Caught in Transit: Identifying Stalls, Upswings and Reversals in Fertility Transitions using a Probabilistic Approach

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Abstract

Possible stalls in fertility transitions, especially in sub-Saharan Africa, have been discussed frequently in the demography literature. However, the various methods used to identify stalls were limited by a reliance on irregular inter-survey intervals, inconsistent definitions, and a failure to account for measurement uncertainty. We propose a new, probabilistic approach for identifying fertility transition stalls based on the results from the 2024 revision of World Population Prospects (United Nations, 2024a) and apply it to all countries for the periods when total fertility is above 2.1 live births per woman. Our method is not restricted to inter-survey intervals, uses all available data from all available data sources, incorporates biases and measurement errors, and provides probabilistic estimates of fertility stalls. We compare our findings for sub-Saharan Africa to those in the literature and find that the probability of many previously identified stalls is probably quite low based on the data available. We also identify several stalls (or reversals) in fertility decline across all regions since 1950 and discuss some of the potential reasons causing these changes in fertility trends.

Introduction

Demographic transition theory has traditionally portrayed fertility decline as a predictable, continuing progression from high to low fertility regimes. Once countries embark on the path of fertility transition, fertility declines unabated until it reaches near- or below-replacement levels. Yet, numerous empirical evidence reveals a far more intricate reality characterized by temporary rapid decelerations, stalls, upswings, and/or reversals, that interrupt the fertility decline patterns. Fertility transitions are not inevitable unidirectional processes but rather complex demographic phenomena that can be disrupted, stalled or temporarily reversed by changing economic conditions, population composition shifts, crises, policy interventions, or cultural and social transformations.

The assumption of linear fertility transitions has profound implications for population projections and our understanding of demographic development. When fertility patterns deviate from expected trajectories, they challenge fundamental assumptions about demographic inevitability and highlight the contingent nature of reproductive change.

Current approaches to identifying deviations from expected patterns of fertility trends face significant methodological limitations. The extent to which these occur, their impact on fertility trends, and implications for population projections in general, have been a matter of debate because of the almost exclusive reliance on survey data of varying quality at irregular intervals, and variable definitions of what constitutes a stall (Machiyama 2010; Schoumaker 2019; Grimm et al. 2022). However, using a sequence of surveys to identify stalls can be problematic if they are conducted at irregular intervals or are subject to sampling, reporting or other types of biases, impacting the accuracy and reliability of reported information. For instance, Machiyama (2010) showed that differences in the misreporting of ages and dates in surveys can lead to incorrect identification of stalls during some fertility transitions in sub-Saharan Africa.

This study introduces a novel probabilistic approach for identifying stalls, upswings, and reversals in fertility transitions—referred to as SURFs from now on in this paper—that addresses these methodological shortcomings while expanding analysis to global fertility patterns since 1950.

Background

Programmatic and academic interest in fertility stalls is rooted in Demographic Transition Theory (DTT), which predicts a more or less continuous decline of mortality and then fertility from high levels to low levels (Caldwell 1976, Kirk 1996). Under this model, once fertility decline begins, it should proceed relatively smoothly toward replacement-level fertility, driven by urbanization, education, improved child survival, and changing economic incentives for childbearing. Since the mid-1980s, however, SURFs, variously defined as a drastic deceleration, plateauing or reversal of fertility rates after their initial decline, have garnered increasing interest because they represent deviations from the DTT's predictions. These deviations imply uncertainty for future socioeconomic and demographic development, challenging the deterministic assumptions underlying traditional transition models.

Recognition of deviations from the DTT's predictions as a significant demographic phenomenon began in earnest in 1985, when a World Bank report noted with concern that fertility decline had stalled in several countries, including Costa Rica, South Korea, and Sri Lanka (Gendell 1985). The report emphasized that analyzing fertility stalls could help end the stalls themselves while helping other countries prevent them. Thereafter, concerns about stalling fertility transitions spread, becoming a growing area of research among academics and policymakers.

Initially, research into fertility stalls focused on countries in Asia, Northern Africa, and Latin America, where fertility transitions were well underway by the 1980s and 1990s. A growing number of case studies identified fertility stalls across various contexts: Argentina (1940s-1960s) (Pantelides 2002), Bangladesh (1996-2000) (Islam, Islam, and Chakroborty 2004), Central Asia (throughout 1980s and after 2000) (Spoorenberg 2015a), China (late 1970s into 1980s) (Feeney et al. 1989), India (1977-1984) (Horiuchi 1992), Iran (1966-86) (Aghajanian 1991), Iraq (2003-2011) (Cetorelli, 2014), Jordan (1998-2009) (Cetorelli and Leone 2012; Krafft, Kula, and Sieverding 2021), Kenya (1998-2003) and Tanzania (1999-2004) (Ezeh, Mberu, and Emina 2009), and Sri Lanka (1974-1982) (Alam and Leete 1993). These case studies revealed that fertility stalls could occur across vastly different cultural, economic, and political contexts, suggesting the phenomenon was not limited to specific regions or development patterns. Stalls were identified loosely based on the various levels of rate of change in fertility indicators (e.g. crude birth rate or TFR) analyzing a sequence of surveys, highlighting the need for more systematic and generalized approaches.

More recent research has largely shifted focus to sub-Saharan Africa, where fertility transitions began later but have exhibited particularly complex patterns of SURFs and regional variations that has led to much debate regarding their causes (Bongaarts and Casterline 2013, Dasgupta et al. 2022). The relatively slow pace of decline in the region has, in part, been related to stalls or slowdowns in some countries' respective fertility declines, that is temporary rapid decelerations in the rate of decline after the onset of the fertility transition and before reaching near-replacement-level fertility.

At the same time, researchers made efforts to systematize the definition of a fertility stall for the sake of conducting comparative analyses and having objective criteria for identification. In his comparative analysis of 38 countries using World Fertility Survey and Demographic and Health Survey data, Bongaarts (2006) provided one of the first systematic approaches, operationalizing stalls as occurring if: (1) a country had a TFR between 2.5 and 5 births per woman (i.e., was in the ‘mid-transition’ phase of the decline) and (2) a country’s TFR failed to decline between two subsequent surveys. Using this definition, he identified seven countries which experienced stalls. In a subsequent paper, Bongaarts (2008) adopted a more nuanced approach for incorporating statistical significance. His revised definition identified a stall if: (1) a country had a TFR above 2.1 (i.e. excluding post-transitional populations) or a contraceptive prevalence above 10 percent among married women (i.e. excluding pre-transitional populations) and (2) had no statistically significant decline in TFR across two DHS surveys. This revised method identified fertility stalls in 14 countries (of which 12 were in sub-Saharan Africa). It also identified countries where declines in TFR were observed, but were not statistically significant due to being too small.

These first attempts to systematize the definition of stalls opened the door to disagreements about whether stalls even occurred in specific countries and years, depending on operationalization, however. For instance, Shapiro and Gebreselassie (2009) did not restrict stalls to the ‘mid-transition’ phase, leading to the identification of additional sub-Saharan African countries where stalls occurred during the ‘early-transition’ phase. This highlighted how different definitional approaches could lead to substantially different conclusions about stalls’ prevalence and timing.

The proliferation of different definitions created additional complexity. Stalls have been variously defined as: 1) no change in TFR over two surveys (Bongaarts 2006) or change in decline rate between periods (Moultrie et al. 2008; Machiyama 2010); 2) less than 2% change in TFR over ten years (Goujon, Lutz, and KC 2015); 3) current TFR same/higher than previous survey or lower but not statistically significant (Schoumaker 2019). Many definitions relied on arbitrary absolute cutoffs that poorly accounted for unique historical trajectories providing necessary context for identifying anomalous fertility behaviors.

Recent studies attempted to address these shortcomings by adopting definitions relative to country-specific levels and trends. Machiyama (2010) developed two criteria: (1) TFR dropped more than 20% from highest observed TFR and (2) average annual pace of TFR decline was less than half the previous inter-survey period. Goujon, Lutz and KC (2015) identified stalls if TFR was 98% of ten-year-earlier levels over a decade. These definitions proved beneficial by allowing country-specific flexibility while maintaining standardized criteria. However, they remained limited by dependence on multiple estimates from surveys at regular, sufficiently short intervals—that proved problematic for many developing countries with irregular data collection.

Schoumaker (2019) proposed a significant methodological advance by combining elements from previous studies into a more flexible definition of stall requiring: (1) TFR is 10% lower than maximum number of children ever born in a previous DHS and (2) current TFR is equal or greater than previous survey or lower but not statistically significant. The key innovation in that study was reconstructing fertility rates through regression smoothing and indirect estimation techniques, providing annual TFR estimates. This advance effectively addressed many shortcomings of previous work, which were more reliant on the frequency of direct estimates from surveys or administrative sources. This study also adopted a more agnostic approach for classifying stalls than previous work, identifying potential stall periods categorically as unambiguous, strongly supported by evidence, or moderately supported by evidence, rather than relying on strictly binary classifications. This probabilistic thinking represented an important step toward acknowledging inherent uncertainty in demographic data and fertility transition complexity.

Despite these advances, significant methodological challenges remain. Definitional differences have resulted in substantial disagreements about where stalls are identified, with Schoumaker (2019) identifying only seven periods in which there is strong to unambiguous evidence of stalls in sub-Saharan Africa, while many more have been claimed in earlier work (Bongaarts 2008; Shapiro and Gebreselassie 2009; Garenne 2008; Ezeh, Mberu, and Emina 2009; Machiyama 2010).

Our study builds on the advances made in this field by first adopting some of the established practices of previous work, like focusing on countries in mid-transition (i.e. imposing a level condition) and classifying based on the rate of change (i.e. imposing a rate condition), and then adopting additional criteria, which incorporates uncertainty in estimates of TFR into the classification algorithm (i.e. imposing a probability condition). This addresses the fundamental challenge plaguing research on SURFs: Systematically identifying demographic disruptions while accounting for data limitations, measurement uncertainties, and the inherently complex, non-linear nature of fertility transitions. Additionally, compared to previous studies, we expand the notion of what constitutes a deviation from expected trends, and use the term Stalls, Upswings and Reversals in Fertility Transitions (SURFs) and employ the same approach to all countries of the world since 1950 to identify the occurrence of SURFs.

Data

The data on TFR used in this study come from the 2024 revision of *the World Population Prospects* (WPP) (United Nations), which produces estimates of all demographic processes by calendar year. Fertility estimates in the WPP are based on a variety of data sources, including vital statistics, population registers, and direct and indirect estimates from surveys and census data.[1] Countries without complete birth statistics from civil registration systems, rely on surveys, censuses and/or sample registration systems to estimate period total fertility rates (TFRs) (United Nations, 2024a). For the 2024 Revision, an annual time series of total fertility from 1950 to 2023 was estimated for each country using a Bayesian hierarchical model built on the theoretical model used by the United Nations to model fertility change. The model considers the biases and uncertainty associated with empirical estimates from different types of data sources, direct and indirect estimation methods, and other factors that contribute to systematic biases and non-sampling errors (Liu and Raftery 2020). For each country, the model produces a Markov chain Monte Carlo (MCMC) sample of trajectories from the Bayesian posterior distribution of annual TFRs. Model parameters were estimated using 10 MCMC chains with 25,000 iterations each, saving every 50th iteration. This yielded a final MCMC sample size of 5,000. The model is implemented in the *bayesTFR* package in R (Ševčíková, Alkema, and Raftery 2011; Liu, Ševčíková, and Raftery 2023).

The availability of underlying data varies substantially by country, ranging from primarily surveys and censuses to complete vital registration. Kenya is an example of the former while the Czech Republic is an example of the latter (see Figure 1 and Figure 2). The estimates and underlying empirical data for all countries and areas are available on the United Nations Population Division data portal at: https://population.un.org/dataportal/home.

[1] For the list of data sources for each country and area, see: https://population.un.org/wpp/DataSources/4

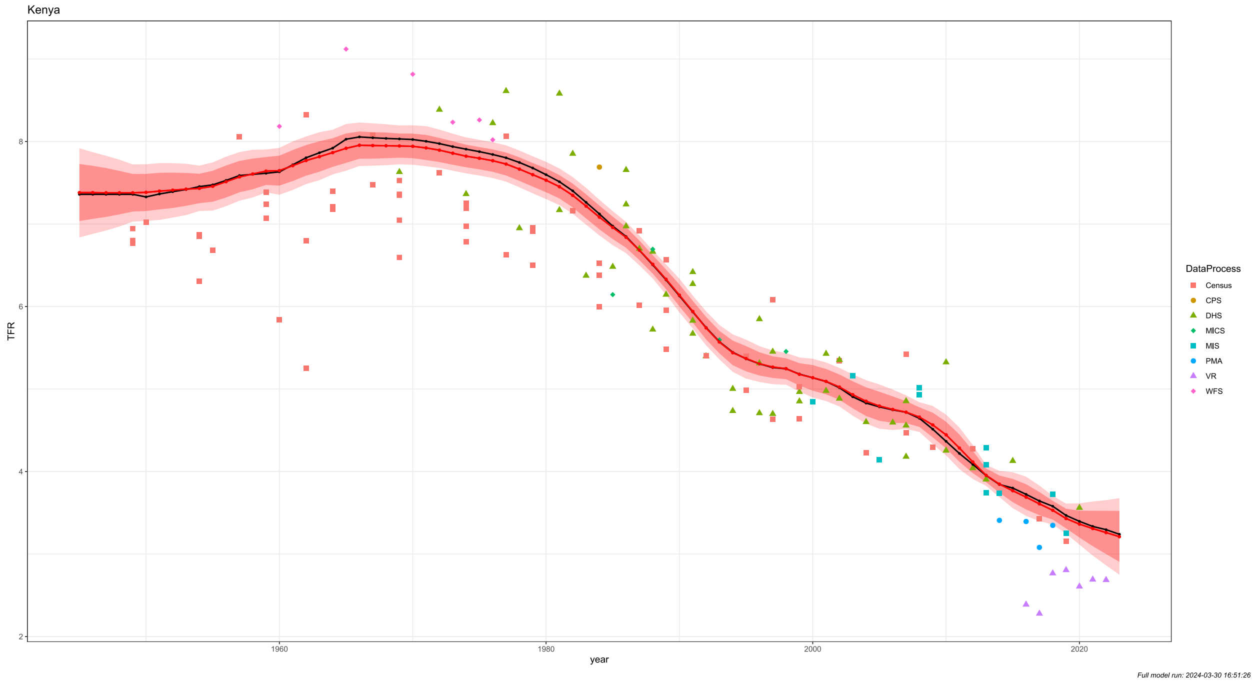


Figure 1. Total fertility rate estimates for Kenya with underlying data. The solid line indicates the final estimate. The solid red line indicates the final estimate for WPP2024 with 80th and 95th uncertainty ranges in lighter red, black line is estimate from WPP2022.

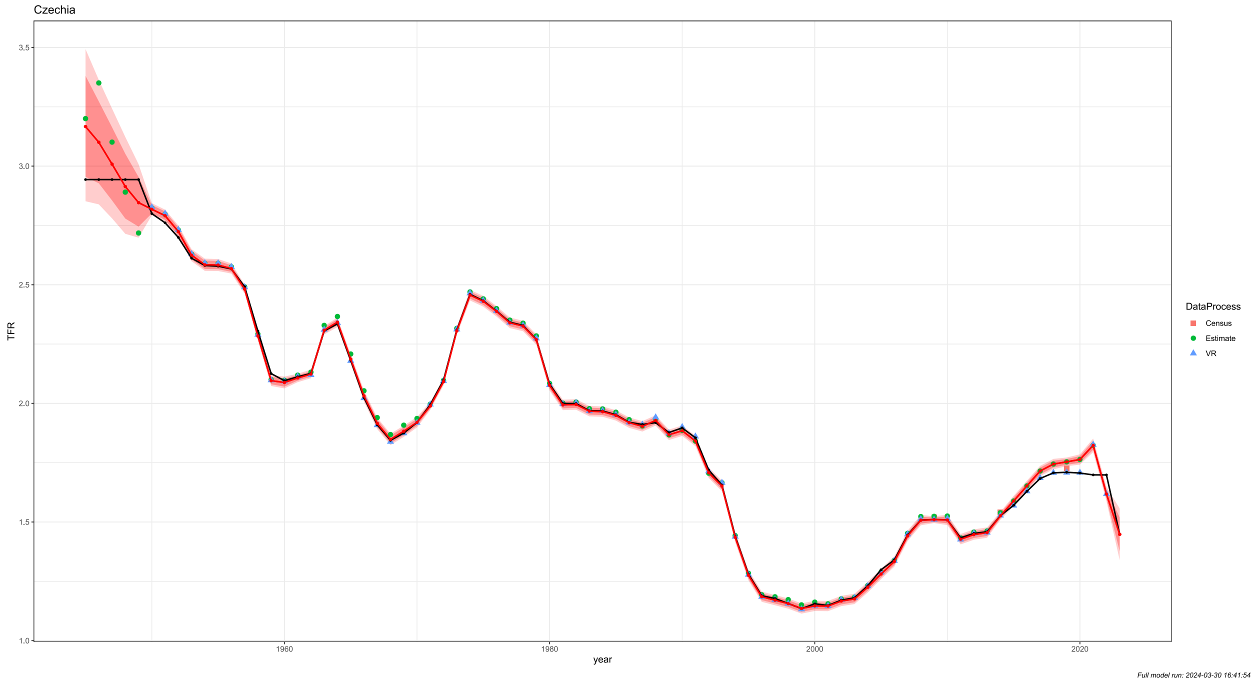


Figure 2. Total fertility rate estimates for Czech Republic with underlying data. The solid red line indicates the final estimate for WPP2024 with 80th and 95th uncertainty ranges in lighter red, black line is estimate from WPP2022.

Methods

Our method of identifying SURFs builds on that proposed by Wheldon et al. (2024) for identifying plateaus in contraceptive prevalence. In our analysis, the fertility trend in any country-year was required to satisfy six conditions to be considered a SURF. First, a country's fertility transition must have been underway (*transition condition*). To determine the start of a country's fertility transition, we adopted the definition used by Alkema et al. (2011) and United Nations (2024b). Countries with a maximum observed TFR below 5.5 over the period 1950 to 2023 were assumed to have entered their fertility transitions before 1950. In all other cases, for the period 1950 to 2023, the fertility transition was assumed to have begun in the year the maximum TFR was observed. The end of the transition phase was defined to be the midpoint of the first five-year period TFR increased for two successive five-periods, after having dropped below 2 births per woman (see United Nations 2024b, p. 28). Both of these thresholds were identified deterministically using the median TFR.

Second, the estimated annual linear rate of change in TFR (defined later) must have been greater than -0.1 children per woman per year (*rate condition*). In other words, if the TFR increased, remained constant, or only decreased very slowly, it would have been identified as a SURF. We adopted this somewhat broader definition due to the fact that, from a policy perspective, very slow fertility decline has similar implications as an outright plateauing of the TFR (Howse 2015).

Third, after accounting for estimation uncertainty, the posterior probability that the rate condition held had to be at least 80 percent (*probability condition*). That is, for any given year to be identified as a SURF, at least 80 percent of the MCMC trajectories had to satisfy the transition, rate and transition conditions.

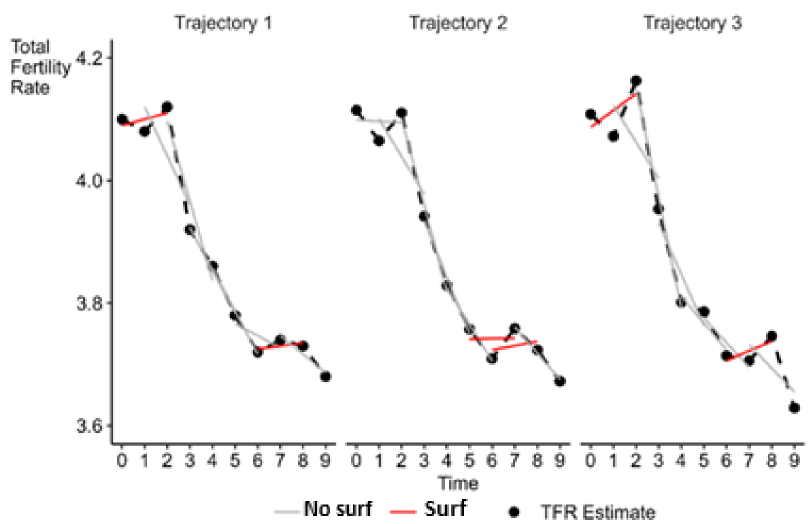
The fourth and fifth conditions concerned how a SURF ends. The fourth condition (*perpetuation condition*) ensured that, once a SURF had started, it persisted so long as the TFR remained above the level seen in the first year of the SURF. This was implemented probabilistically as follows. In each year following the first year of a SURF, if the probability that the TFR was above the start-year TFR exceeded 80 percent, and the transition condition held, the SURF was perpetuated. The rate and probability conditions were not required. To temper the effects of this condition at low levels of fertility, the fifth condition (*excedence condition*) required that, for any period to be a SURF, the maximum TFR during the SURF had to be at least 2.1 children per woman. Any SURFs identified thus far that failed to satisfy this condition were dropped.

