			45.9%	15.3%	38.8%
Share of birth weight-adjusted explained			17.3%	15.7%	67.1%

Notes: This table shows differences across US census divisions in mortality; the omitted division is the Northeast. Columns 1 and 2 analyze overall one-year mortality. Column 1 limits to the comparable sample but includes no controls. Column 2 adjusts for 500 gram birth weight category cells. Columns 3 through 5 include birth weight controls and look at deaths in various periods of life. The regression results in these columns are conditional on reaching the minimum age: deaths up to one week; deaths from one week to one month, conditional on surviving to one week, etc. Coefficients are in units of 1,000 deaths: a coefficient of 1 indicates an increase of 1 death in 1,000 births. Shares reported in the final row are calculated based on each census division pair and averaged. Robust standard errors are in parentheses. Data for all countries cover 2000–2003; as described in the text, the sample is limited to singleton births at ≥ 22 weeks of gestation and ≥ 500 grams with birth weight and gestational age observed.

***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

As one summary statistic, lowering the postneonatal mortality rate of all census divisions to the level experienced by the best-off division would reduce infant mortality in the United States by 0.75 deaths per 1,000 births.

IV. Demographics of Postneonatal Disadvantage

It is well known that—relative to Europe—the United States has higher inequality on many metrics (Bertola and Ichino 1995). Similarly, there is significant variation across the United States in the extent of income inequality by region (Frank 2009). Given these patterns, a natural question is whether the variation across countries and across regions is explained by worse outcomes among relatively disadvantaged households in the United States relative to Europe (or in some census divisions relative to others).[14] For example, a key focus of a recent National Research Council report was the question of whether even highly advantaged Americans are in worse health than their counterparts in peer countries, or whether worse average health outcomes in the United States only reflect higher levels of health inequality (National Research Council 2013).

In this section we focus on the postneonatal period and explore the demographics of the variation in this outcome. We first simply document the variation in postneonatal mortality across demographic groups, which provides a broad sense of which demographic groups are most important in accounting for mortality variation across space. We then put somewhat more structure on the question by defining an "advantaged" group in each country/region and asking—akin to the question in the National Research Council report—whether there is variation across regions even among a relatively more advantaged group. As we will see, these estimates suggest that disadvantaged groups account for an outsized share of the cross-regional differences in postneonatal mortality rates. We then explore the extent to which these mortality gaps are a result of differences in resources (i.e., income) across region, as opposed to differences which arise after holding income constant.

The cross-country analysis in this section focuses on the United States, Finland, and Austria; our data from the United Kingdom and Belgium unfortunately do not provide tabulations by socioeconomic status so we are not able to use these data in these analyses. In addition, as noted in the data section, our income data are available only for the United States and Finland. We will therefore document the income analysis only comparing the United States and Finland, and within the United States.

A. *Postneonatal Mortality by Demographic Group*

We begin by investigating how postneonatal mortality rates vary by demographic group. Figure 6, panel A documents postneonatal death rates by education/socioeconomic status group, for which we observe four groups in the United States and Austria and three groups in Finland. In the United States, this is based on education: less than a high school degree, a high school degree, some college, and college degree or more. In Austria, we also use educational data: compulsory school, vocational school, high school with A-levels, and university or teaching college. In Finland, the groups are defined based on occupation: blue collar, lower white collar, and upper white collar or entrepreneur. The steeper socioeconomic gradient observed in postneonatal mortality within the United States is striking relative to the socioeconomic gradients observed in Austria or Finland. Notably, the within-US gradient is not simply due to high mortality rates in the least educated group; there is wide variation across the distribution; in contrast, to the extent that there is any inequality by socioeconomic status in Austria or Finland, it appears to be driven by the lowest education or occupation group. Similar findings emerge in Figure 6 panel B, across regions within the United States.

[14] A large literature—see, for example Avendano (2012)—has estimated the cross-country relationship between income inequality and infant mortality, tending to find a strong positive cross-sectional correlation that is not always robust to alternative specifications (such as country fixed effect models).

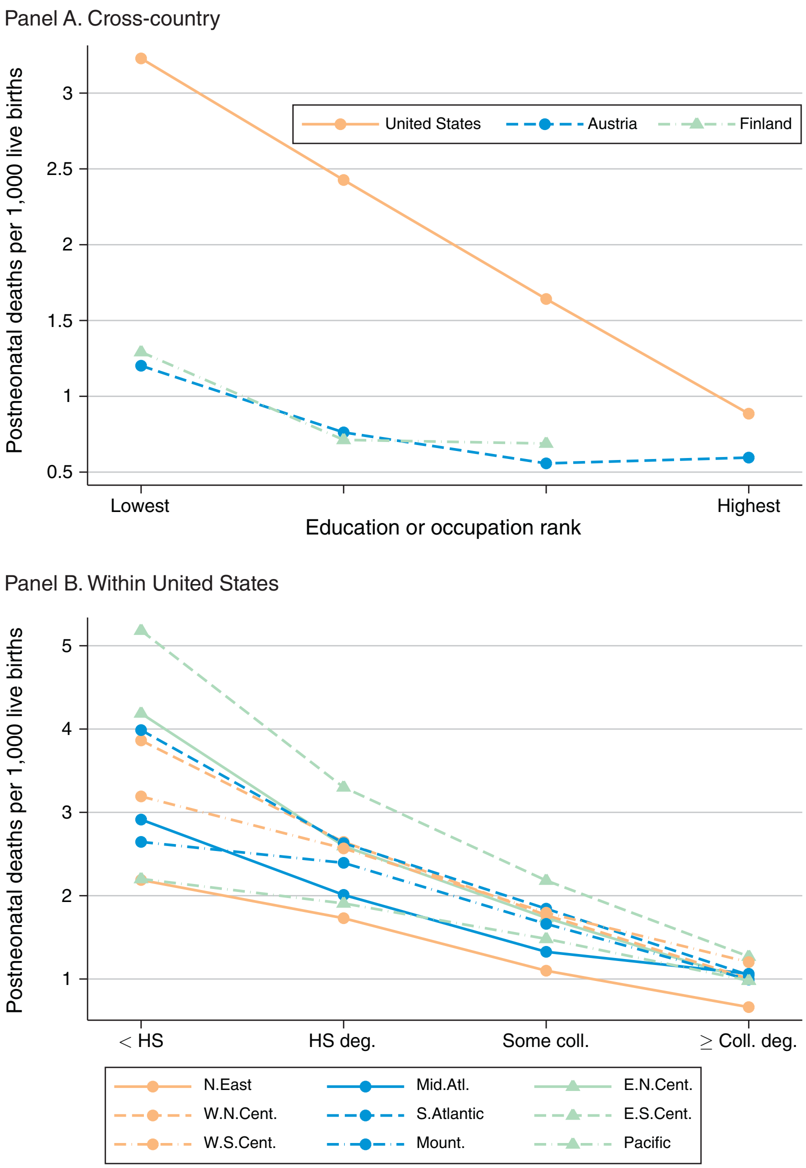


FIGURE 6. GRADIENT IN POSTNEONATAL DEATH RATES BY SOCIOECONOMIC STATUS AND LOCATION

Notes: These figures show the gradient in postneonatal death rates by socioeconomic status and location. In panel A, the sample for all countries cover 2000 through 2005. In panel B, the sample within the United States cover 2000 through 2003. The sample is limited to singleton births at $\geq$ 22 weeks of gestation and $\geq$ 500 grams with no missing covariates. Because the death rates are postneonatal, the sample also excludes infants who died before one month of age.

What this analysis does not directly address is the question of whether there are groups in the United States that do as well as comparable groups in Europe. That is: do the most advantaged groups in the three countries—or in the nine census divisions—look similar? To investigate this question, we focus attention on an "advantaged" demographic: mothers who are high education/occupation, married and white (United States) or nonimmigrant (Austria).[15] We then compare the mortality profile of this group, and the corresponding less advantaged group, across the three countries. It is worth noting in this analysis that the comparison with Austria is likely to be the most informative because in both the United States and Austria we have data on education; in Finland, we use occupation as a proxy for educational level, which is likely to be correlated with education but is less comparable.

We show visual evidence on the cross-country/cross-group comparison in Figure 7, which shows cumulative death rates in the three countries for the two education/occupation groups. In Figure 7 panel A, the advantaged individuals, there appears to be virtually no difference in death rates. In contrast, for the lower portion of the distribution (Figure 7 panel B) the US death rate is much higher. In the postneonatal period the death rate for this group in the United States is 2.4 per 1,000, versus 0.83 in Austria and 0.97 in Finland.