Finally, the sixth condition (*length condition*) concerned the lengths of SURFs and inter-SURF periods. A two-stage sequential condition, it required, first, that any one-year break between SURFs according to conditions 1–5 be classified as a SURF year and, second, SURFs had to last a minimum of two years. Thus, any SURF that was still only one year long after applying conditions 1–5 plus the inter-SURF length condition was dropped. The length conditions were designed to ensure that transient fluctuations and random "noise" were not erroneously identified as non-SURFs or SURFs. Furthermore, it is not evident that a single-year SURF is substantively meaningful from an interpretation perspective.

To implement conditions 1–6, we used the following procedure. For each country, the transition condition was applied to median TFR estimates and projections. The ranges within which years were SURF-eligible were thus obtained. Then, for each MCMC trajectory, annual linear rates of change were estimated by fitting local linear regressions in a sequence of three-year moving windows centered at each year. Within each window, the regression slope coefficient was taken as the estimate of the local linear rate of change for the central year. A trajectory-level SURF was indicated when the slope coefficient exceeded -0.1 children per woman per year. Using a three-year piecewise regression, in conjunction with the length condition and probability condition, helped to avoid identifying stochastic annual fluctuations as SURFs. For each year, the probability was calculated as the number of trajectories with SURFs divided by the total number of trajectories.

Figure 3 shows a simulated example of this procedure, using only three trajectories. In this example, local linear regression identifies a SURF in period 7 for all three trajectories. In Trajectories 1 and 3 (but not in trajectory 2), the procedure identifies a SURF in period 1. In Trajectory 2, an additional SURF was identified for Period 6. The results of the procedure indicate that there is likely to be a very high probability of a SURF in period 7. The probability of a SURF in period 1 is relatively high but less certain, and the probability of a SURF in period 6 is still lower. In all other periods, there was no indication of a SURF. In our analysis, we apply this procedure to all TFR trajectories to obtain a time series of SURF probabilities for each country.

Figure 3. Example of procedure for identifying SURFs using piecewise linear regression across trajectories.



To investigate the impact of uncertainty on our results, we repeated the procedure above using only the median estimates and projections of TFR. In this case, if the rate condition held, the probability of a SURF was set to 1 and zero otherwise. We plotted these results alongside the probabilistic SURFs for comparison.

Results

Across all countries, we found a total of 146 SURFs between 1950 and 2050 (Table 1). The Western Asia subregion had the greatest number at 22. The Caribbean and three European subregions had between 14 and 17 SURFs. In Northern America, only 2 were found. On average, SURFs lasted 11.1 years, but there was wide variation across subregions. SURFs in Central Asia and Eastern Asia lasted over 17 years, on average, while those in Western and Middle Africa lasted an average of 3 years.

Table 1. SURF count and average length (years) by geographic subregion, 1950–2050. Each SURF is counted once, regardless of its length.

Region	Subregion	No. SURFs	Avg. Length (years)
Africa	Eastern Africa	11	9.5
	Northern Africa	3	13.7
	Western Africa	2	3.0
	Southern Africa	2	5.0
	Middle Africa	1	3.0
Asia	Western Asia	22	8.2
	Central Asia	7	17.4
	Eastern Asia	6	18.0
	South-Eastern Asia	4	8.5
	Southern Asia	3	10.7
Europe	Eastern Europe	15	11.4
	Southern Europe	14	11.9

	Northern Europe	14	14.7
	Western Europe	7	16.1
Latin America and the Caribbean	Caribbean	17	6.6
	South America	6	10.8
Northern America		2	14.5
Oceania	Australia/New Zealand	4	16.8
	Micronesia	3	10.3
	Polynesia	3	4.0

Table 2 presents results for countries in sub-Saharan Africa using our new method (column "SURF") and compares them with stalls identified by Schoumaker (2019). Four of the stalls found by Schoumaker (2019) coincided with SURFs: Zimbabwe (2007–2015, Figure 4), Congo (2008–2010, Figure 5), South Africa (2003–2010, Figure 6), and Senegal (2010–2011, Figure 7). Other country-year combinations defined as "strong evidence" by Schoumaker (2019) had a probability of occurrence of up to 70% (Namibia [Figure 8]), 56% (Cameroon [Figure 9], Zambia, Zimbabwe) and 33% (Kenya). Other countries with "moderate evidence" according to Schoumaker (2019), such as the United Republic of Tanzania, had a probability of occurrence of up to 68% (see Appendix 1 for graphical representations of SURFs for all countries).

Table 2 provides an overview of SURFs occurring outside sub-Saharan Africa, highlighting patterns across countries at various stages of the fertility transition. These SURFs can be broadly categorized into two distinct periods. The first period includes the mid-20th century (mid-1940s to 1960s) in regions such as Northern America, Europe, Australia, and New Zealand, often associated with the post-war baby boom and economic recovery. The second period encompasses the late 20th to early 21st century (late 1970s to mid-2010s), observed in diverse regions including Northern Africa (Algeria [Figure 10], Egypt [Figure 11]) and Western Asia (Armenia, Georgia, Iraq, Israel, Jordan and Lebanon), Central Asia (Kazakhstan, Kyrgyzstan, Turkmenistan and Uzbekistan [Figure 12]), Eastern and South Eastern-Asia (China, Cambodia, Indonesia, Timor-Leste, Iran , Sri Lanka) and Latin America and the Caribbean (Cuba, Dominica, Grenada, Guadeloupe, Argentina, Paraguay, Uruguay, US Virgin Islands, and Puerto Rico).

The operation of the perpetuation, maximum, and length conditions is evident in SURF years that, nevertheless, had probabilities below 80 percent. For example, were it not for the perpetuation condition, the SURF in Zimbabwe (2007–2017) would have ended in 2011, and were it not for the length condition, the SURF in South Africa (2003–2010) would have been broken by a one-year non-SURF period in 2006.

Using only the median TFR estimates resulted in more and longer SURFs relative to using the full probabilistic approach. For example, the median-based SURF in Zimbabwe lasted an extra six years to 2023, and Namibia had a 13-year long SURF (2004-2016) that was not identified at all under the probabilistic approach.

Table 2. SURFs in sub-Saharan Africa and TFR stalls identified by Schoumaker (2019). Column "SURF" identifies periods that are SURFs; column "Schoumaker (2019) Stall" identifies periods that were identified as stalls by Schoumaker (2019) with varying levels of evidence. Note that, where SURFS/stalls overlap but are offset, some contiguous SURFs/stalls may be split across multiple rows (e.g., Zimbabwe, 2006).

Subregion	Country	Period	TFR Range	SURF	Schoumaker (2019) Stall
Eastern Africa	Kenya	1993-1998	5.25-5.57	FALSE	Limited evidence
		1999-2013	3.96-5.17	FALSE	Strong+ evidence
	Madagascar	1993-1997	6.02-6.06	FALSE	Moderate evidence
	Malawi	2000-2004	5.86-6.01	FALSE	Limited evidence
	Mauritius	1973-1976	3.07-3.45	TRUE	
		1987-2000	1.91-2.36	TRUE	
	Mayotte	2013-2026	4.17-4.7	TRUE	
	Mozambique	2007-2011	5.47-5.68	TRUE	
	Reunion	1961-1965	6.06-6.27	TRUE	
		1989-1992	2.4-2.57	TRUE	
		1996-2017	2.19-2.5	TRUE	
		2020-2021	2.15-2.19	TRUE	
	Rwanda	2000-2005	5.5-5.97	FALSE	Limited evidence
	Seychelles	1983-1984	3.22-3.24	TRUE	
		1999-2020	1.98-2.41	TRUE	
	Uganda	2001-2006	6.43-6.76	FALSE	Limited evidence
	U. Rep. of Tanzania	2000-2004	5.57-5.67	FALSE	Moderate evidence
	Zambia	1992-1996	6.18-6.35	FALSE	Limited evidence
		2003-2007	5.61-5.71	FALSE	Strong+ evidence
	Zimbabwe	2006	3.64	FALSE	Strong+ evidence
		2007-2015	3.68-4.13	TRUE	Strong+ evidence
		2016-2017	3.76-3.83	TRUE	
Middle Africa	Cameroon	1999-2004	5.43-5.61	FALSE	Strong+ evidence
		2005-2011	5.06-5.43	FALSE	Limited evidence
	Congo	2011	4.82	FALSE	Strong+ evidence
		2006-2007	4.64-4.65	FALSE	Strong+ evidence
		2008-2010	4.72-4.85	TRUE	Strong+ evidence
	Gabon	2001-2012	4.09-4.42	FALSE	Moderate evidence
Southern Africa	Lesotho	2010-2011	3.25-3.34	TRUE	
	Namibia	2008-2013	3.62-3.67	FALSE	Strong+ evidence
	South Africa	1999-2002	2.32-2.56	FALSE	Moderate evidence
		2003-2010	2.36-2.68	TRUE	Moderate evidence
		2011-2016	2.26-2.44	FALSE	Moderate evidence
Western Africa	Benin	2001-2006	5.67-5.85	FALSE	Limited evidence
	Burkina Faso	1993-1999	6.59-6.89	FALSE	Limited evidence
	Cabo Verde	2009-2011	2.25-2.33	TRUE	
	Cote d'Ivoire	2000-2012	5.18-5.77	FALSE	Moderate evidence
	Ghana	1988-1993	5.42-5.92	FALSE	Limited evidence
		1998-2003	4.59-4.83	FALSE	Limited evidence
	Nigeria	1991-2003	6.07-6.42	FALSE	Moderate evidence
	Senegal	2012	5.13	TRUE	

		1993-1997	5.64-6.05	FALSE	Limited evidence
		2005-2009	5.02-5.13	FALSE	Limited evidence
		2010-2011	5.06-5.1	TRUE	Limited evidence

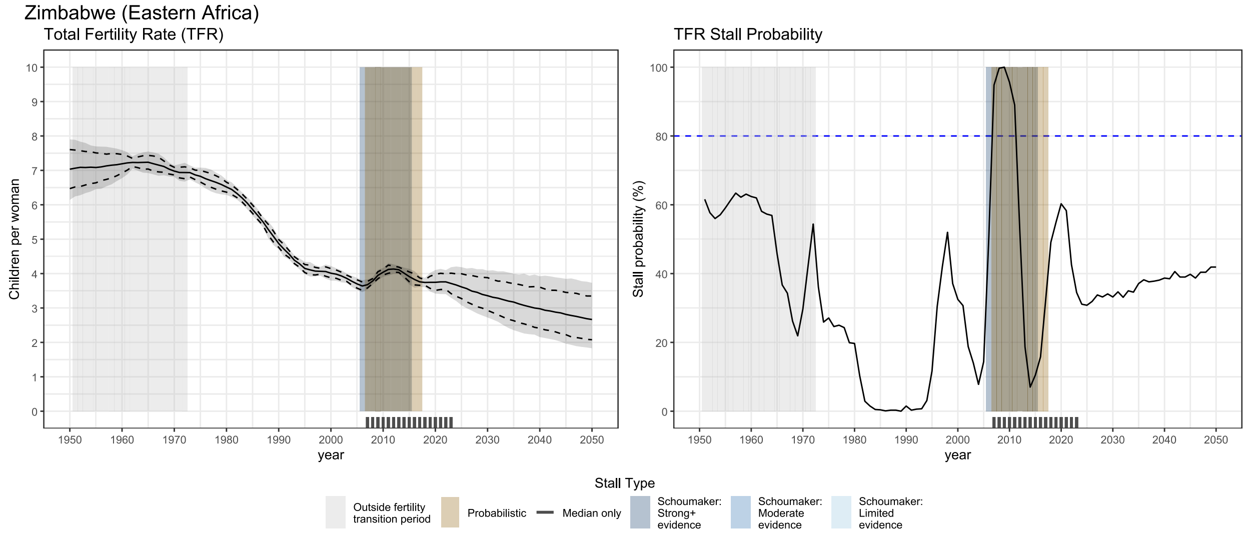


Figure 4. SURFs and TFR stalls in Zimbabwe, 1950–2050. Shaded regions indicate probabilistic SURFs and TFR stalls identified by Schoumaker (2019). The rugs at the bottom of the plot indicate SURFs based only on median TFR.

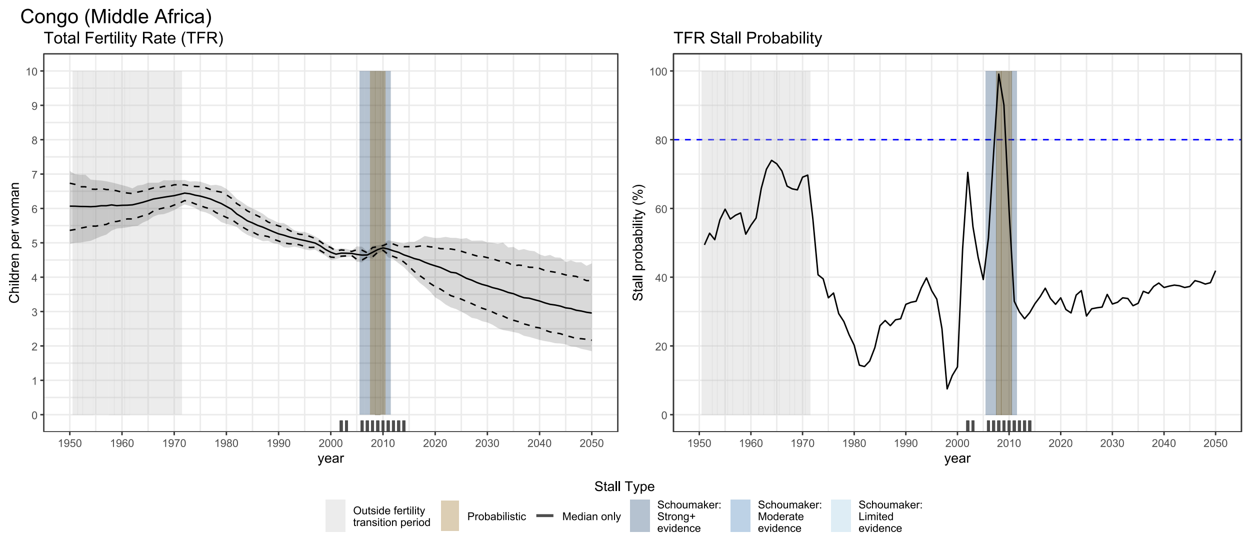


Figure 5. SURFs and TFR stalls in Congo, 1950–2050. Shaded regions indicate probabilistic SURFs and TFR stalls identified by Schoumaker (2019). The rugs at the bottom of the plot indicate SURFs based only on median TFR.

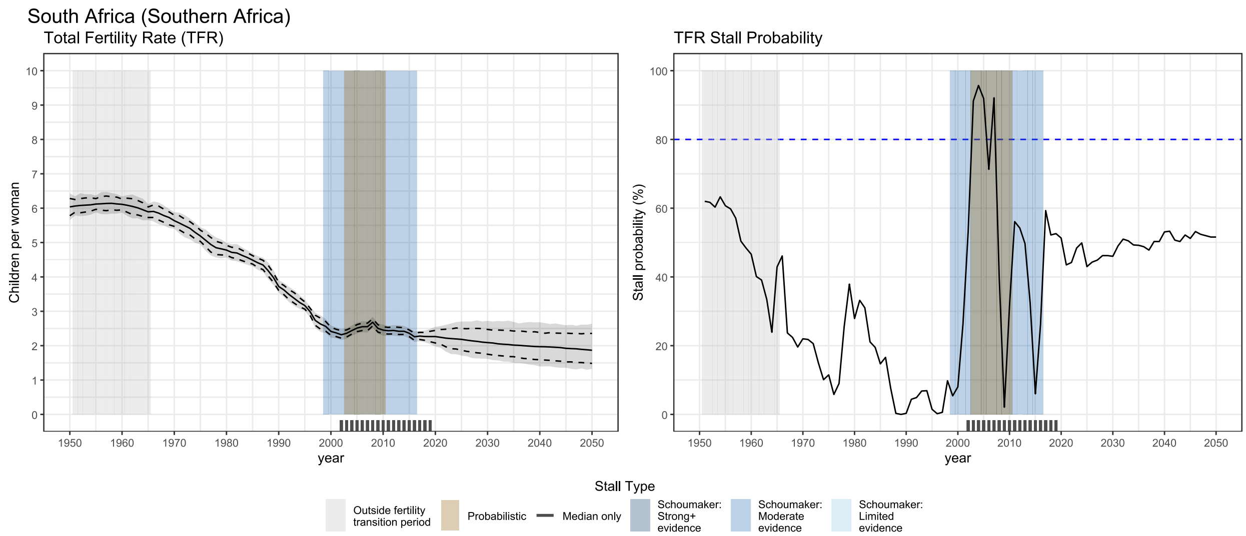


Figure 6. SURFs and TFR stalls in South Africa, 1950–2050. Shaded regions indicate probabilistic SURFs and TFR stalls identified by Schoumaker (2019). The rugs at the bottom of the plot indicate SURFs based only on median TFR.

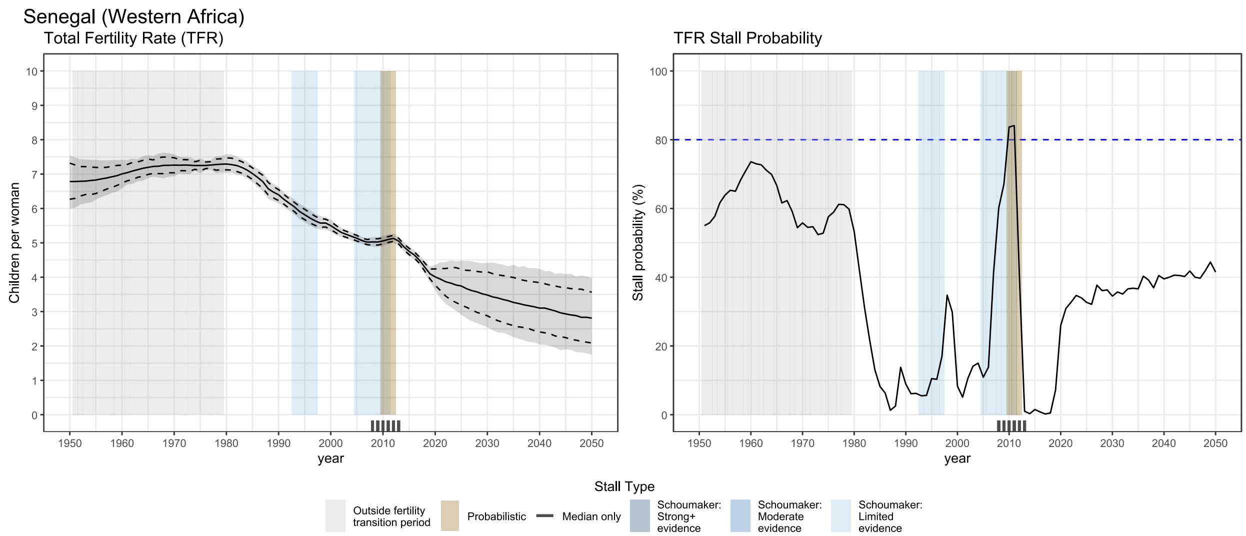


Figure 7. SURFs and TFR stalls in Senegal, 1950–2050. Shaded regions indicate probabilistic SURFs and TFR stalls identified by Schoumaker (2019). The rugs at the bottom of the plot indicate SURFs based only on median TFR.

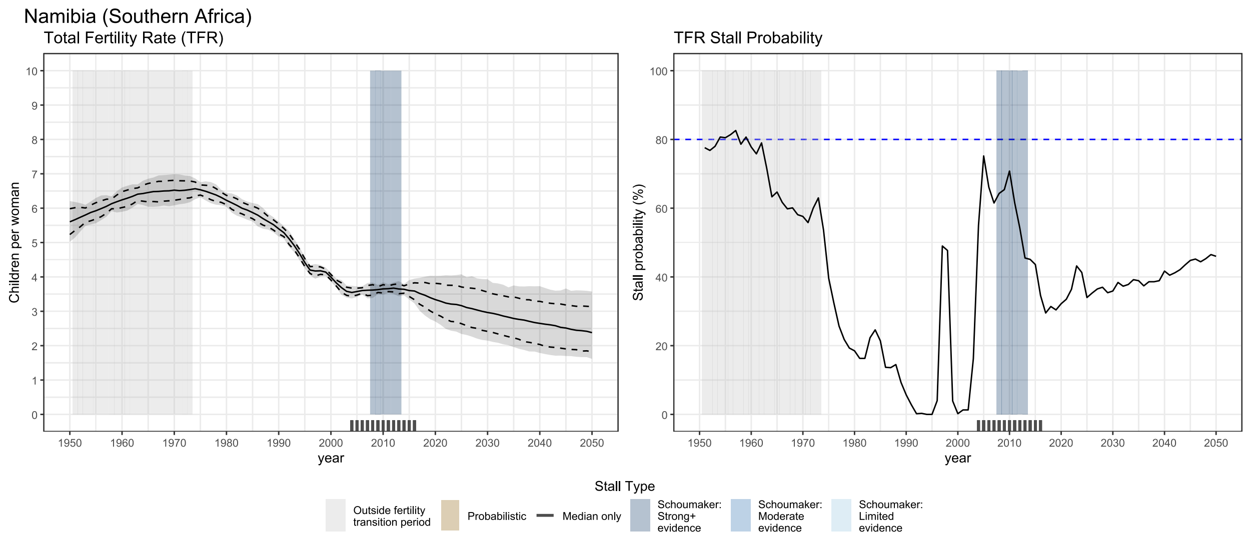


Figure 8.SURFs and TFR stalls in Namibia, 1950–2050. Shaded regions indicate probabilistic SURFs and TFR stalls identified by Schoumaker (2019). The rugs at the bottom of the plot indicate SURFs based only on median TFR.

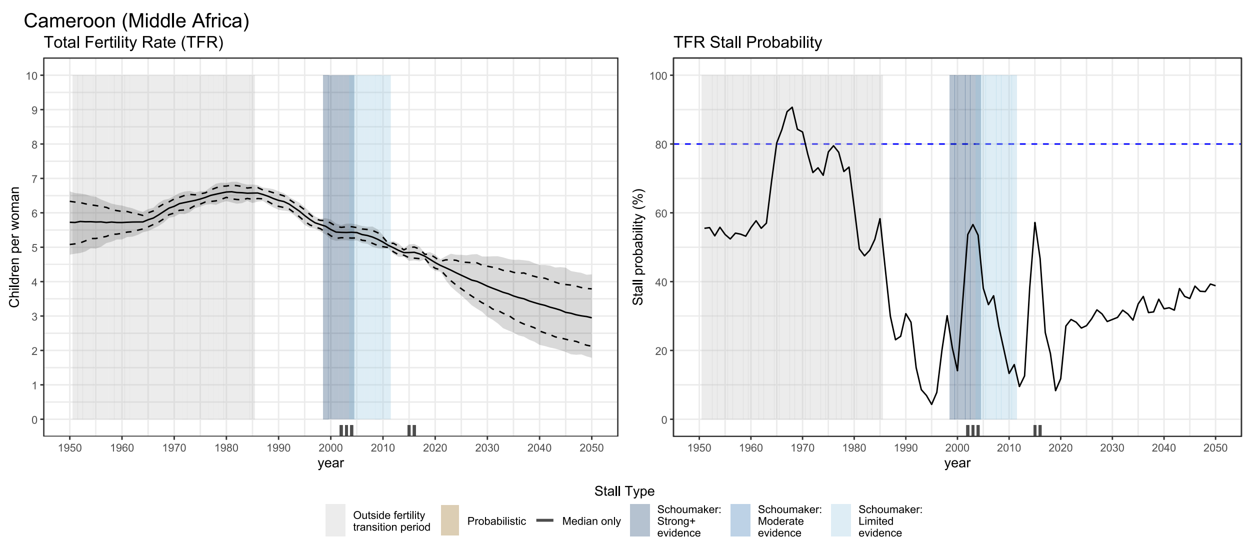


Figure 9. SURFs and TFR stalls in Cameroon, 1950–2050. Shaded regions indicate probabilistic SURFs and TFR stalls identified by Schoumaker (2019). The rugs at the bottom of the plot indicate SURFs based only on median TFR.

Table 3. SURFs in countries not in sub-Saharan Africa.

Region	Subregion	Country	Period	TFR Range
Africa	Northern Africa	Algeria	2003-2023	2.45-3.09
		Egypt	2009-2016	3.26-3.5
		Tunisia	2008-2019	1.98-2.31
Asia	Central Asia	Kazakhstan	1983-1986	3.06-3.21
			2001-2053	1.91-3.32
			2002-2024	2.57-3.33
		Turkmenistan	2009-2012	2.8-2.96
		Uzbekistan	1990-1991	4.12-4.19
			2006-2009	2.46-2.63
			2012-2043	2.34-3.5
	Eastern Asia	China	1967-1970	5.81-6.51
			1980-1987	2.56-2.97
		China, Macao SAR	1978-1993	1.43-2.23
		Dem. People’s Rep. of Korea	1952-1975	2.61-4.29
		Japan	1962-1987	1.63-2.16
		Mongolia	2005-2034	1.99-3.01
	South-Eastern Asia	Indonesia	2004-2005	2.42-2.46
			2010-2012	2.46-2.51
		Malaysia	1990-1992	3.31-3.37
		Timor-Leste	1980-2005	5.22-5.98
	Southern Asia	Iran (Islamic Rep. of)	1975-1985	5.94-6.63
		Maldives	2006-2011	2.2-2.39
		Sri Lanka	1999-2013	2.13-2.31
	Western Asia	Armenia	1982-1991	2.51-2.71
		Azerbaijan	2003-2022	1.59-2.15
		Bahrain	2002-2004	2.7-2.78
			2011-2015	2.02-2.17
		Cyprus	1953-1954	3.47-3.51
			1958-1965	3.38-3.62
			1975-1994	2.08-2.51
		Georgia	1983-1985	2.34-2.4
			2005-2027	1.58-2.23
		Iraq	2010-2011	4.46-4.59
		Israel	1950-1952	4.57-4.74
			1955-1956	4.39-4.44
			1963-1965	4.09-4.16
			1969-1974	3.61-3.85
			1991-2022	2.79-3.12
		Jordan	2006-2009	3.71-3.87
		Kuwait	2013-2020	1.97-2.16
		Lebanon	2009-2012	2.19-2.34
		Oman	2008-2017	2.76-2.97
		Saudi Arabia	2016-2017	2.65-2.67
			2022-2025	2.14-2.31
		Türkiye	2011-2016	2.05-2.19

Europe	Eastern Europe	Belarus	1969-1972	2.23-2.31
			1981-1988	1.99-2.13
		Bulgaria	1959-1962	2.21-2.31
			1967-1982	2.01-2.29
		Czechia	1960-1965	2.09-2.34
			1969-1988	1.88-2.46
		Hungary	1952-1956	2.48-2.96
			1972-1979	1.93-2.36
		Poland	1972-1985	2.23-2.42
		Republic of Moldova	1979-1989	2.38-2.78
		Romania	1966-1989	1.87-3.59
		Russian Federation	1980-1989	1.92-2.25
		Slovakia	1969-1979	2.41-2.61
		Ukraine	1955-1959	2.29-2.31
			1965-1989	1.91-2.13
	Northern Europe	Denmark	1952-1966	2.49-2.65
		Estonia	1958-1990	1.88-2.27
		Iceland	1952-1964	3.79-4.26
			1971-1973	2.92-3.08
			1978-1980	2.35-2.49
			1986-2012	1.93-2.3
		Ireland	1956-1974	3.38-4.08
		Jersey	1956-1969	1.98-2.79
		Lithuania	1956-1958	2.58-2.65
			1966-1972	2.26-2.41
			1981-1991	1.98-2.13
		Norway	1950-1971	2.47-2.96
		Sweden	1952-1967	2.17-2.45
		United Kingdom	1952-1971	2.19-2.93
	Southern Europe	Croatia	1964-1966	2.14-2.23
		Greece	1954-1955	2.4-2.42
			1963-1979	2.24-2.48
		Italy	1953-1973	2.29-2.66
		Kosovo (UNSC res. 1244)	1998-2006	2.36-2.79
		Malta	1959-1960	3.58-3.63
			1970-1998	1.79-2.15
		Montenegro	1950-1951	4.36-4.63
		North Macedonia	1984-1993	2.24-2.32
		Portugal	1950-1971	2.96-3.23
		Portugal	1975-1976	2.75-2.81
		Slovenia	1960-1968	2.19-2.48
			1971-1979	2.12-2.21
		Spain	1950-1978	2.44-3
	Western Europe	Austria	1952-1972	2.07-2.82
		Belgium	1950-1968	2.29-2.7
		France	1954-1963	2.69-2.87
		Germany	1955-1968	2.16-2.52
		Luxembourg	1950-1969	1.96-2.4

		Netherlands	1950-1964	3.03-3.21
		Switzerland	1954-1967	2.29-2.65
Latin America and the Caribbean	Caribbean	Antigua and Barbuda	1984-2001	1.96-2.27
		Aruba	1984-1990	2.17-2.35
		Bahamas	1991-1993	2.51-2.71
		Barbados	1957-1963	4.15-4.71
		Cuba	1959-1969	4-4.56
		Curacao	1990-1996	2.3-2.44
			2000-2001	2.34-2.4
			2009-2014	1.88-2.19
		Grenada	1982-1989	3.15-3.58
		Guadeloupe	1998-2007	2.14-2.3
			2010-2015	2.14-2.21
			2018-2020	2.09-2.16
		Puerto Rico	1954-1956	4.68-4.7
			1976-1977	2.87-2.9
			1985-1993	2.2-2.3
			1996-1997	2.14-2.17
		St. Vincent and the Grenadines	2007-2015	2.06-2.17
	South America	Argentina	1967-1987	2.98-3.37
			2013-2014	2.33-2.38
		French Guiana	1988-2007	3.46-3.96
			2011-2021	3.47-3.88
		Paraguay	1979-1980	5.07-5.1
		Uruguay	1970-1978	2.77-3.02
Northern America		Canada	1950-1963	3.37-3.86
		United States of America	1950-1964	3.09-3.75
Oceania	Australia/New Zealand	Australia	1950-1964	3.06-3.54
			1967-1971	2.85-2.95
		New Zealand	1950-1964	3.55-4.31
			1984-2015	1.89-2.19
	Micronesia	Guam	1982-1990	2.85-3.03
		Guam	2003-2022	2.64-3.17
		Kiribati	2006-2007	3.81-3.86
	Polynesia	French Polynesia	1983-1988	3.62-3.86
			2005-2008	2.12-2.22
		Samoa	2008-2009	4.43-4.49

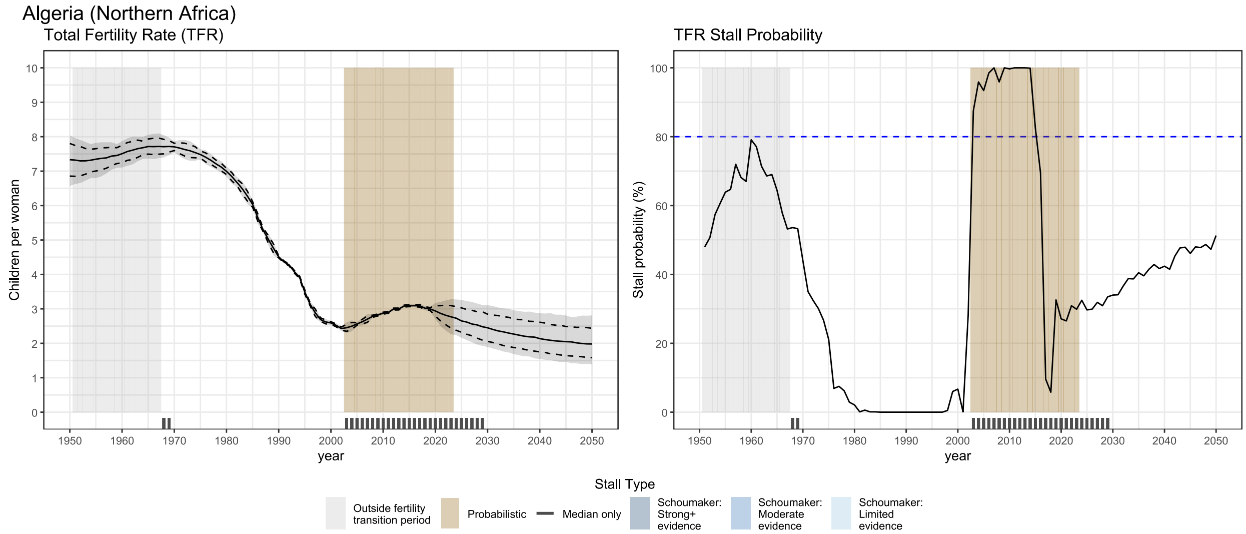


Figure 10. SURFs in Algeria, 1950–2050. Shaded regions indicate probabilistic SURFs and TFR stalls identified by Schoumaker (2019). The rugs at the bottom of the plot indicate SURFs based only on median TFR.

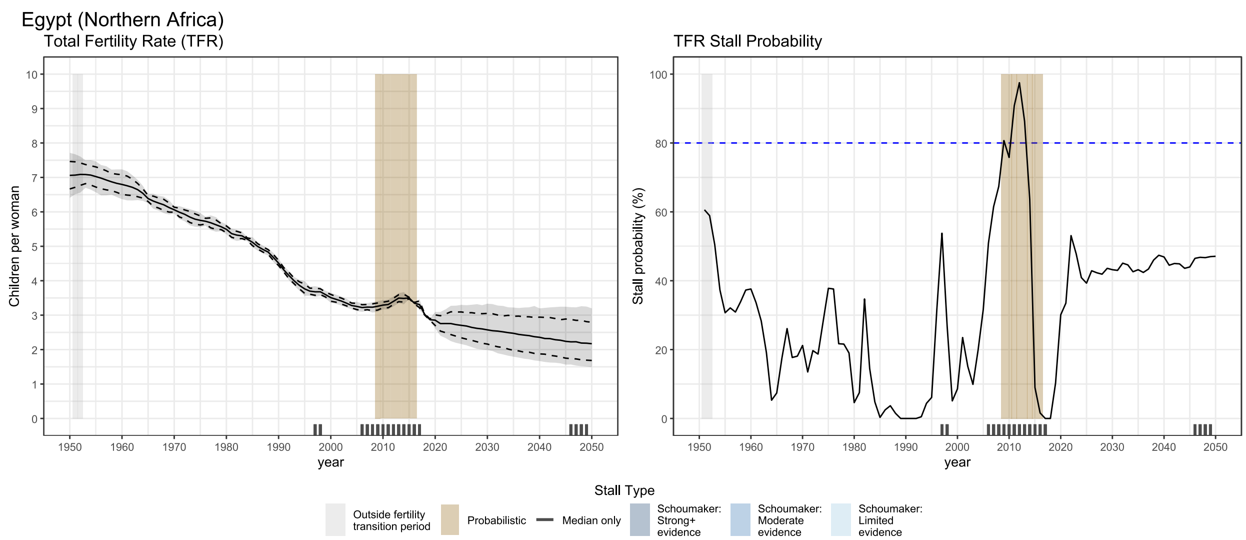


Figure 11. SURFs in Egypt, 1950–2050. Shaded regions indicate probabilistic SURFs and TFR stalls identified by Schoumaker (2019). The rugs at the bottom of the plot indicate SURFs based only on median TFR.

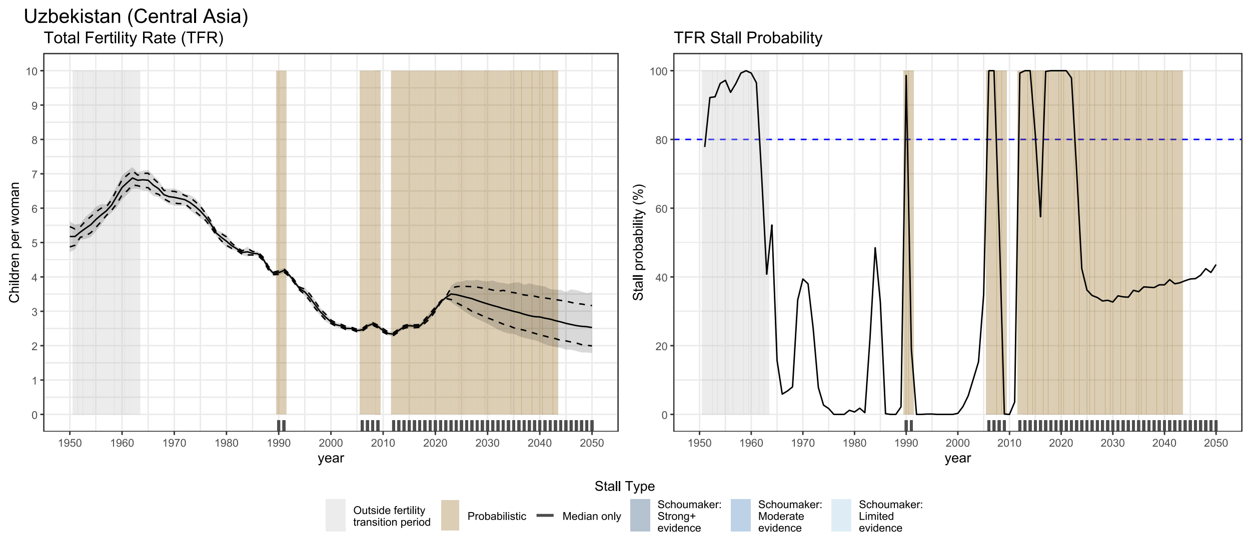


Figure 12. SURFs in Uzbekistan, 1950–2050. Shaded regions indicate probabilistic SURFs and TFR stalls identified by Schoumaker (2019). The rugs at the bottom of the plot indicate SURFs based only on median TFR.

Discussion

We proposed a new probabilistic method for identifying stalls, upswings, and reversals in country-level fertility transitions (which we called SURFs) and applied it to the model-based estimates and projections of TFRs published by the United Nations (2024a). There are several advantages over earlier, similar attempts. Firstly, the model-based estimates are complete annual time series for all countries. Thus, our method is not limited to analyzing change over intervals between surveys, which are often irregular and wide. This improves comparability over time and location, and provides estimates even for countries with limited data.

Further, the model-based estimates of TFR systematically accounted for bias and measurement error in the source data. Our method used the complete posterior distribution from the model, thus was able to propagate the resulting uncertainty through to the detection of SURFs. Specifically, we produced estimates of the probabilities of SURFs in each year. This continuous measure is more informative than the binary classifications of many earlier methods and generalizes and expands the approach of Schoumaker (2019) who classified TFR stalls by strength of supporting evidence. Finally, by using a global set of TFR estimates and designing a completely generalizable approach, we were able to produce estimates for all countries of the world for each year between 1950 and 2050.

Some periods that were previously identified as stalls in the literature were not found to be SURFs according to our method. One such example is the period 1999–2004 in Cameroon which Schoumaker (2019) deemed a stall with strong supporting evidence. Visibly, the TFR in our data set does appear to stagnate over the latter part of this period. However, despite increasing, the probability of a SURF fails to reach the threshold of 80 percent. This is due to the uncertainty in the estimates of TFR which, in turn, is driven by data quality and availability. In contrast, applying our classification scheme to only the posterior median TFR, therefore ignoring uncertainty, does produce a SURF over the period 2002–2004. We emphasize that the full probabilistic analysis is the most appropriate, but the median-only results can be useful in highlighting the role played by low data quality and availability in limiting the ability to detect changes in fertility trends.

Impact on fertility projections

The WPP methodology for projecting country-specific fertility levels is based on the theory of the demographic transition, wherein the distributions of fertility declines are informed by historical trends within the country, as well as the variability in historical fertility trends of all countries that have already experienced a fertility decline. This approach not only takes into account the historical experience of each country (including the uncertainty in past estimates), but also reflects uncertainty about future fertility decline based on the past experience of other countries at similar levels of fertility (United Nations 2024b). SURFs, because of their deviations from expected trends, are difficult to project. For example, in Kazakhstan successive revisions of WPP since 2010 projected a decline in TFR. However, as new data became available, it was evident TFR would continue to increase. In some cases, the upswings and reversals in fertility declines actually observed fell outside uncertainty ranges of earlier projections1.

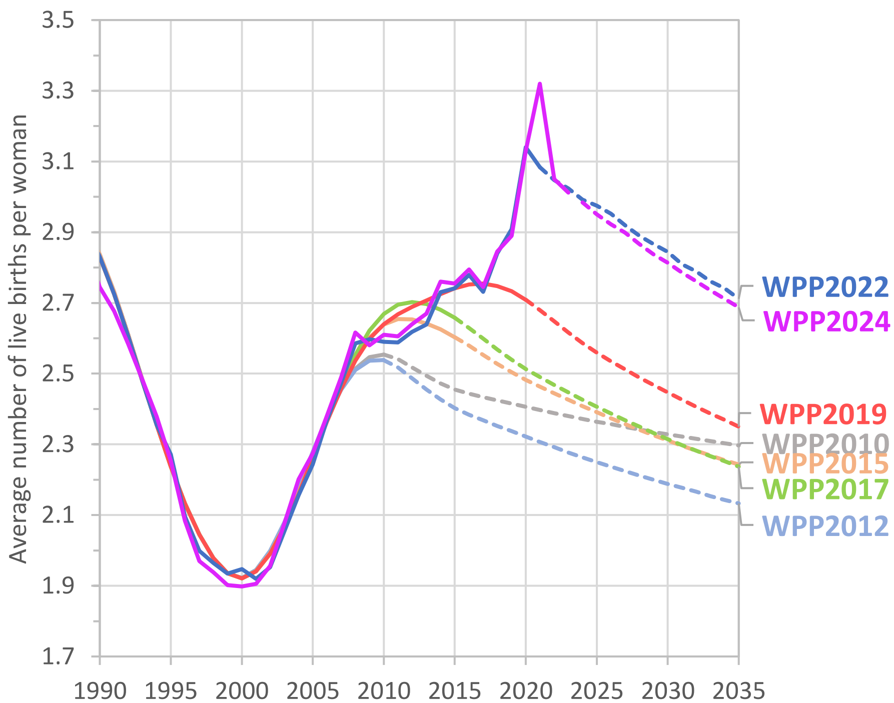


Figure 13: Projections of total fertility for Kazakhstan from World Population Prospects, revisions 2010 to 2024, available at the archive of WPP:
https://population.un.org/wpp/downloads?folder=Archive&group=Standard%20Projections

Impact on the number of births

While the focus and interest of many scholars has focused on TFR, the ultimate, and only, fertility indicator that influences the population growth or decline is the number of births. When a SURF occurs at higher levels of TFR in rapidly growing populations, the SURF increases the rate of population growth and slows the progress of the demographic transition. In contrast, a SURF in TFR may not necessarily lead to increasing number of births when the number of women in reproductive ages in the population is declining, and thus canceling the effect of increase in fertility rates. A common impact at lower levels of fertility is the creation of waves in the cohorts born that impact the age pyramids of populations for decades – see example of Egypt, Algeria, Indonesia, Kazakhstan, Cuba, the Czech Republic, Iran and the United Kingdom (Figure 13).