We explore this in regression form by estimating regressions analogous to those in column 5 of Table 3 but including an interaction between an indicator variable for the United States and an indicator variable for our advantaged definition. We can then test whether individuals in the advantaged group have higher mortality in the United States than elsewhere. This estimation is presented in Table 6. Panel A considers postneonatal mortality. Relative to both Austria (column 1) and Finland (column 2) the main effect of United States is large and positive and the interaction is large and negative. The advantaged group in the United States cannot be statistically distinguished from the advantaged group in either of the comparison countries.[16]

Although the primary focus in this section is on postneonatal mortality, in panel B of Table 6 we demonstrate that the United States *does not* show excess inequality in neonatal mortality. The main effect of the United States in both columns is negative, indicating that disadvantaged groups in the United States do *better* than their counterparts in Europe conditional on circumstances at birth (this is marginally significant for Finland). The interaction effect is small, statistically insignificant, and of differing sign across columns.

Table 7 documents an analogous set of estimates across census divisions within the United States. Column 1 focuses on postneonatal mortality. The first set of coefficients, which estimate the differences across the advantaged and non-advantaged group, suggests large differences across census divisions.[17] The negative interaction coefficients suggest that these differences shrink considerably (at least relative to the Northeast) when we look at the advantaged group. At the bottom of the table we provide a summary measure of the average difference across all division-pairs in the advantaged and non-advantaged groups. The average difference for the advantaged group is 0.17 deaths per 1,000; for the non-advantaged, it is 0.55 per 1,000. Another

[15] This group accounts for 22 percent in the United States, 7 percent in Austria, and 16 percent in Finland.

[16] Appendix Tables A2 and A3 present analogous results after varying the definition of advantaged. Appendix Table A2 uses only the education/occupation variable and Table A3 uses education/occupation and married (but not race). The results are very similar. In particular, leaving race out of the definition makes virtually no difference, reinforcing our earlier argument that our estimates do not appear to be driven by black/white differences in the United States.

[17] This analysis uses a linear probability model; results are similar with a probit approach.

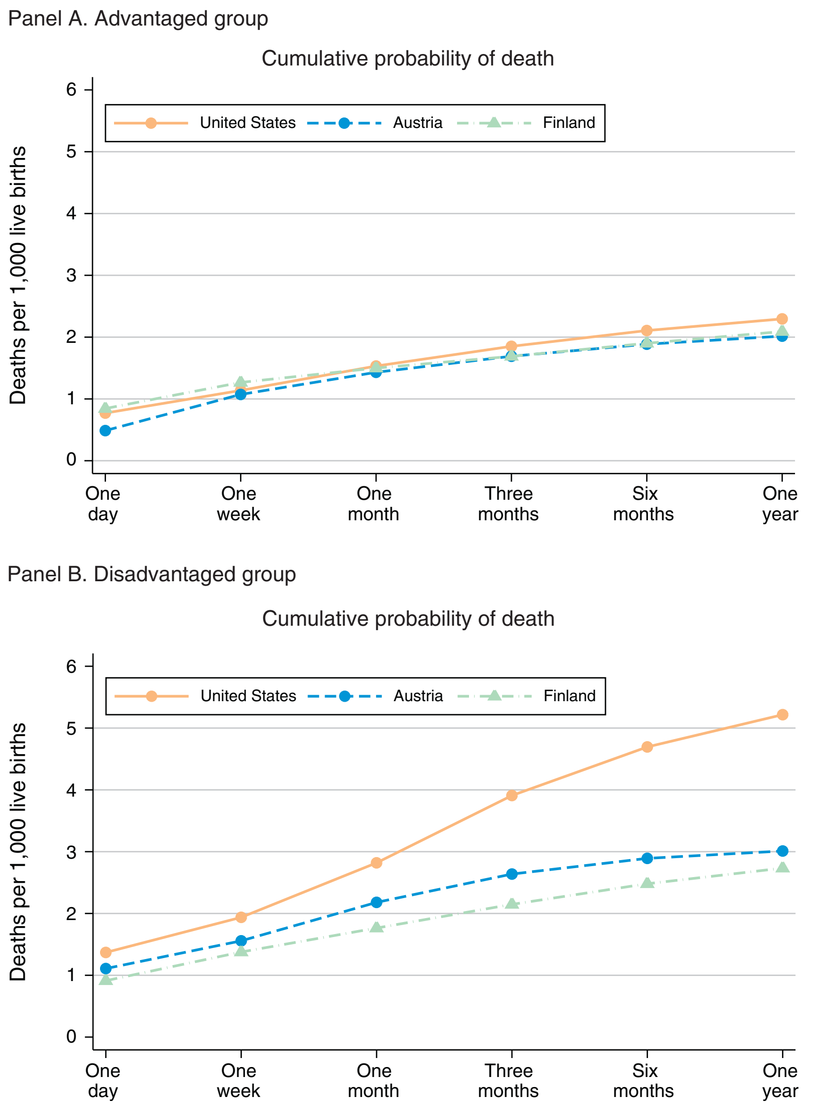


Figure 7. Cumulative Probability of Death, by Country, by Socioeconomic Group

Notes: These figures show the cumulative probability of death, by country, timing of death, and group. "Advantaged" is as defined in the text (mothers who are high education/occupation, married and white (United States), or nonimmigrant (Austria)). Data for all countries cover 2000–2005; as described in the text, the sample is limited to singleton births at $\geq$ 22 weeks of gestation and $\geq$ 500 grams with no missing covariates.