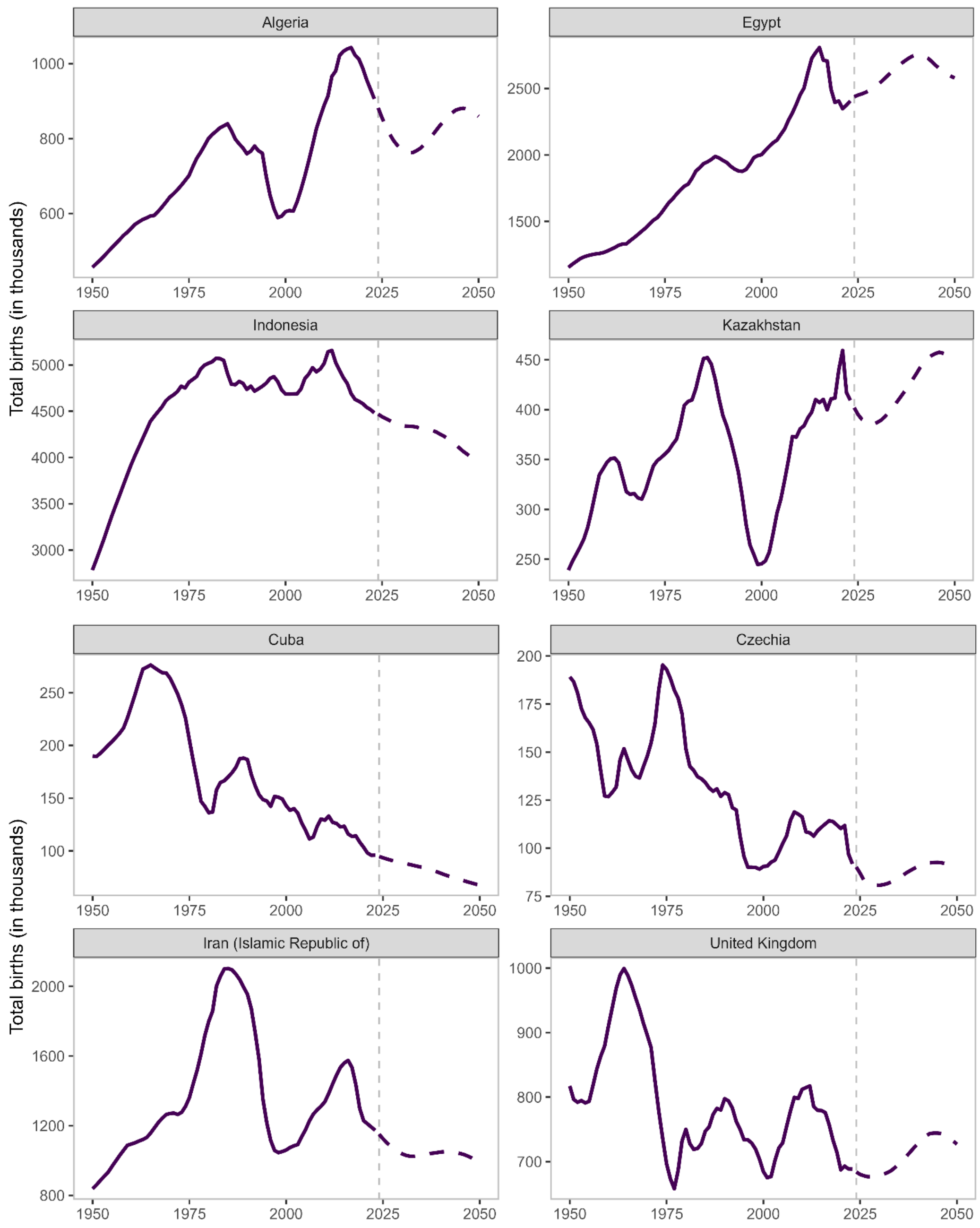


Figure 14: Number of births in selected countries experiencing SURFs, estimates and projections 1950-2050

Baby booms and the impact of pronatalist policies in Europe, Northern America and developed Oceania

We identified SURFs in the 1950s and 1960s in most countries of Western and Northern Europe and in some countries of Southern Europe (Italy, Portugal and Spain), most of these SURFs happened at the

TFR below 3 births per woman with the exception of Iceland, Ireland, Netherlands and Portugal where total fertility reached above 3. Similarly, Canada, United States of America, Australia and New Zealand all experienced SURFs above 3 births per woman. These are consistent with the literature on baby-booms of the 1950s and early 1960s, where nuptiality and move towards earlier timing and spacing of births led to “baby booms” (Van Bavel and Reher 2013; Coleman 1992). Some of the countries, such as France and Belgium, already reached TFR below 2.1 births per woman before 1950, but had a baby boom after WWII.

In Eastern Europe, from the late 1960s to 1980s pronatalist policies that aimed at increasing both birth rates and employment participation of women, created temporary increases of TFR (Demeny 1986, David and Skilogianis 1999). Between 1966 and 1990, Romania had some of the most pronounced pro-natalist policies. Communist authorities—concerned over the decline of fertility and especially its effects on the future workforce—interpreted the declining fertility trend as a direct result of legalizing abortion in 1957 and therefore in 1966 the government prohibited abortion (with the exception of a few medical situations) and ceased to import and to produce contraceptives (Bradatan 2007). The policy led to a dramatic fertility increase from 1.9 births per woman in 1966 to 3.6 in 1967, the year after the law was adopted, and total fertility rate stayed above replacement level until 1990, when the law was abolished.

SURFs in the countries of Latin America and the Caribbean

In South America, SURFs are rare, occurring only in four countries – Argentina, French Guiana, Paraguay and Uruguay. All other countries in this subregion have experienced fast uninterrupted fertility declines. Argentina and Uruguay were early-transition countries and by the 1950s, these countries had already reached relatively low fertility levels: Argentina's total fertility rate (TFR) was about 3.2 births per woman and Uruguay’s stood at 2.7 in 1950. Later on, both countries underwent periods of stagnation in fertility decline around 2.5 to 3 births per woman, albeit at different times, coinciding with broader economic and political instability. In Argentina, fertility either stagnated or declined slowly between 1967 and 1987, and between 2013 and 2014. Similarly, Uruguay experienced a deceleration in fertility decline between 1970 and 1978. The mid-1960s to 1970s were marked by macroeconomic imbalances, inflation, unemployment, and frequent political regime changes (Adserà and Menéndez, 2011).

While in Central America, we find no evidence of SURFs, in the Caribbean they are numerous (17 across 10 countries and territories), generally at fertility levels between 2 and 3 births per woman, but also including those at above 4 births per woman in Barbados, Cuba and Puerto Rico. In Cuba, following a pre-revolutionary decline, the fertility increased from 3.9 births per woman in 1958 to a peak of 4.6 in 1963. This temporary increase has been interpreted as a lag between the implementation of institutional reforms following the revolution and subsequent shifts in reproductive behavior. A baby boom during the early 1960s, especially among women aged 15–19 and 20–24, was largely attributed to improved short-term economic conditions (Díaz-Briquets 1982; Hollerbach et al., 1981). The subsequent fertility declines in the 1970s were driven by expanded access to contraception and abortion services, as well as a drop in marriage rates, although worsening economic conditions also played a substantial role (Díaz-Briquets 1982).

The SURFs in progress in Central Asia and Mongolia

Central Asian fertility trends deviate significantly from DTT and represent a compelling case study of demographic transition deviation whereby the region's historical fertility declines were followed by unexpected SURFs.

Since 1980, the region has experienced remarkable fertility transformations, characterized by an initial plateau/increase in the early 1980s followed by a decline in the later part of the decade corresponding to the perestroika. The collapse of the Soviet Union in 1990 contributed to accelerating swiftly the ongoing trends (Anichkin and Vishnevsky 1994, Blum 1987). Unexpectedly, this trajectory fundamentally shifted in the late 1990s and early 2000s, with fertility increases occurring across Central Asian states (Spoorenberg 2013).

Kazakhstan exemplifies this pattern most dramatically, with total fertility rates dropping from 3.0 births per woman in 1980 to 1.9 in 1999, then rebounding to 3.3 by 2021, representing sustained and universal fertility recuperation across different population groups (Kan 2023). The fertility increases in Central Asia reflect multiple interconnected factors including economic resurgence driven by rising oil prices and foreign investment, changes in population composition through selective emigration, and evolving reproductive behaviors (Spoorenberg 2015a). Ethnic differentials play a crucial role in these patterns, with distinct parity-specific behaviors observed across different ethnic groups (Agadjanian, Dommaraju and Glick 2008, Spoorenberg 2015a, 2017a, 2017b).

Interestingly, these patterns identified in Central Asia are also found in neighboring Mongolia, where fertility is also experiencing impressive recent fertility increase (Spoorenberg, 2015b). In the case of Mongolia, among other factors, shifts in birth timing have significantly influenced the recent rise in fertility (Jugder, Baffour and Zhao 2021).

In Central Asia and Mongolia, recent fertility increases have also coincided with the adoption and implementation of pro-natalist policies. These policies have taken various forms, including economic incentives for married couples and families to encourage childbearing, enhanced benefits for working mothers, paid maternity leave, and universal child grants (Spoorenberg and Enkhtsetseg 2009, Spoorenberg 2015a). Although most of these policies were adopted after the recent fertility upturns began, they may have played a role in sustaining these increases.

Common occurrence of SURFs in Western Asia

Western Asia is the subregion with most SURFs identified in 22 cases across 13 countries. Some of the these were discussed in previous literature, such as Iraq (2003-2011) (Cetorelli, 2014) or Jordan (1998-2009) (Cetorelli and Leone 2012; Krafft, Kula, and Sieverding 2021). Gulf countries (Bahrain, Kuwait, Oman and Saudi Arabia) need deeper analysis of fertility trends among national and non-national populations to understand the SURF occurrences. Former states of USSR (Armenia, Azerbaijan and Georgia) experienced SURFs in late socialism, potentially linked to pronatalist policies as in the countries of Eastern Europe, and in post-socialist periods that relate to economic and social transformations and changes in reproductive behaviour and migration dynamics.

Israel has 5 SURFs identified over the whole period from 1950 to 2022. The dynamics of Israel's fertility patterns revolved around three major socio-demographic dimensions – religion, ethnicity and socioeconomic structure that had profound impact on the fertility levels and trends, together with shifts in population distribution by these dimensions (Friedlander 2003).

SURFs in other countries of Asia and Oceania

We have identified SURFs in 5 countries of Eastern Asia (Mongolia is discussed above with Central Asia), 3 countries each in South-eastern and Southern Asia and 2 countries in Micronesia and 2 countries in Polynesia.

In China, the first SURF is identified for the period 1967-1970. After the extraordinary decline in TFR from 1970 to 1980, in which rising age at marriage played a significant role, the TFR stopped declining, despite the implementation of the one-child policy since 1980. This stall from 1980 to 1987 was caused by a boom in marriage that followed a relaxation in 1980 of locally administered restrictions on marriage before the officially designated desirable age. In fact, the total fertility rate of married women (summed over duration of marriage rather than age) averaged much lower in the mid-1980s than in 1980 (Coale et al. 1991)

A significant rise in the level of fertility in Iran (SURF identified for 1975-1985) manifested itself by both the lower age at marriage and rising levels of fertility by high-parity women. One of the first legal changes following the Islamic Revolution was to lower the minimum age of marriage to 9 for females and 14 for males, many family planning clinics were closed and importation of contraceptives was ceased (Aghajanian 1991).

The countries with SURFs in Northern Africa

In Algeria, after a long decline of fertility—the total fertility rate (TFR) declined steadily from the mid-1980s, reaching a low of approximately 2.4 children per woman in 2002—fertility began to rise in the early 2000s, increasing over the next decade and a half and peaking at around 3.0 children per woman by 2018, before showing a modest decline in more recent years. In Egypt, fertility declined from 5.5 children per woman in 1980 to 3.2 in 2010. Following the 2011 revolution and the broader sociopolitical upheavals associated with the Arab Spring, the TFR rose unexpectedly, peaking at 3.5 in 2015. Fertility began to decline again after 2015, reaching an estimated 2.75 by 2022. Tunisia recorded an unexpected increasing trend over the 2000–2018 period, from lower levels of total fertility compared to Algeria or Egypt, as TFR was already at 1.9 births per woman in 2002, raising to above 2.3 in 2014.

The timing of fertility stalls in Algeria, Egypt and Tunisia closely aligns with periods of political, social and economic disruption, consistent with broader findings in the demographic literature. In Algeria, the fertility rebound coincided with the end of the country's prolonged internal conflict (1991–2002), often referred to as the "Black Decade"—a period marked by widespread violence, economic hardship, and mass displacement (Krause 2018; Mechraoui, Zizzari, and El Haïk-Wagner, 2023). The subsequent post-conflict era, particularly under President Abdelaziz Bouteflika, brought relative political stability and economic recovery, largely driven by high oil and gas revenues (Kate and Kamel, 2010). Fertility increases in post-conflict settings have been observed elsewhere and are often interpreted as the result of delayed childbearing during conflict and a broader return to family formation in contexts of renewed stability (Agadjanian and Prata 2002; Lindstrom and Berhanu 1999). In Algeria, the rise in fertility among women aged 25–34 likely reflects a catch-up effect following the postponement of marriage and childbearing during the conflict years.

In Egypt, the fertility stall followed the 2011 revolution—a time of widespread social unrest, economic volatility, and institutional uncertainty (Radovich et al. 2018). The short-term increase in fertility appears to have been partly driven by a rise in marriage rates, particularly among women aged 25–29. Structural changes in the labor market, especially a contraction in public sector employment—which has historically been preferred by women—led to a decline in female labor force participation (Assaad and Krafft 2015; Krafft 2020). Under these conditions, the opportunity costs of childbearing declined, which may have contributed to fertility increases, particularly among well-educated women in their twenties (Frini and Muller 2012). Recent research suggests that when economic modernization stalls or reverses, the expected negative association between women's education and fertility can weaken or even disappear (El-Kogali and Kraft 2020). In Egypt, this was reflected in the convergence of fertility rates across educational groups by the mid-2010s (Radovich et al. 2018), indicating that fertility behavior among educated women became more similar to that of their less-educated counterparts, likely due to converging constraints on employment and household formation.

Probabilistic approach reveals new patterns of SURFs in sub-Saharan Africa

The probabilistic approach to identifying SURFs in sub-Saharan Africa reveals substantial differences with Schoumaker's methodology (2009). Most notably, there are numerous instances where Schoumaker identified strong evidence for fertility stalls, yet the probabilistic approach classified these same periods as having no SURF occurrence. Kenya's 1999-2013 period exemplifies this divergence, where Schoumaker's strong evidence contrasts sharply with the probabilistic method's absence of SURFs. Similar patterns emerge in Cameroon (1999-2004), Namibia (2008-2013), and Zambia (2003-2007), suggesting that the probabilistic approach's incorporation of measurement error and data uncertainty leads to more conservative and potentially more accurate assessments of fertility dynamics in these African contexts.

The temporal coverage differences between the two approaches are particularly striking in the African context, where irregular survey timing has historically limited demographic analysis. The probabilistic method identifies SURFs in numerous periods that remain undetected by Schoumaker. For example, Mozambique's 2007-2011 SURF represent significant demographic events that would have been missed entirely by survey-interval approaches. This enhanced temporal coverage is especially valuable in sub-Saharan Africa, where countries often experience long gaps between demographic surveys.

The probabilistic approach also offers better ways to define the temporal boundaries of SURFs compared to Schoumaker's method. While traditional approaches were constrained to broad survey intervals, the annual time series methodology provides more precise dating of SURF periods. This precision is crucial for understanding the timing of fertility transitions in relation to policy interventions, economic changes, or social upheavals that may have influenced reproductive behavior in sub-Saharan African countries. The ability to pinpoint when SURFs begin and end provides policymakers and researchers with more actionable information for understanding the drivers of fertility change across the continent.

The conservative nature of the probabilistic approach in classifying SURFs, particularly evident in cases where Schoumaker found strong evidence, reflects the method's explicit acknowledgment of data limitations prevalent in many sub-Saharan African settings. By modeling uncertainty rather than treating survey estimates as definitive, the probabilistic approach avoids potential false positives that could arise from measurement error, sampling variability, or other data quality issues. This methodological difference suggests that some previously identified SURFs in sub-Saharan African countries may have been artifacts of data limitations rather than genuine demographic phenomena (Machiyama 2010), underscoring the importance of uncertainty quantification in demographic analysis of regions with challenging data environments.

Conclusion

The intricate patterns of SURFs identified in this paper contribute to a broader understanding that fertility transitions are not inevitable unidirectional processes, but rather complex demographic phenomena that can be disrupted, reversed, or stalled by changing economic conditions, population composition shifts, policy interventions, and cultural or social transformations.

References

Adserà, Alícia, and Ana M. Menéndez. 2011. “Fertility Changes in Latin America in Periods of Economic Uncertainty.” Population Studies 65 (1): 37–56.

Aghajanian, Akbar. 1991. “Population Change In Iran, 1966-86: A Stalled Demographic Transition?” Population and Development Review 17 (4): 703–15.

Agadjanian, Victor, and Ndola Prata. 2002. “War, Peace, and Fertility in Angola.” Demography 39 (2): 215–231.

Agadjanian, Victor, Premchand Dommaraju, and Jennifer E. Glick. 2008. “Reproduction in upheaval: Ethnic-specific fertility responses to social turbulence in Kazakhstan.” *Population Studies* 62 (2): 211-233. doi:https://doi.org/10.1080/02615470802045433

Alam, Iqbal, and Richard Leete. 1993. “Pauses in Fertility Trends in Sri Lanka and the Philippines?” In The Revolution in Asian Fertility: Dimensions, Causes, and Implications, 83–96. New York: Clarendon Press.

Alkema, Leontine, Adrian E Raftery, Patrick Gerland, Samuel J Clark, François Pelletier, Thomas Buettner, and Gerhard K Heilig. 2011. “Probabilistic Projections of the Total Fertility Rate for All Countries.” Demography 48 (3): 815–39.

Anichkin, Alexandr, and Anatoli Vishnevsky. 1994. "Three types of fertility behavior in the USSR." In *Demographic Trends and Patterns in the Soviet Union before 1991*, by Wolfgang Lutz, Sergei Scherbov and Andrei Volkov, 41-56. London: Routledge/IIASA.

Assaad, Ragui, and Caroline Krafft. 2015. “The Structure and Evolution of Employment in Egypt: 1998–2012.” In The Egyptian Labor Market in an Era of Revolution, edited by Ragui Assaad and Caroline Krafft, 27–51. Oxford: Oxford University Press.

Barsoum, Ghada, Ahmed Rashad, and Sanaa Hassanein. 2014. Labour Market Transitions of Young Women and Men in Egypt. Work4Youth Publication Series No. 16. Geneva: International Labour Organization.

Blum, Alain. 1987. "La transition démographique dans les républiques orientales de l'URSS [The demographic transition in the Eastern Republics of the USSR]." *Population* 42 (2): 337-358.

Bongaarts, John. 2006. “The Causes of Stalling Fertility Transitions.” Studies in Family Planning 37 (1): 1–16.

———. 2008. “Fertility Transitions in Developing Countries: Progress or Stagnation?” Studies in Family Planning 39 (2): 105–10.

Bongaarts, John, and John Casterline. 2013. “Fertility Transition: Is Sub-Saharan Africa Different?” Population and Development Review 38 (Suppl 1): 153.

Bradatan, Cristina (2007) History, Population Policies, and Fertility Decline in Eastern Europe: A Case Study. Journal of Family History 32(2). DOI:10.1177/0363199006297732

Cetorelli, Valeria (2014), The Effect on Fertility of the 2003–2011 War in Iraq. Population and Development Review, 40: 581-604. https://doi.org/10.1111/j.1728-4457.2014.00001.x

Cetorelli, Valeria, and Tiziana Leone. 2012. “Is Fertility Stalling in Jordan?” Demographic Research 26:293–318.

Coale, Ansley J., Wang Feng, Nancy E. Riley and Lin Fu De. 1991. Recent Trends in Fertility and Nuptiality in China.,389-393(1991). DOI:10.1126/science.251.4992.389

Demeny, Paul (1986). “Pronatalist Policies in Low-Fertility Countries: Patterns, Performances, and Prospects,” Population and Development Review 12 (1986), Issue Supplement: Below Replacement Fertility in Industrial Societies: Causes, Consequences, Policies: 335-358.

David, Henry P. and Joanna Skilogianis eds (1999). From Abortion to Contraception: A Resource to Public Policies and Reproductive Behavior in Central and Eastern Europe from 1917 to the Present, (London: Greenwood Press, 1999), 165-190.

Díaz-Briquets, Sergio. 1981. Cuba: The Demography of Revolution. Population Bulletin 36 (1): 1–41.

El-Kogali, Safaa, and Caroline Krafft. 2020. “Expect the Unexpected: Fertility Trends in Egypt and the Role of Women’s Education and Employment Opportunities.” In The Egyptian Labor Market in an Era of Revolution, edited by Caroline Krafft and Ragui Assaad, 209–230. Oxford: Oxford University Press.

Ezeh, Alex C, Blessing U Mberu, and Jacques O Emina. 2009. “Stall in Fertility Decline in Eastern African Countries: Regional Analysis of Patterns, Determinants and Implications.” Philosophical Transactions of the Royal Society B: Biological Sciences 364 (1532): 2991–3007.

Feeney, Griffith, Feng Wang, Mingkun Zhou, and Baoyu Xiao. 1989. “Recent Fertility Dynamics in China: Results from the 1987 One Percent Population Survey.” Population and Development Review 15 (2): 297–322.

Friedlander, Dov. 2009. “Fertility in Israel: Is the transition to replacement level in sight?” In: United Nations Population Division. Population Bulletin of the United Nations. Completing the fertility transition. Special Issue Nos. 48/49 2002. New York.

Frini, Anis, and Christophe Muller. 2012. “Women's Education and Fertility in MENA Countries: A Reassessment.” Journal of North African Studies 17 (3): 445–467. https://doi.org/10.1080/13629387.2012.728682.

Garenne, Michel. 2008. “Situations of Fertility Stall in Sub-Saharan Africa.” African Population Studies 23 (2).

Gendell, Murray. 1985. “Stalls in the Fertility Decline in Costa Rica, Korea, and Sri Lanka.” World Bank Staff Working Papers 693. Population and Development Series. Washington, DC: The World Bank.

Goujon, Anne, Wolfgang Lutz, and Samir KC. 2015. “Education Stalls and Subsequent Stalls in African Fertility: A Descriptive Overview.” Demographic Research 33:1281–96.

Grimm, Michael, Isabel Günther, Kenneth Harttgen, and Stephan Klasen. 2022. “Slow-Downs of Fertility Decline: When Should We Call It a ‘Fertility Stall’?” Demographic Research 46 (26): 737–66.

Guzmán, José Miguel, Suzana Cavenaghi, George Rodríguez, and Edith A. Pantelides. 2006. The Fertility Transition in Latin America. New York: United Nations.

Horiuchi, Shiro. 1992. “Stagnation in the Decline of the World Population Growth Rate during the 1980s.” Science 257 (5071): 761–65.

Howse, Kenneth. 2015. “What Is Fertility Stalling and Why Does It Matter.” Population Horizons 12 (1): 13–23.

Islam, M Mazharul, M Ataharul Islam, and Nitai Chakroborty. 2004. “Fertility Transition in Bangladesh: Understanding the Role of the Proximate Determinants.” Journal of Biosocial Science 36 (3): 351–69.

Jugder, Munkhbadar, Bernard Baffour, and Zhongwei Zhao. 2021. "Recent fertility changes in Mongolia: What can we learn from examining tempo-adjusted fertility." *Asian Population Studies* 17 (2): 162-180. doi:https://doi.org/10.1080/17441730.2021.1882097.

Kan, Maxim. 2023. "Sustained and universal fertility recuperation in Kazakhstan." *European Journal of Population* 39(23). doi:https://doi.org/10.1007/s10680-023-09671-6.

Kate, Adel T., and Nadia Kamel. 2010. "The Algerian Economy: Between the Oil Rents and the Private Sector." In Algeria: Anger of the Dispossessed, edited by Martin Evans and John Phillips, 123–139. New Haven: Yale University Press.

Krause, Kristine. 2018. "Gender Dimensions of Violence and Reconciliation in Algeria's Black Decade." International Feminist Journal of Politics 20 (4): 517–534. https://doi.org/10.1080/14616742.2018.1480903.

Krafft, Caroline. 2020. "Why Is Fertility on the Rise in Egypt? The Role of Women's Employment Opportunities." Journal of Population Economics 33 (4): 1173–1218. https://doi.org/10.1007/s00148-020-00776-

Krafft, Caroline, Elizabeth Kula, and Maia Sieverding. 2021. "An Investigation of Jordan's Fertility Stall and Resumed Decline." Demographic Research 45:605–52.

Liu, Peiran, and Adrian E Raftery. 2020. "Accounting for Uncertainty about Past Values in Probabilistic Projections of the Total Fertility Rate for Most Countries." The Annals of Applied Statistics 14 (2): 685.

Liu, Peiran, Hana Ševčíková, and Adrian E Raftery. 2023. "Probabilistic Estimation and Projection of the Annual Total Fertility Rate Accounting for Past Uncertainty: A Major Update of the bayesTFR R Package." Journal of Statistical Software 106:1–36.

Machiyama, Kazuyo. 2010. "A Re-Examination of Recent Fertility Declines in Sub-Saharan Africa." DHS Working Papers 68.

Moultrie, Tom A, Victoria Hosegood, Nuala McGrath, Caterina Hill, Kobus Herbst, and Marie-Louise Newell. 2008. "Refining the Criteria for Stalled Fertility Declines: An Application to Rural KwaZulu-Natal, South Africa, 1990-2005." Studies in Family Planning 39 (1): 39–48.

Pantelides, Edith Alejandra. 2002. "Completing the Fertility Transition: The Case of Argentina." In Completing the Fertility Transition, 48/49:309–16. Population Bulletin of the United Nations. New York: Unitd Nations.

Schoumaker, Bruno. 2019. "Stalls in Fertility Transitions in sub-Saharan Africa: Revisiting the Evidence." Studies in Family Planning 50 (3): 257–78.

Ševčíková, Hana, Leontine Alkema, and Adrian E Raftery. 2011. "bayesTFR: An R Package for Probabilistic Projections of the Total Fertility Rate." Journal of Statistical Software 43 (1): 1.

Shapiro, David, and Tesfayi Gebreselassie. 2008. "Fertility Transition in Sub-Saharan Africa: Falling and Stalling." African Population Studies 23 (1).

———. 2009. "Fertility Transition in Sub-Saharan Africa: Falling and Stalling." African Population Studies 23 (1): 3–23.

Spoorenberg, Thomas. 2013. "Fertility changes in Central Asia since 1980." *Asian Population Studies* 9(1): 50-77. doi:https://doi.org/10.1080/17441730.2012.752238.

Spoorenberg, Thomas. 2015a. "Explaining recent fertility increase in Central Asia." *Asian Population Studies* 11(2): 115-133. doi:https://doi.org/10.1080/17441730.2015.1027275.

Spoorenberg, Thomas. 2015b. "Reconstructing historical fertility change in Mongolia: Impressive fertility rise before continued fertility decline." *Demographic Research* 33(29): 841-870. doi:https://doi.org/10.4054/DemRes.2015.33.29.

Spoorenberg, Thomas. 2017a. "The onset of fertility transition in Central Asia." *Population-F* 72(3): 473-503. https://shs.cairn.info/journal-population-2017-3-page-473?lang=en.

Spoorenberg, Thomas. 2017b. "After fertility's nadir? Ethnic differentials in parity-specific behaviours in Kyrgyzstan." *Journal of Biosocial Science* 49(S1): S62-S73. doi:https://doi.org/10.1017/S0021932017000335.

Spoorenberg, Thomas, and Enkhtsetseg Byambaa. 2009. "Future low fertility prospects in Mongolia? An evaluation of the factors that support having a child." *Journal of Population Research* 26 (3): 227-247. doi:https://doi.org/10.1007/s12546-009-9017-2.

United Nations. 2024a. *World Population Prospects*. New York: United Nations, Department of Economic and Social Affairs, Population Division. https://population.un.org/wpp/.

United Nations. 2024b. World Population Prospects 2024: Methodology of the United Nations Population Estimates and Projections, UN DESA/POP/2024/DC, New York: United Nations, Department of Economic and Social Affairs, Population Division.

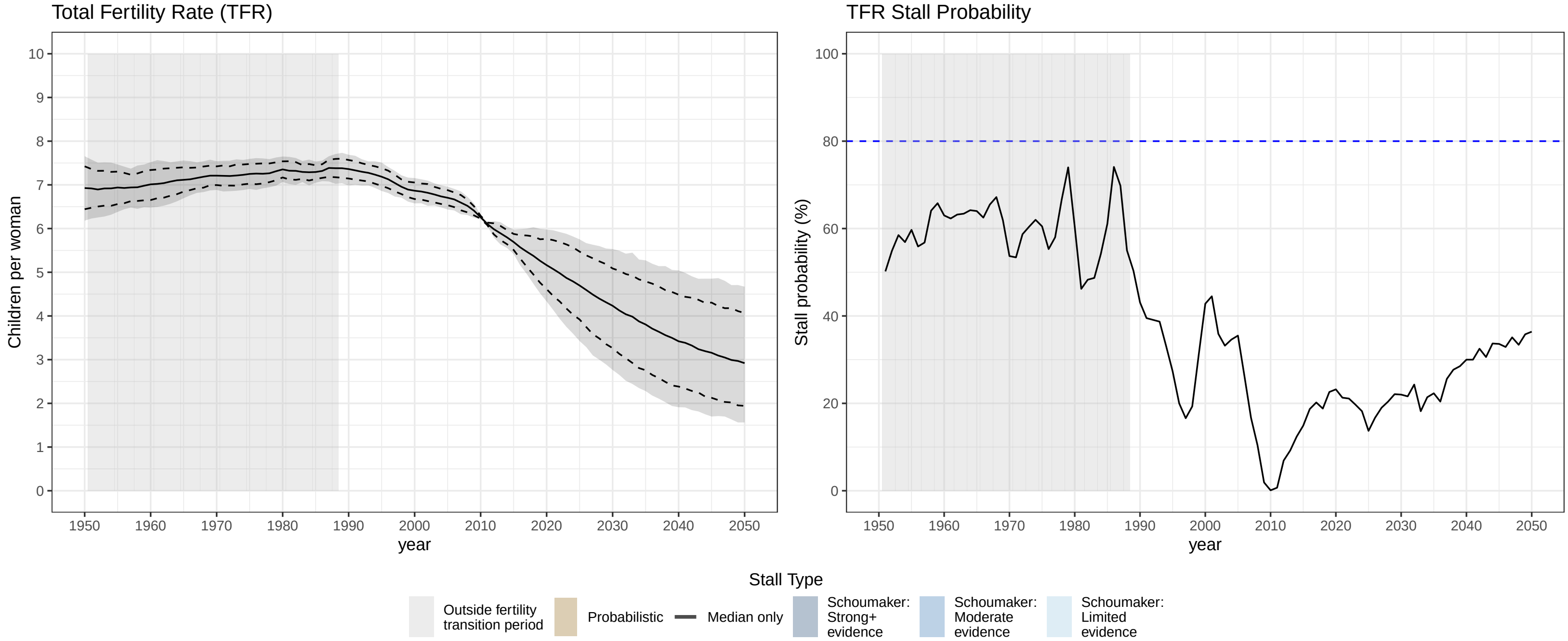
Weinreb, Alex, Dov Chernichovsky and Aviv Brill. 2018. Israel’s Exceptional Fertility. Jerusalem: Taub Center for Social Policy Studies in Israel. https://www.taubcenter.org.il/en/research/israels-exceptional-fertility/

Wheldon, M. C., Kantorová, V., Molitoris, J., and Dasgupta, A. (2024), “A New Look at Contraceptive Prevalence Plateaus in Sub-Saharan Africa: A Probabilistic Approach,” Demographic Research, 50, 899–928. https://doi.org/10.4054/DemRes.2024.50.31

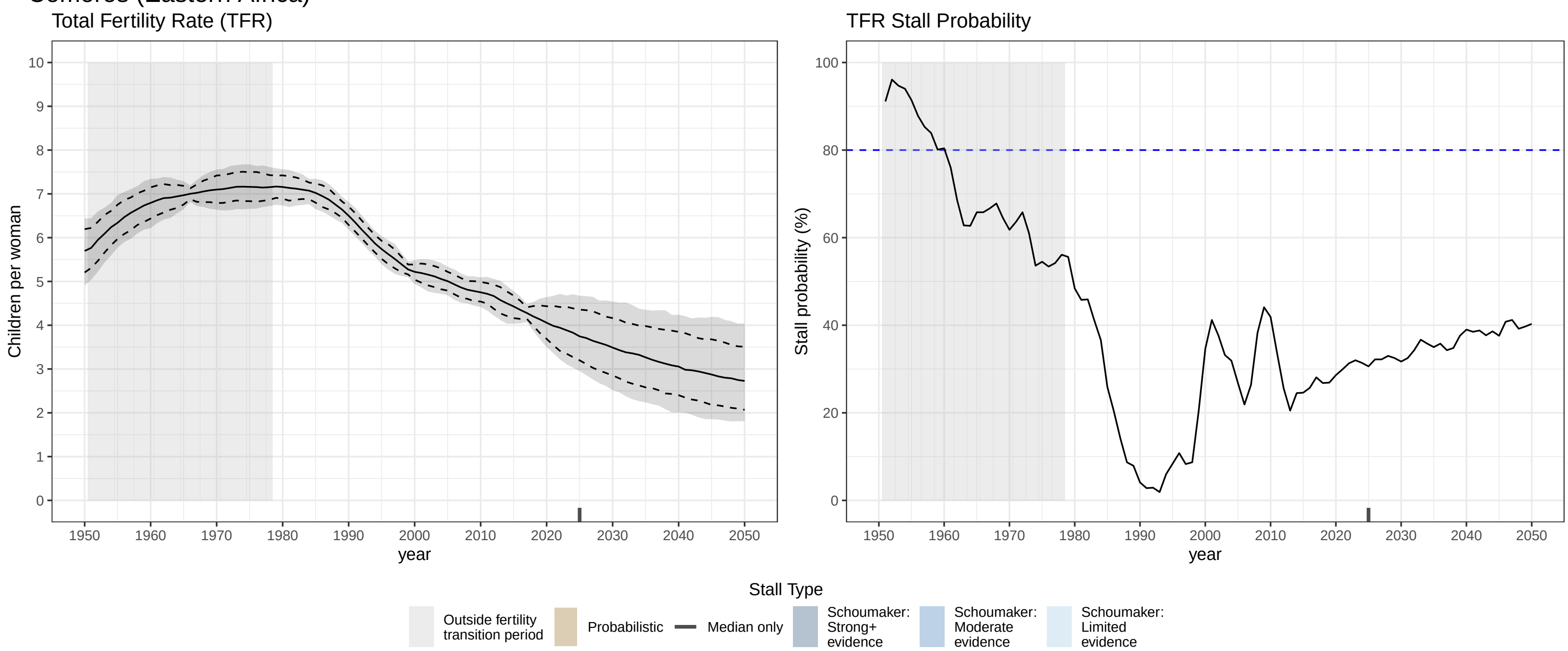
APPENDIX 1

Plots of total fertility rate (TFR), probability of SURFs, and TFR stalls identified by Schoumaker (2019) for all countries and areas with populations greater than 90,000 in 2024.

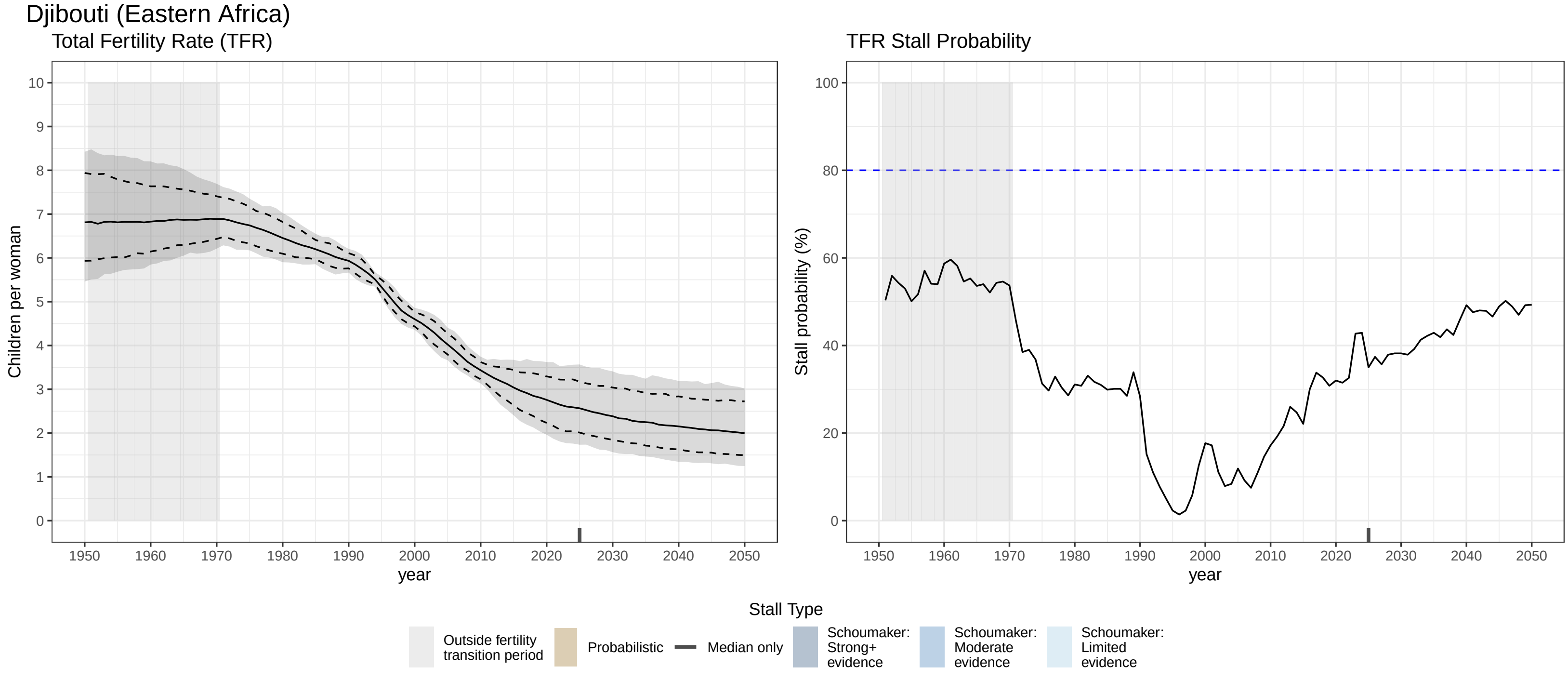
Burundi (Eastern Africa)



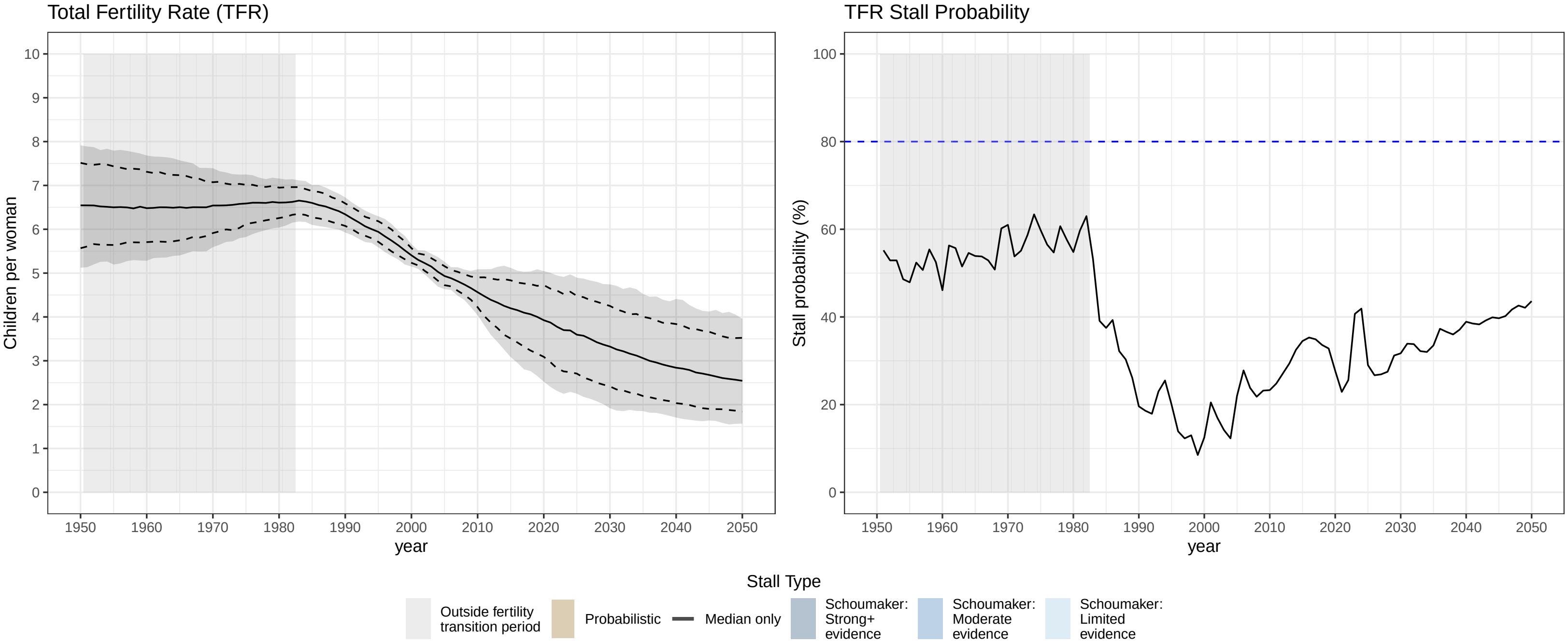
Comoros (Eastern Africa)