way to summarize these estimates is to note that the maximum difference among the non-advantaged group is 1.6 excess deaths per 1,000 births (East South Central versus Northeast), whereas the maximum difference for the advantaged group is 0.4 deaths per 1,000.

As a comparison, column 2 of this table estimates the same regressions for neonatal mortality. As in our comparison with Europe, across US regions we observe

Table 6—Cross-Country Differences in Postneonatal and Neonatal Mortality, by Group

	United States versus Austria (1)	United States versus Finland (2)
Panel A. Postneonatal mortality		
United States	1.357***	0.920***
	(0.046)	(0.064)
Advantaged	−0.093	−0.296**
	(0.144)	(0.129)
United States × advantaged	−1.146***	−0.941***
	(0.145)	(0.130)
Observations	23,505,784	23,347,108
High SES, United States versus Europe	0.126	0.853
Panel B. Neonatal mortality		
United States	0.024	−0.149*
	(0.068)	(0.083)
Advantaged	−0.259	−0.080
	(0.218)	(0.192)
United States × advantaged	0.063	−0.116
	(0.219)	(0.193)
Observations	23,565,160	23,406,026
High SES, United States versus Europe	0.675	0.128

Notes: This table shows differences across countries in mortality by advantaged versus disadvantaged group. The regressions adjust for 500 gram birth weight category cells. The regression results in panel A are conditional on surviving to one month of age. "Advantaged" is as defined in the text (mothers who are high education/occupation, married and white (in the United States) or nonimmigrant (in Austria)). Coefficients are in units of 1,000 deaths: a coefficient of 1 indicates an increase of 1 death in 1,000 births. Robust standard errors are in parentheses. Data for all countries cover 2000–2005; as described in the text, the sample is limited to singleton births at $\geq$ 22 weeks of gestation and $\geq$ 500 grams with no missing covariates. The last row in each panel reports the *p*-value from a test for equality between the advantaged group in the United States relative to the advantaged group in the comparison country.

***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

much less variation in neonatal mortality relative to postneonatal mortality. Perhaps more notable, however, is that the neonatal mortality gaps across advantaged and non-advantaged groups are virtually identical across census divisions.

Overall, this evidence suggests that the observed higher US postneonatal mortality relative to Europe is due entirely, or almost entirely, to higher mortality among disadvantaged groups. Focusing on the cross-country results, well-off individuals in all three countries have similar infant mortality rates. Another way to state this is in the context of within-country inequality. In both Finland and Austria, postneonatal mortality rates are extremely similar across groups with varying levels of advantage, either unconditionally or (more starkly) conditional on detailed birth weight. In contrast, there is tremendous inequality within the United States, with lower socioeconomic status groups experiencing much higher postneonatal mortality rates.

Table 7—Cross-Census Division Differences in Postneonatal and Neonatal Mortality, by Group

Mortality (in 1,000s):	Postneonatal 1 to 12 months (1)	Neonatal < 1 month (2)
Mid-Atlantic	0.336***	0.218***
	(0.072)	(0.084)
Mid-Atlantic × advantaged	−0.341***	−0.245*
	(0.094)	(0.147)
East North Central	1.068***	0.635***
	(0.072)	(0.082)
East North Central × advantaged	−0.836***	−0.154
	(0.095)	(0.143)
West North Central	1.021***	0.642***
	(0.085)	(0.092)
West North Central × advantaged	−0.706***	−0.038
	(0.112)	(0.162)
South Atlantic	0.912***	0.335***
	(0.070)	(0.080)
South Atlantic × advantaged	−0.759***	−0.0102
	(0.093)	(0.141)
East South Central	1.589***	0.497***
	(0.091)	(0.092)
East South Central × advantaged	−1.229***	−0.067
	(0.130)	(0.180)
West South Central	0.920***	0.239***
	(0.073)	(0.082)
West South Central × advantaged	−0.613***	0.008
	(0.102)	(0.152)
Mountain	0.673***	0.592***
	(0.079)	(0.089)
Mountain × advantaged	−0.604***	−0.163
	(0.109)	(0.165)
Pacific	0.440***	0.393***
	(0.069)	(0.081)
Pacific × advantaged	−0.303***	−0.127
	(0.093)	(0.144)
Advantaged	−0.645***	−0.064
	(0.078)	(0.123)
Observations	15,056,924	15,094,906
Average difference, advantaged	0.17	0.25
Average difference, not advantaged	0.55	0.26