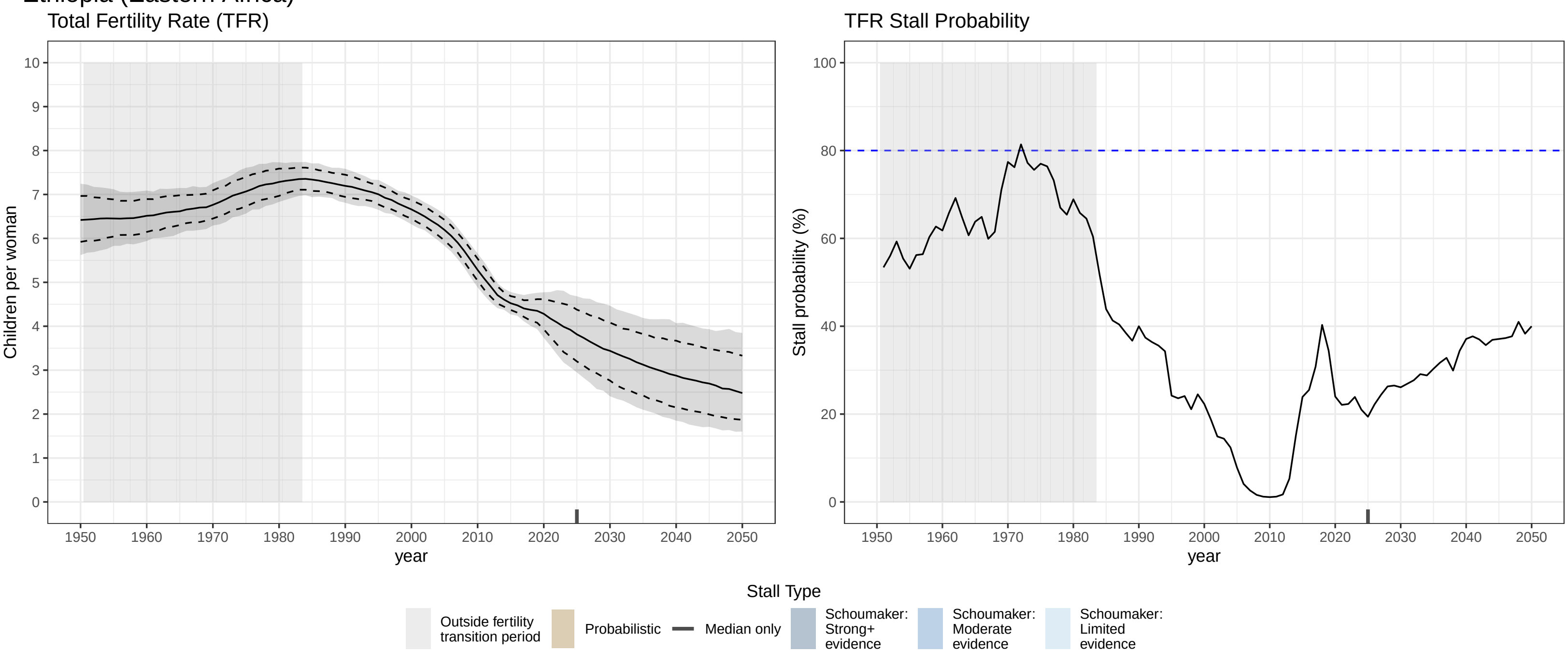
Djibouti (Eastern Africa)



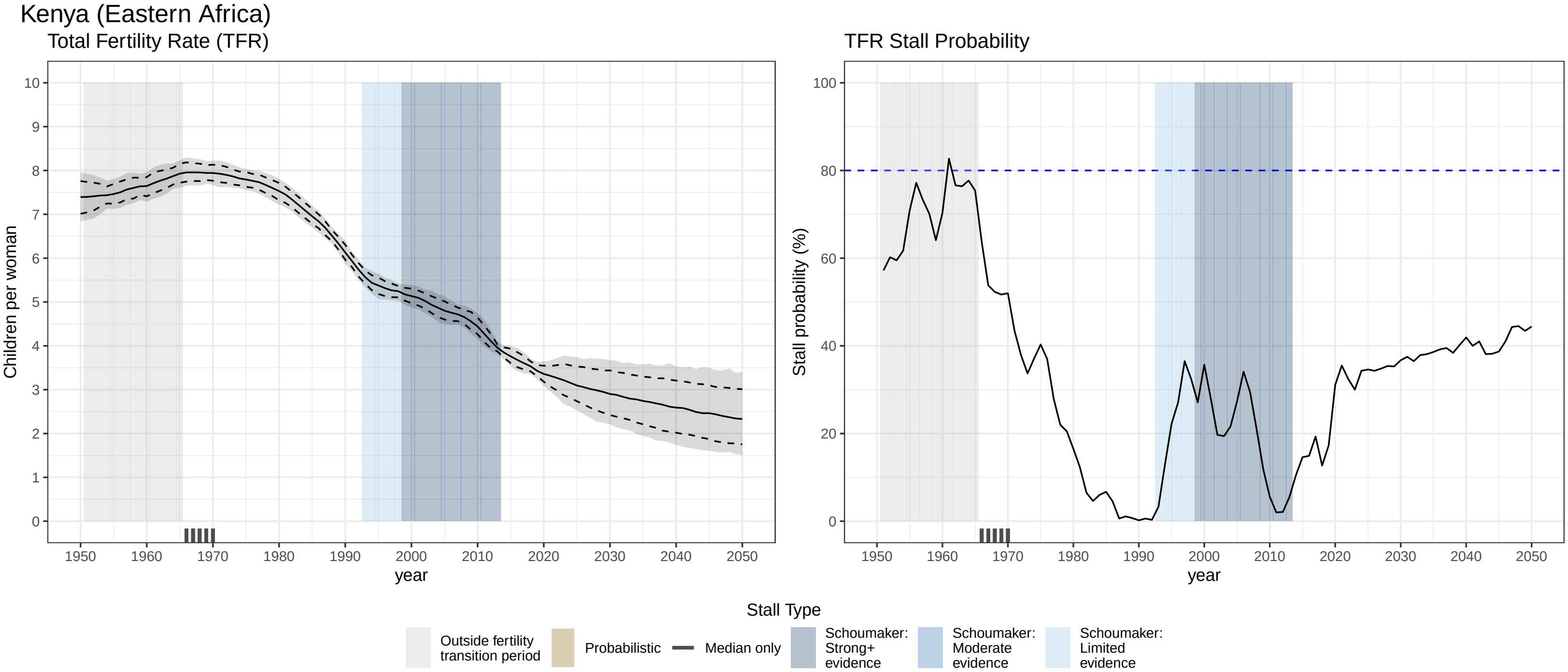
Eritrea (Eastern Africa)

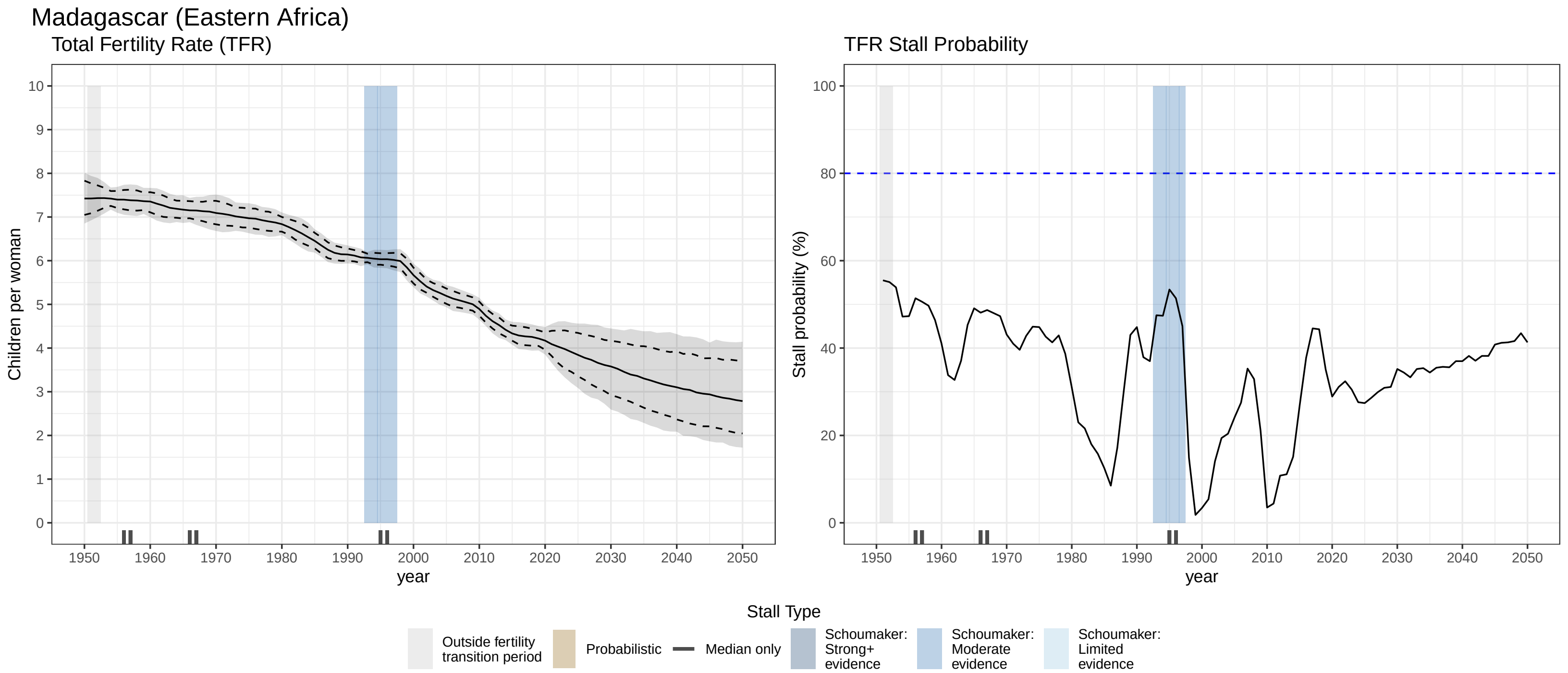


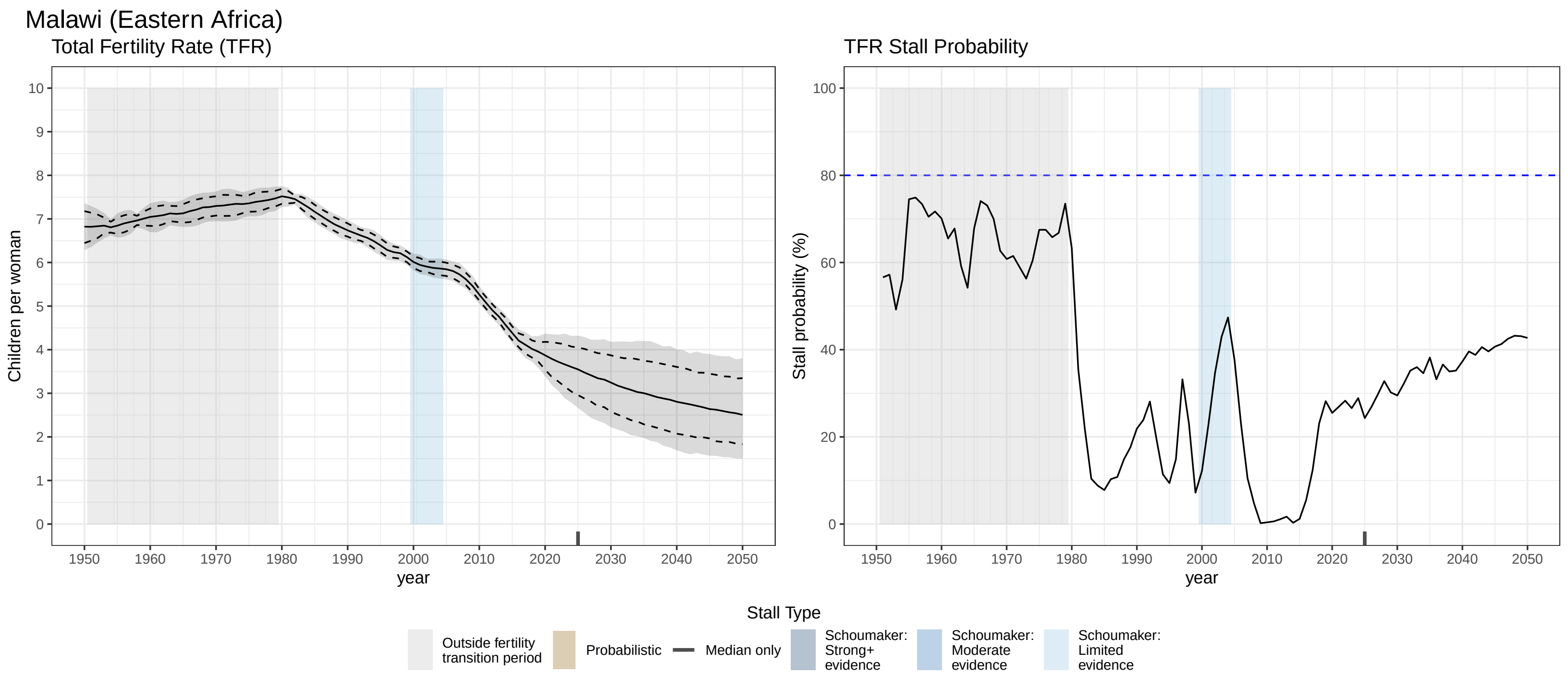
Ethiopia (Eastern Africa)

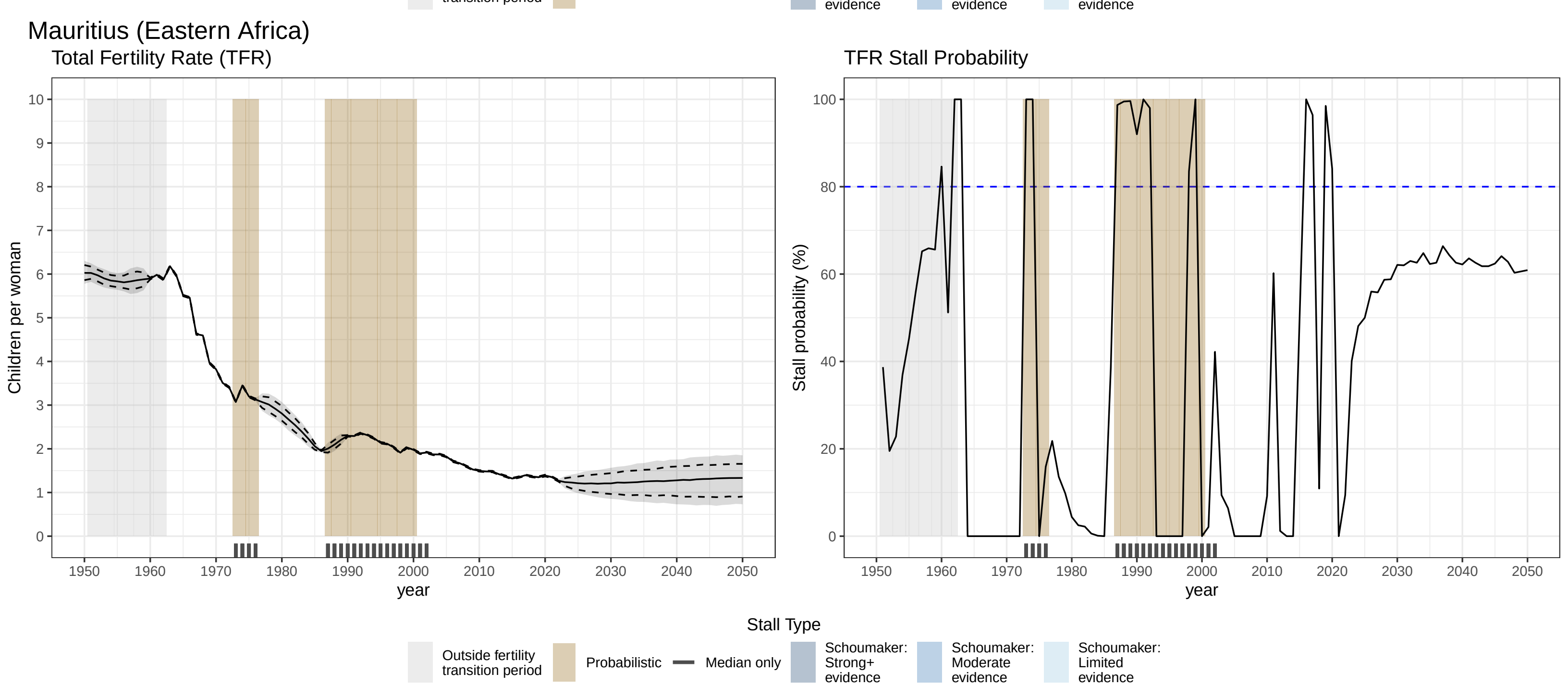


Kenya (Eastern Africa)

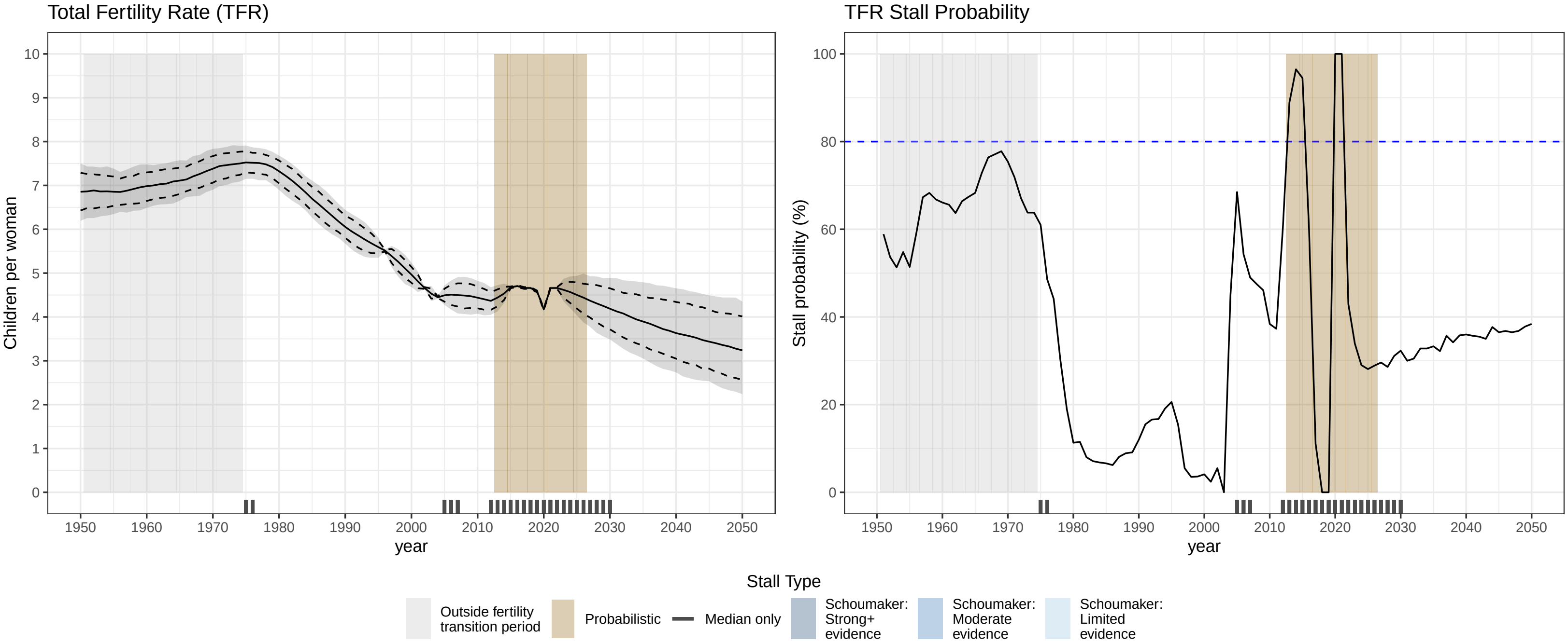



Madagascar (Eastern Africa)
Total Fertility Rate (TFR)
TFR Stall Probability
Children per woman
Stall probability (%)
year
Stall Type
Outside fertility transition period
Probabilistic
Median only
Schoumaker: Strong+ evidence
Schoumaker: Moderate evidence
Schoumaker: Limited evidence