Notes: This table shows differences across census divisions in mortality by advantaged versus disadvantaged group. The regressions adjust for 500 gram birth weight category cells. The regression results in column 1 are conditional on surviving to 1 month of age. "Advantaged" is as defined in the text (mothers who are high education/occupation, married, and white). Coefficients are in units of 1,000 deaths: a coefficient of 1 indicates an increase of 1 death in 1,000 births. Robust standard errors are in parentheses. Data cover 2000–2003; as described in the text, the sample is limited to singleton births at ≥ 22 weeks of gestation and ≥ 500 grams with no missing covariates.

***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

B. *The Role of Income Differences*

One explanation for the excess variation across groups in the United States (or within the poorer census divisions) is excess variation in income. Income per se has been shown to impact birth weight, although impacts on infant mortality are less clear (see, e.g., Currie and Cole 1993; Baker 2008; Almond, Hoynes and Schanzenbach 2011; Hoynes, Miller, and Simon 2012). More generally, Cutler and Lleras-Muney (2010) document evidence that income plays a role in accounting for some of the education-health gradient in both the United States and the United Kingdom. If the poor in the United States are worse off than the poor elsewhere, then it is possible this drives some of the effects we observe.[18] On the other hand, it is possible that these differences arise even within groups with similar incomes. If this is the case, it would suggest that excess postneonatal mortality in the United States is not a direct issue of income.

Ideally, we would address this question with individual-level data on income linked to birth outcomes. Unfortunately, such data are not accessible. As an alternative, we investigate this question using more aggregated data from the United States and Finland. Note that we are more confident in using these data for within-US comparisons, given that our income data are more comparable within the United States.

We approach this analysis, in both the cross-country and within-US case, by dividing individuals into deciles based on the mean income by their demographic cell. We then estimate the postneonatal mortality differences across countries and—separately—the average difference across division-pairs in postneonatal mortality for each income decile. To the extent that differences in income drive the postneonatal mortality differences across areas, we should see limited differences in postneonatal mortality within income groups.

The results are shown in Table 8. They do not suggest similar mortality rates within income groups, at least not for low income individuals. When we compare the United States to Finland we find continued evidence of significantly elevated mortality rates in the United States even among groups with comparable income. For example, in the second income decile, the United States has a postneonatal mortality rate of 1.2 deaths per 1,000 more than Finland, despite virtually identical median incomes in this group across countries. Consistent with our earlier evidence, at the higher income levels there is no statistically significant postneonatal mortality gap across countries.

The GDP per capita in Finland is, on average, lower than the United States. As a result, if the United States adopted the Finnish income distribution, along with the US schedule of postneonatal mortality by income, infant mortality would actually be expected to increase. These cross-country results are, however, somewhat difficult to interpret given the vast differences in non-cash welfare provision by each country, which are not included in our income measures.

[18] A related issue is that some authors have argued income inequality per se drives poor US birth outcomes (Reagan, Salsberry, and Olsen 2007), although the most recent evidence on this suggests it is probably not a robust relationship (Aizer, Higa and Winkler 2013).

Table 8—Postneonatal Disadvantage within Income Groups

	United States versus Finland			Within United States across divisions		
	Excess US mortality, 1–12 months (1)	Median income, US [2005 US$] (after taxes) (2)	Median income, Finland [2005 US$] (after taxes) (3)	Average difference across divisions, 1–12 months (4)	Median income, richest division (5)	Median income, poorest division
Income group 1	1.751*** (0.214) [1,055,295]	$19,205	$20,583	0.987 [1,040,820]	$27,873	$23,421
Income group 2	1.190*** (0.397) [1,054,913]	$28,809	$27,892	0.631 [1,040,783]	$39,555	$37,284
Income group 3	1.002*** (0.289) [1,058,082]	$33,987	$34,367	0.580 [1,043,016]	$46,243	$45,101
Income group 4	0.935*** (0.239) [1,090,286]	$39,175	$38,788	0.366 [1,038,100]	$53,330	$52,622
Income group 5	0.837** (0.380) [1,018,329]	$43,993	$43,149	0.520 [1,040,192]	$60,748	$60,217
Income group 6	0.886*** (0.256) [1,055,909]	$49,230	$49,944	0.335 [1,040,649]	$68,886	$67,770
Income group 7	0.540 (0.568) [1,058,485]	$55,321	$57,139	0.276 [1,040,475]	$77,689	$76,507
Income group 8	−0.348 (0.543) [1,054,957]	$62,491	$59,225	0.184 [1,040,587]	$88,098	$86,244
Income group 9	−2.109 (1.779) [1,055,930]	$73,036	$71,529	0.185 [1,047,361]	$103,865	$101,755
Income group 10	N/A [1,056,316]	$96,706	N/A	0.256 [1,033,599]	$153,357	$125,257

Notes: This table shows the postneonatal disadvantage by income group. Income data is defined for the households based on their location and demographic data. US income data comes from the IPUMS. Finnish income data comes from their Household Budget Survey. For the cross-country comparison, income is after tax for both countries; for the comparison within the United States, it is before tax. Income deciles are defined based on the entire sample. All figures are in units of 1,000 deaths: a coefficient of 1 indicates an increase of 1 death in 1,000 births. Robust standard errors are in parentheses. Number of observations on which the estimates are based are in square brackets. Data for all countries cover 2000–2005; as described in the text, the sample is limited to singleton births at $\geq$ 22 weeks of gestation and $\geq$ 500 grams with no missing covariates.

***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

Comfortingly, the estimates from our within-US analysis, shown in the right panel of Table 8, confirm the broad conclusions from our cross-country analysis. Even within fairly narrow income bins, there is large variation across census divisions. In the poorest income decile, the average difference across division-pairs is 1 death per 1,000. Among the higher income groups there is less variation, consistent with the overall more limited variation in higher socioeconomic status groups demonstrated in Table 7.

We can summarize the importance of income in two ways. First, we estimate our basic regressions (i.e., column 5 of Table 5) but include detailed controls for income (we use $1,000 income bins); only 20 percent of the average division-pair gap is closed by the addition of these controls. Second, we ask what reduction in postneonatal mortality would be achieved if all census divisions were endowed with the income distribution of the richest census region (the Northeast); we estimate that this would close 30 percent of the postneonatal mortality gap. Overall, this discussion suggests variation in postneonatal mortality rates across areas does not appear to be due to differences in income per se; notably, this is largely consistent with an existing literature that finds that increasing resources per se does not have detectable effects on infant mortality in the United States (Baker 2008; Almond, Hoynes, and Schanzenbach 2011; Currie and Cole 1993; Hoynes, Miller, and Simon 2012).

V. Discussion and Conclusion

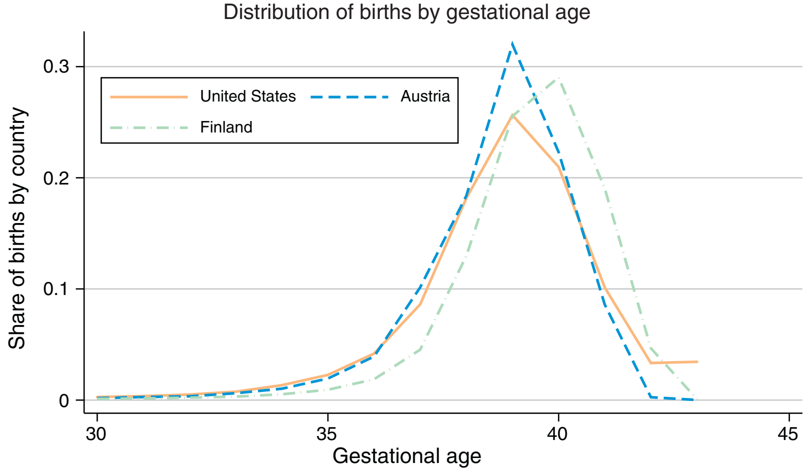
Our ultimate goal in understanding the US infant mortality disadvantage relative to Europe is to better understand what policy levers might be effective in reducing infant mortality in the United States. Our results on neonatal mortality strongly suggest that differential access to technology-intensive medical care provided shortly after birth is unlikely to explain the US IMR disadvantage. This conclusion is, perhaps, surprising in light of evidence that much of the decline in infant mortality in the 1950 to 1990 period was due to improvement in neonatal intensive care unit (NICU) technology (Cutler and Meara 2000). However, a variety of evidence suggests that access to technology-intensive post-birth medical care should affect mortality risks during the neonatal period, rather than during the postneonatal period: median time spent in the NICU is 13 days (March of Dimes 2011), and this care is thought to primarily affect neonatal mortality (see, for example, Rudolph and Borker 1987, Budetti et al. 1981, and Shaffer 2001). Consistent with this assertion, Almond et al. (2010) analyze the mortality consequences of incremental increases in medical expenditures for at-risk infants (including NICU admission as well as other expenditures), and find that the mortality benefits of additional medical care are concentrated in the first 28 days of life. Our results suggest that if anything the United States has a mortality *advantage* during the neonatal period.