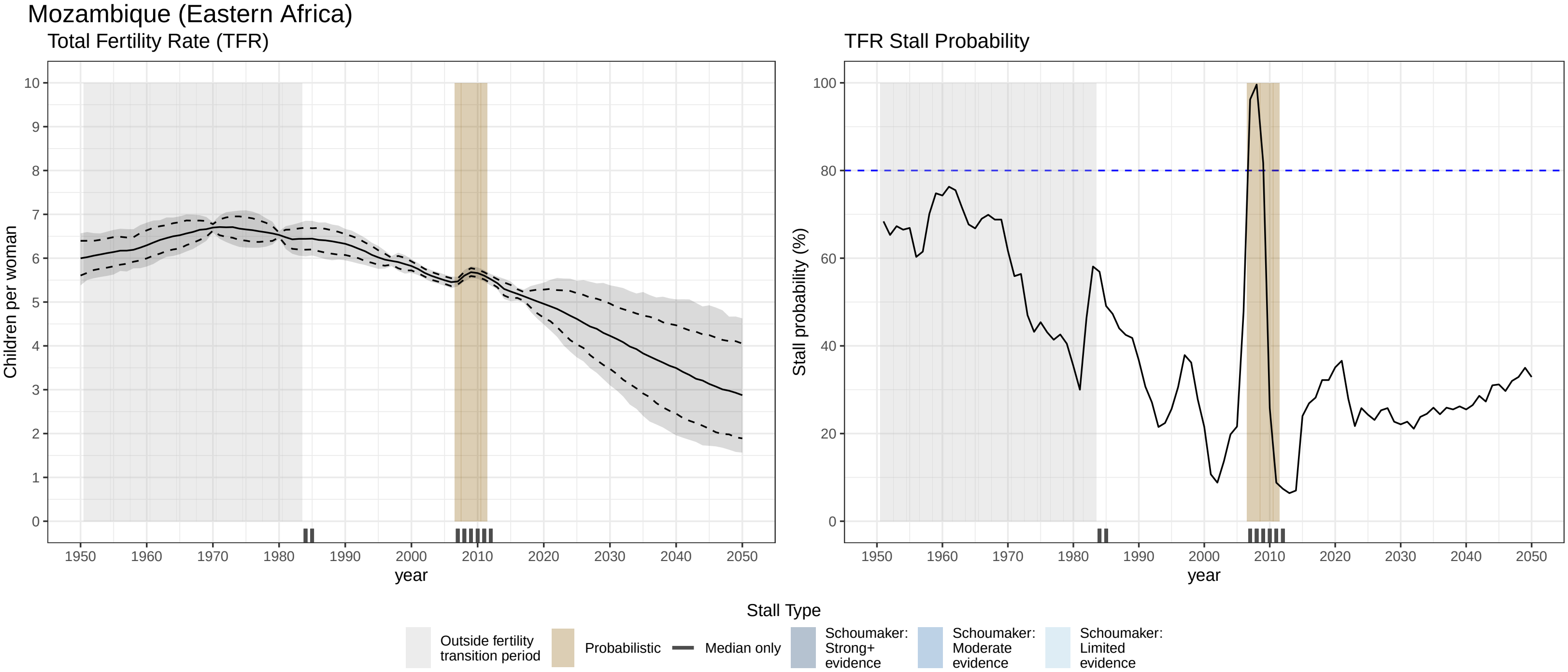

Malawi (Eastern Africa)
Total Fertility Rate (TFR)
TFR Stall Probability
Children per woman
Stall probability (%)
year
Stall Type
Outside fertility transition period
Probabilistic
Median only
Schoumaker: Strong+ evidence
Schoumaker: Moderate evidence
Schoumaker: Limited evidence


Mauritius (Eastern Africa)
Total Fertility Rate (TFR)
TFR Stall Probability
Children per woman
Stall probability (%)
year
Stall Type
Outside fertility transition period
Probabilistic
Median only
Schoumaker: Strong+ evidence
Schoumaker: Moderate evidence
Schoumaker: Limited evidence

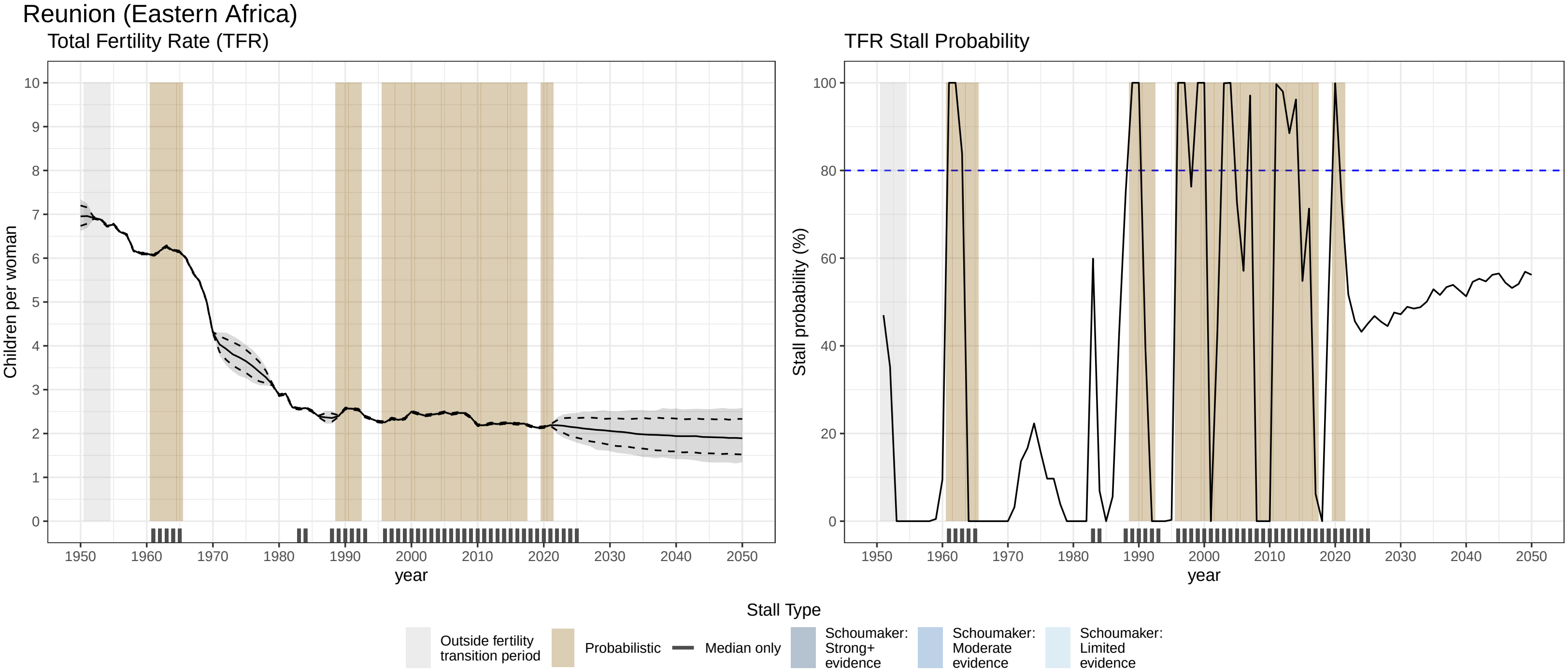
Mayotte (Eastern Africa)



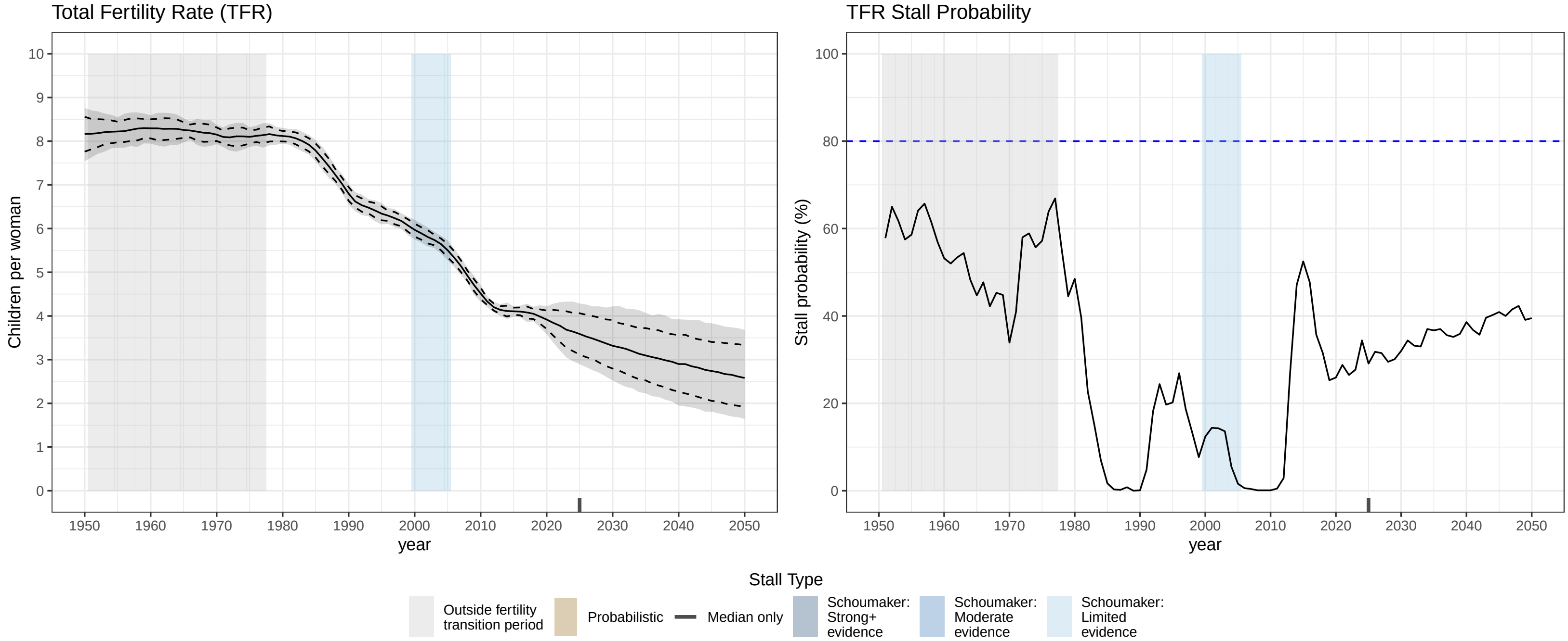
Mozambique (Eastern Africa)



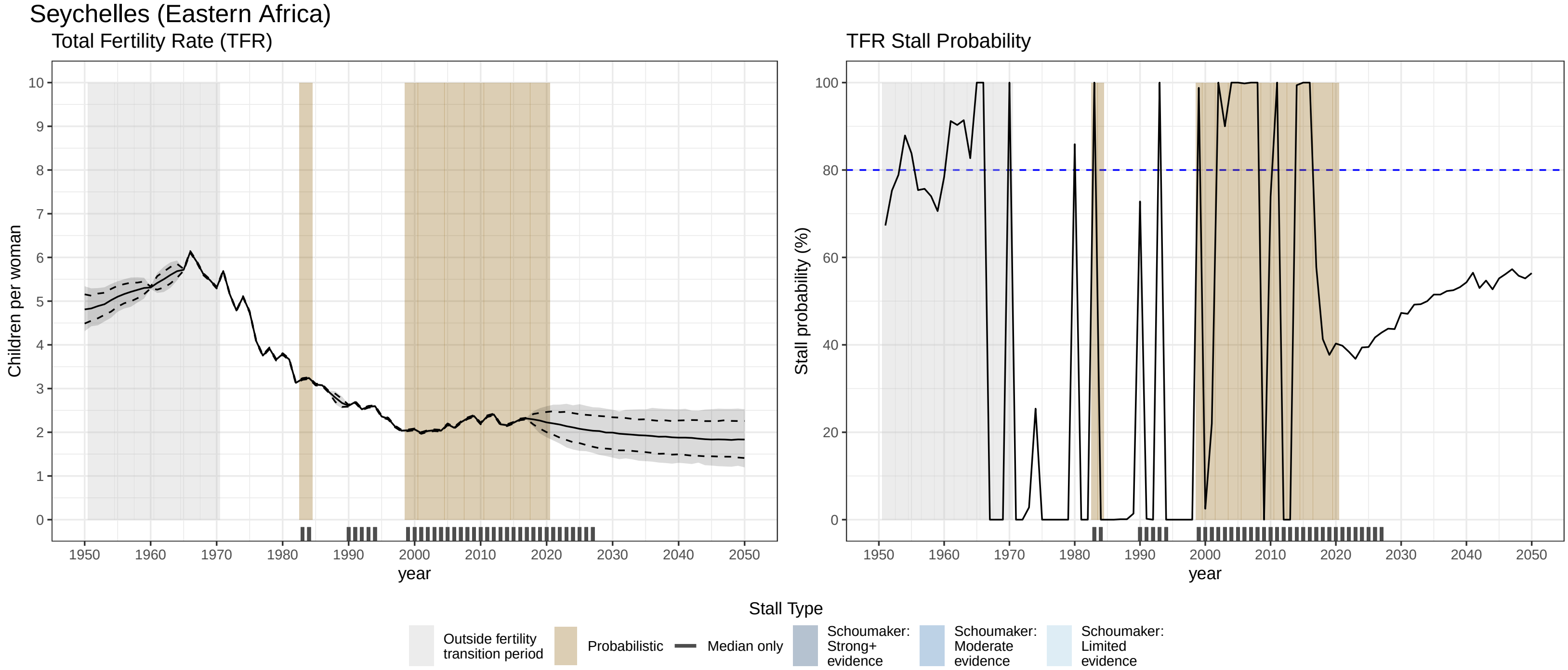
Reunion (Eastern Africa)



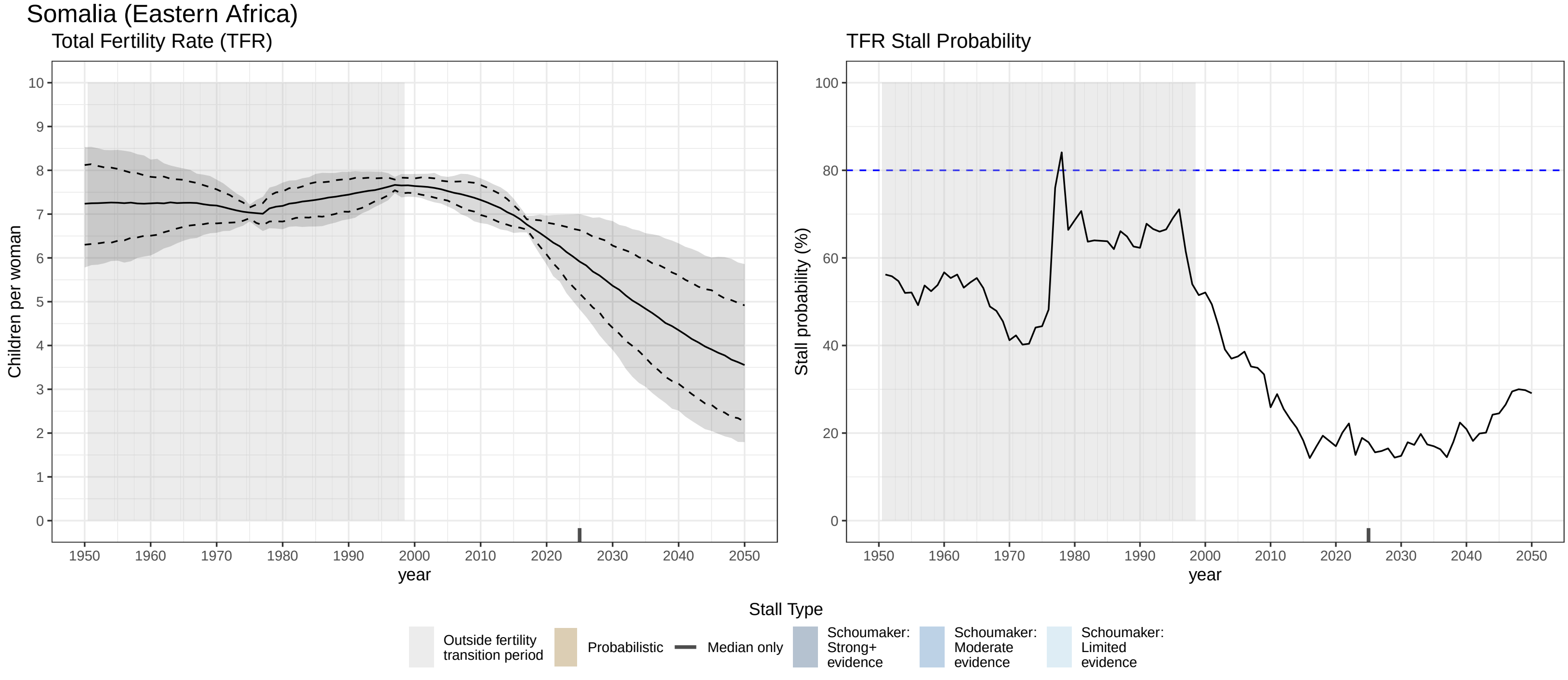
Rwanda (Eastern Africa)



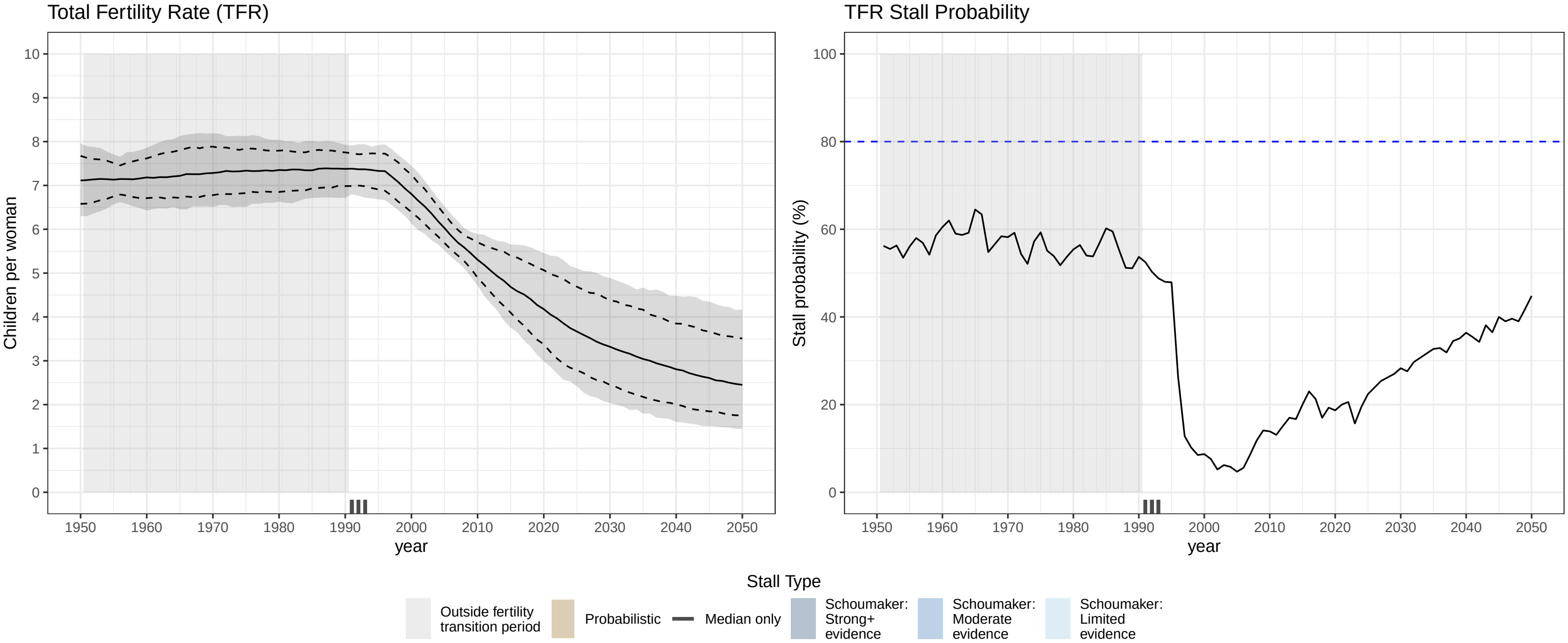
Seychelles (Eastern Africa)



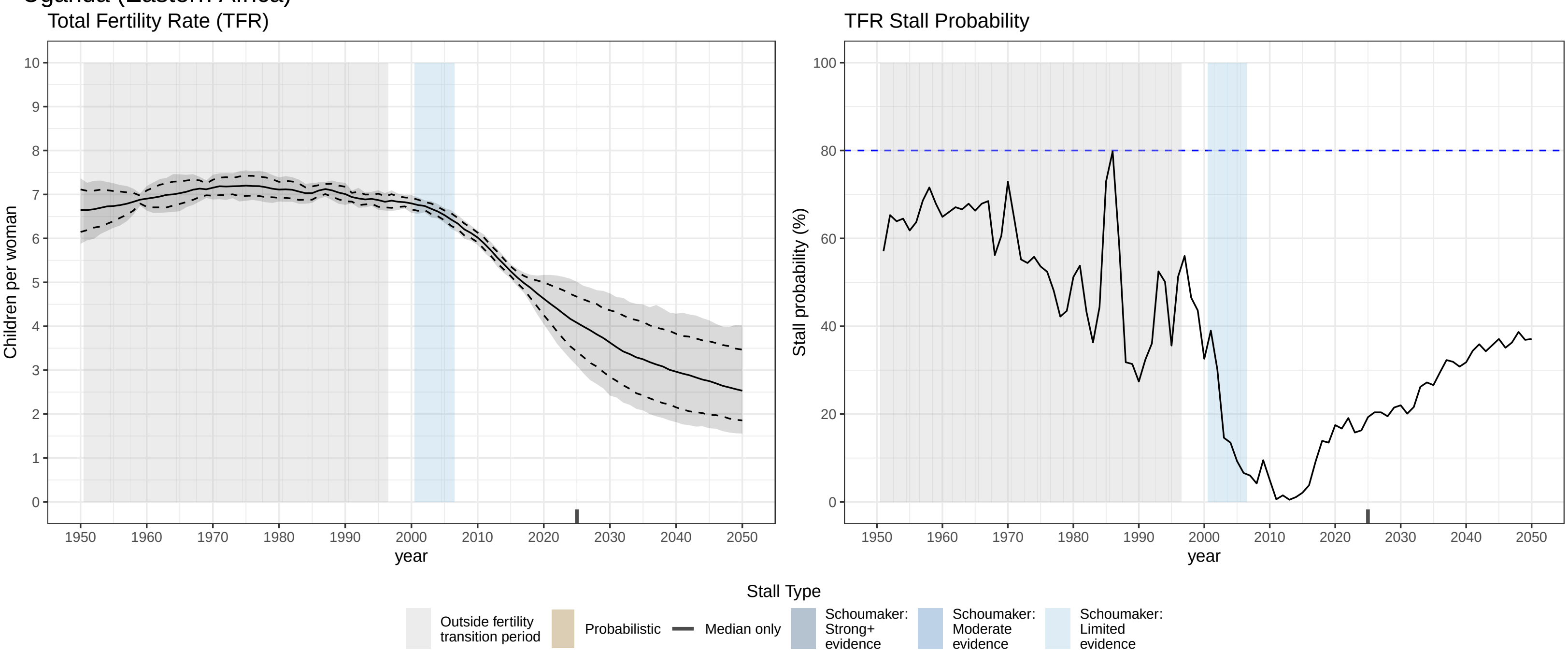
Somalia (Eastern Africa)