Instead, the facts documented here suggest that, in general, policy attention should focus on either preventing preterm births or on reducing postneonatal mortality. Although the former has received a tremendous amount of policy focus (MacDorman and Mathews 2009, Wilcox et al. 1995), the latter has to the best of our knowledge received very little attention. Our estimates suggest that decreasing postneonatal mortality in the United States to the level in Austria would lower US death rates by around 1 death per 1,000. Applying a standard value of a statistical life of US$7 million, this suggests it would be worth spending up to $7,000 per infant to achieve this gain. If policies were able to focus on individuals of lower socioeconomic status—given our estimates that advantaged groups do as well in the United States as elsewhere—even higher levels of spending per mother targeted would be justified.

Identifying particular policies that could be effective in achieving these gains is beyond the scope of this paper and is an area that deserves more research attention. That said, one policy worth mentioning is home nurse visits. Both Finland and Austria, along with much of the rest of Europe, have policies that bring nurses or other health professionals to visit parents and infants at home. These visits combine well-baby checkups with caregiver advice and support. Notably, in light of our income results, these policies do not focus on alleviating resource constraints per se but rather on providing information and support targeted to mothers and infants. While such small scale programs exist in the United States, they are far from universal, although provisions of the Affordable Care Act have expanded them to some extent. Randomized evaluations of such programs in the United States have shown evidence of mortality reductions, notably from causes of death we identify as important such as SIDS and accidents (Olds et al. 2007). To the extent that programs of this type are among the few available policy levers that focus on providing support to mothers and infants in the period after they are out of the hospital system, our evidence suggests they may be a clear place for future research.

Appendix: Additional Tables and Figures

Panel A. Gestational age



Panel B. Birth weight

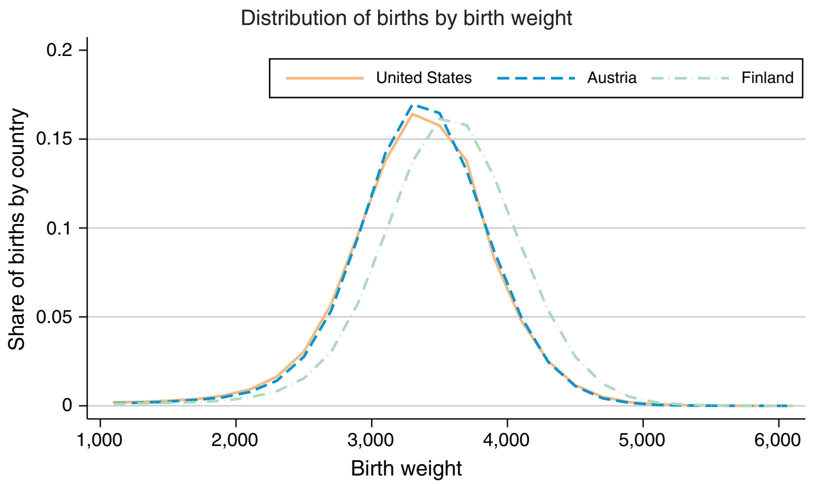


Figure A1. Distribution of Births by Gestational Age and Birth Weight, by Country

Notes: This figure shows the distribution of gestational age and birth weight for each country. For ease of presentation, panel A is limited to births > 30 weeks and panel B is limited to birth weights between 1,000 and 6,000 grams. Data for all countries covers 2000–2005; as described in the text, the sample is limited to singleton births at ≥ 22 weeks of gestation and ≥ 500 grams with both birth weight and gestational age observed.

Table A1—Cross-Country Differences in Mortality: Robustness

Sample restriction	< 1 week (1)	1 week to 1 month (2)	1 to 12 months (3)
Panel A. United States versus Finland			
Baseline	−0.276***	0.164***	0.647***
	(0.063)	(0.033)	(0.054)
Exclude births < 1,000gr	−0.269***	0.124***	0.601***
	(0.055)	(0.030)	(0.053)
Demographic controls	−0.320***	0.142***	0.516***
	(0.063)	(0.033)	(0.054)
Exclude Apgar < 9	0.027	0.123***	0.672***
	(0.036)	(0.038)	(0.084)
Exclude US blacks	−0.218***	0.145***	0.496***
	(0.063)	(0.033)	(0.054)
Exclude first births	−0.422***	0.111**	0.676***
	(0.083)	(0.044)	(0.074)
Include multiple births	−0.351***	0.157***	0.697***
	(0.067)	(0.035)	(0.054)
Panel B. United States versus Austria			
Baseline	−0.019	0.068*	1.083***
	(0.056)	(0.036)	(0.043)
Exclude births < 1,000gr	0.034	0.140***	1.050***
	(0.045)	(0.029)	(0.040)
Demographic controls	−0.067	0.059	1.026***
	(0.056)	(0.037)	(0.044)
Exclude Apgar < 9	−0.103***	0.082***	0.964***
	(0.027)	(0.025)	(0.038)
Exclude US blacks	0.078	0.049	0.904***
	(0.056)	(0.036)	(0.043)
Exclude first births	−0.053	0.061	1.127***
	(0.074)	(0.048)	(0.062)
Include multiple births	−0.029	0.035	1.113***
	(0.060)	(0.039)	(0.044)

Notes: This table shows differences across countries in mortality, using either Finland (panel A) or Austria (panel B) as the omitted country, as in Table 3. Each cell shows the key estimate of interest from a different regression equation: the baseline as in Table 3 (row 1 in each panel); excluding births less than 1,000 grams (row 2 in each panel); including demographic controls (a quadratic in mother's age in years; an indicator variable for whether the mother is currently married; an indicator variable for whether the child is male; and an indicator variable for high education/occupation as defined in the text; row 3 in each panel); excluding infants with Apgar scores less than 9 (row 4 in each panel); excluding US blacks (row 5 in each panel); excluding first births (row 6 in each panel); and including multiple births (row 7 in each panel). The regressions adjust for 500 gram birth weight category cells. The regression results are conditional on reaching the minimum age: deaths up to one week; deaths from one week to one month, conditional on surviving to one week, etc. Coefficients are in units of 1,000 deaths: a coefficient of 1 indicates an increase of 1 death in 1,000 births. Robust standard errors are in parentheses. Data for all countries covers 2000–2005; as described in the text, the sample is limited to singleton births at $\geq$ 22 weeks of gestation and $\geq$ 500 grams with birth weight and gestational age observed in all rows, and no missing covariates in rows 3 through 7 of each panel.

***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

Table A2—Cross-Country Differences in Mortality, by Group (*education only*)

	United States versus Austria (1)	United States versus Finland (2)
United States	1.383***	0.924***
	(0.047)	(0.062)
High SES	−0.119	−0.272**
	(0.114)	(0.120)
United States × high SES	−1.108***	−0.952***
	(0.115)	(0.121)
Observations	23,505,784	23,382,000
High SES, United States versus Europe	0.009	0.782

Notes: This table shows differences across countries in mortality by advantaged versus disadvantaged group, as in Table 6, except that "advantaged" here is defined only as high education/occupation. The regressions adjust for 500 gram birth weight category cells. The regression results are conditional on surviving to one month of age. Coefficients are in units of 1,000 deaths: a coefficient of 1 indicates an increase of 1 death in 1,000 births. Robust standard errors are in parentheses. Data for all countries covers 2000–2005; as described in the text, the sample is limited to singleton births at ≥ 22 weeks of gestation and ≥ 500 grams with no missing covariates. The last row in each panel reports the *p*-value from a test for equality between the advantaged group in the United States relative to the advantaged group in the comparison country.

*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

Table A3—Cross-Country Differences in Mortality, by Group (*education + married only*)

	United States versus Austria (1)	United States versus Finland (2)
United States	1.375***	0.915***
	(0.046)	(0.061)
High SES and married	−0.064	−0.320**
	(0.132)	(0.127)
United States × (high SES and married)	−1.180***	−0.922***
	(0.133)	(0.128)
Observations	23,505,784	23,382,000
High SES and married, United States versus Europe	0.119	0.947

Notes: This table shows differences across countries in mortality by advantaged versus disadvantaged group, as in Table 6, except that "advantaged" here is defined only as high education/occupation and married. The regressions adjust for 500-gram birth weight category cells. The regression results are conditional on surviving to one month of age. Coefficients are in units of 1,000 deaths: a coefficient of 1 indicates an increase of 1 death in 1,000 births. Robust standard errors are in parentheses. Data for all countries covers 2000-2005; as described in the text, the sample is limited to singleton births at ≥ 22 weeks of gestation and ≥ 500 grams with no missing covariates. The last row in each panel reports the *p*-value from a test for equality between the advantaged group in the US relative to the advantaged group in the comparison country.

*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

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