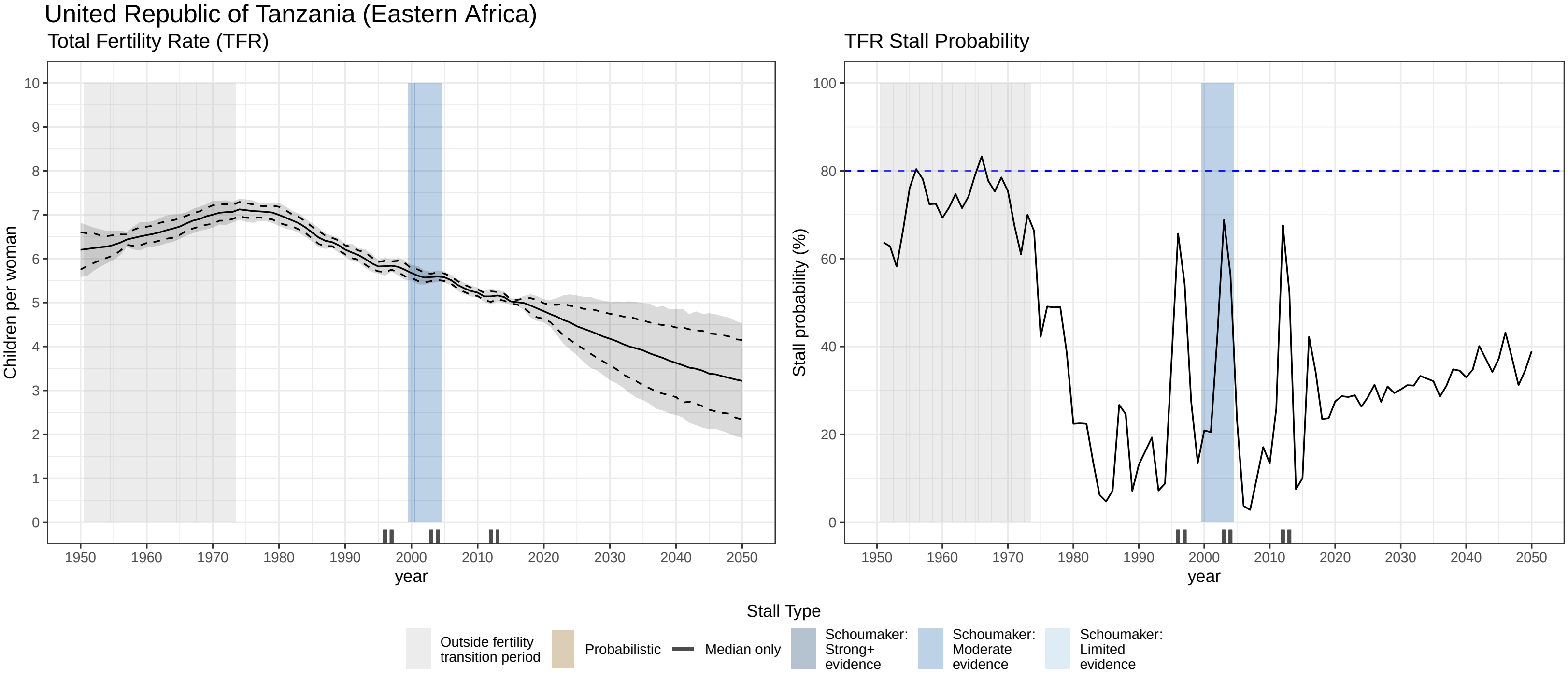
South Sudan (Eastern Africa)



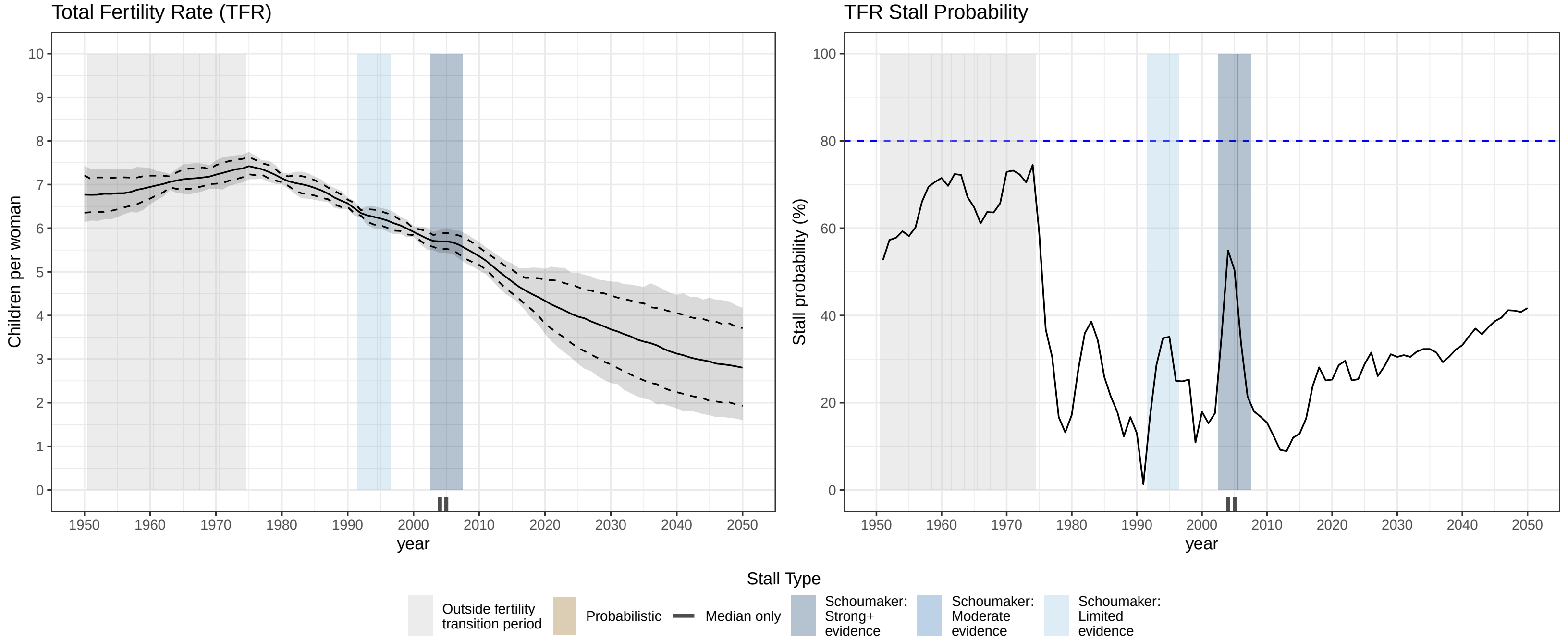
Uganda (Eastern Africa)



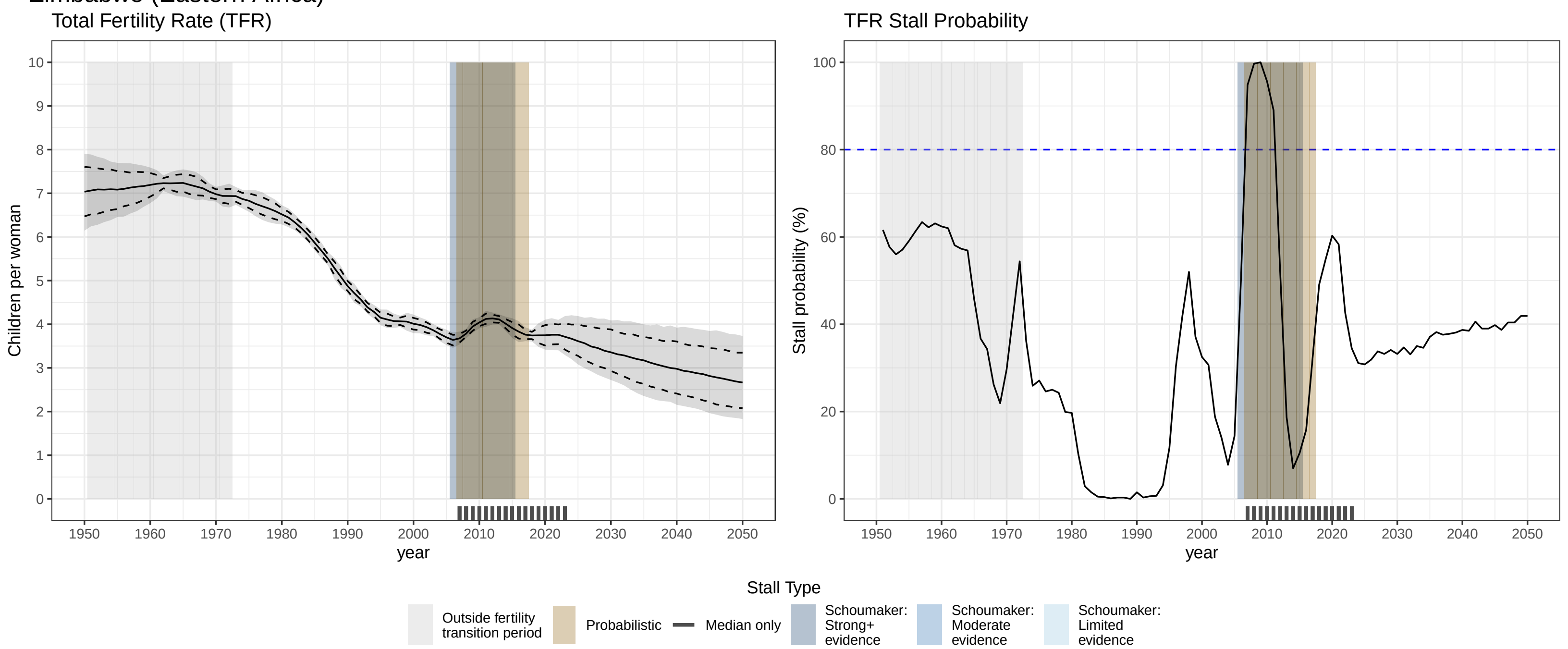
United Republic of Tanzania (Eastern Africa)



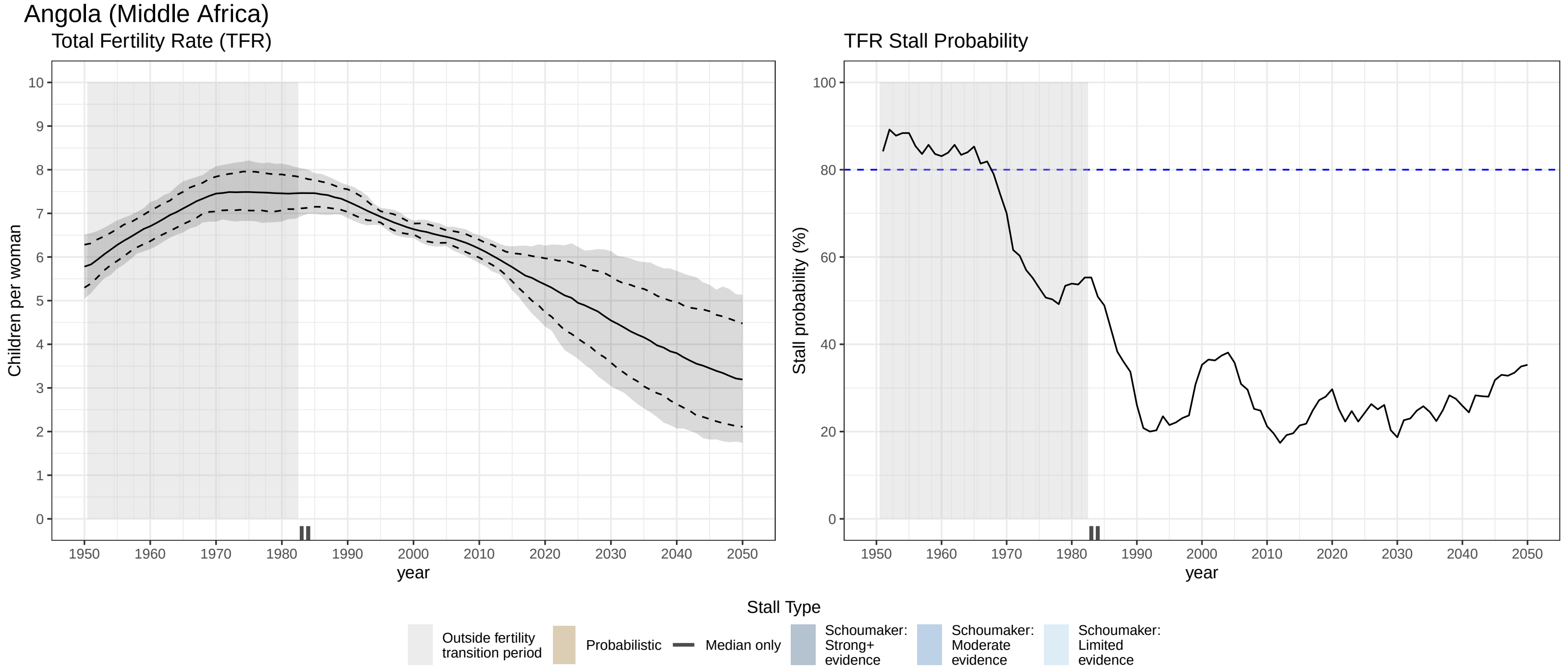
Zambia (Eastern Africa)



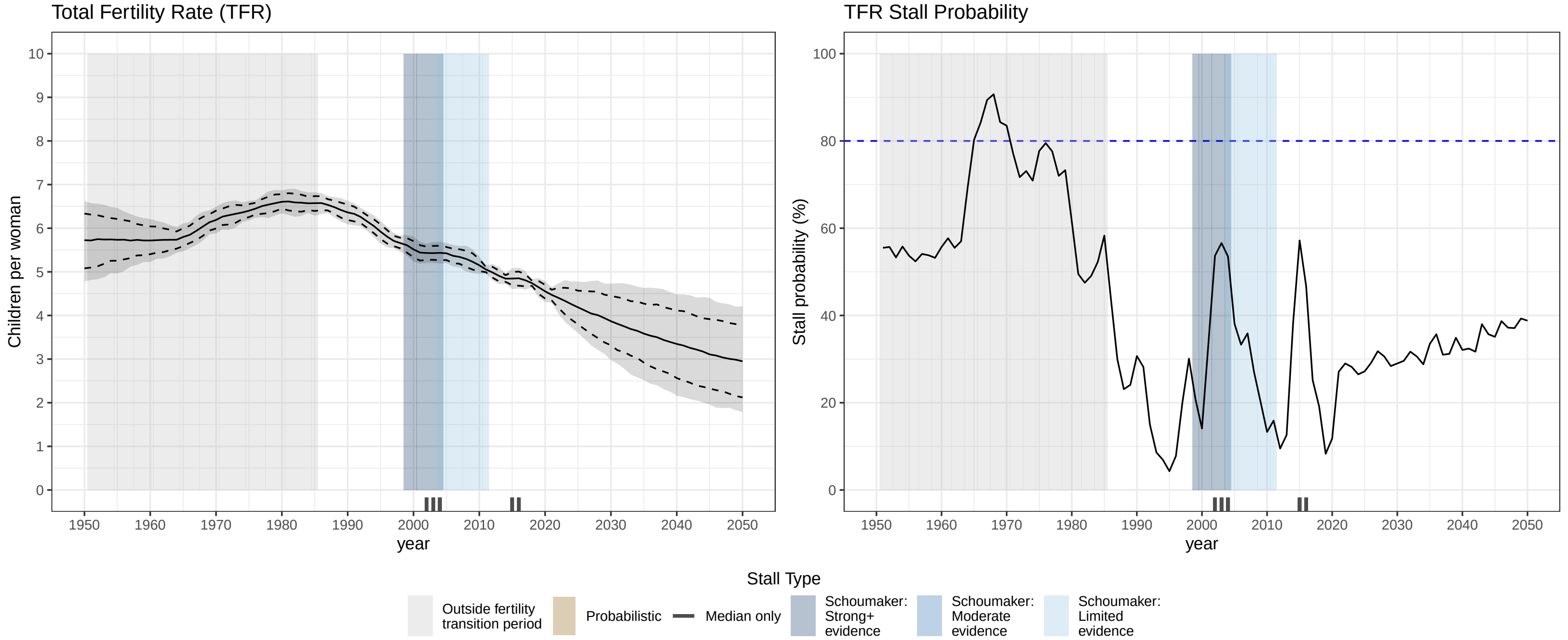
Zimbabwe (Eastern Africa)



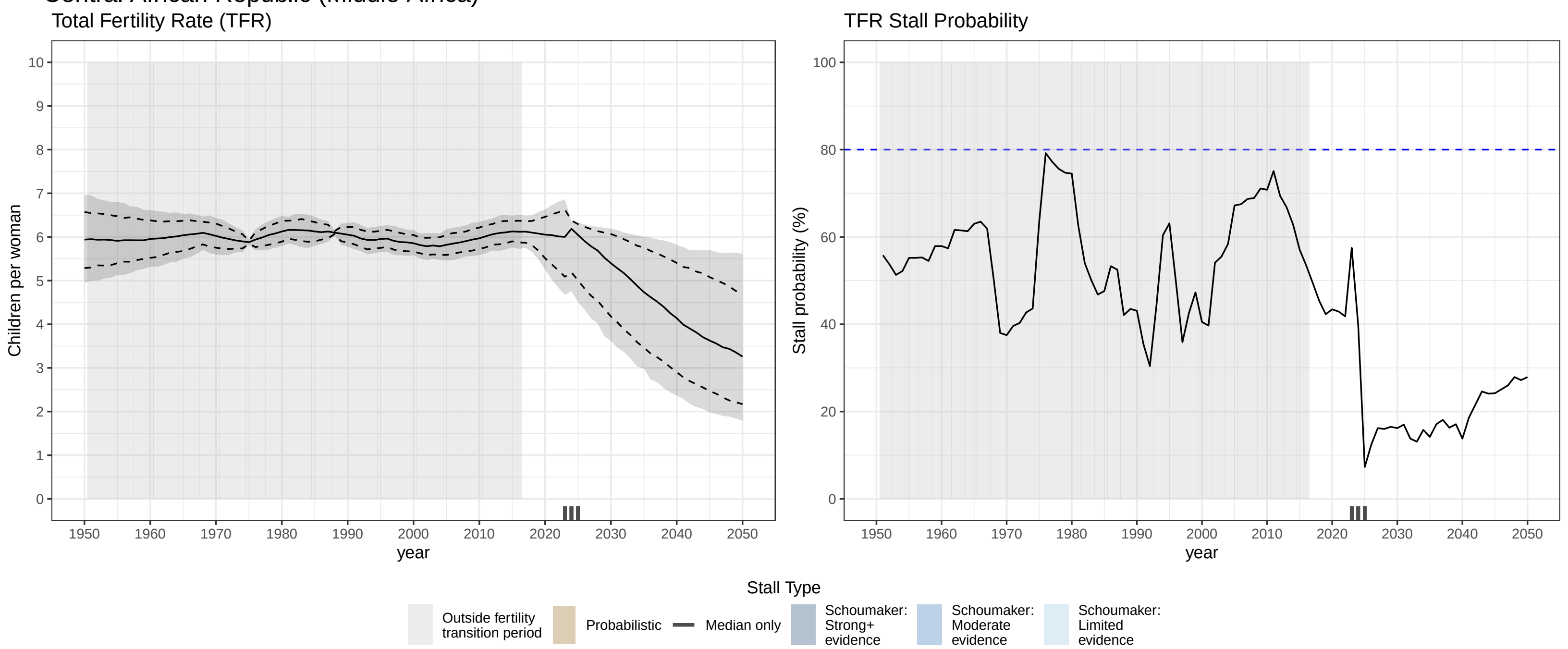
Angola (Middle Africa)



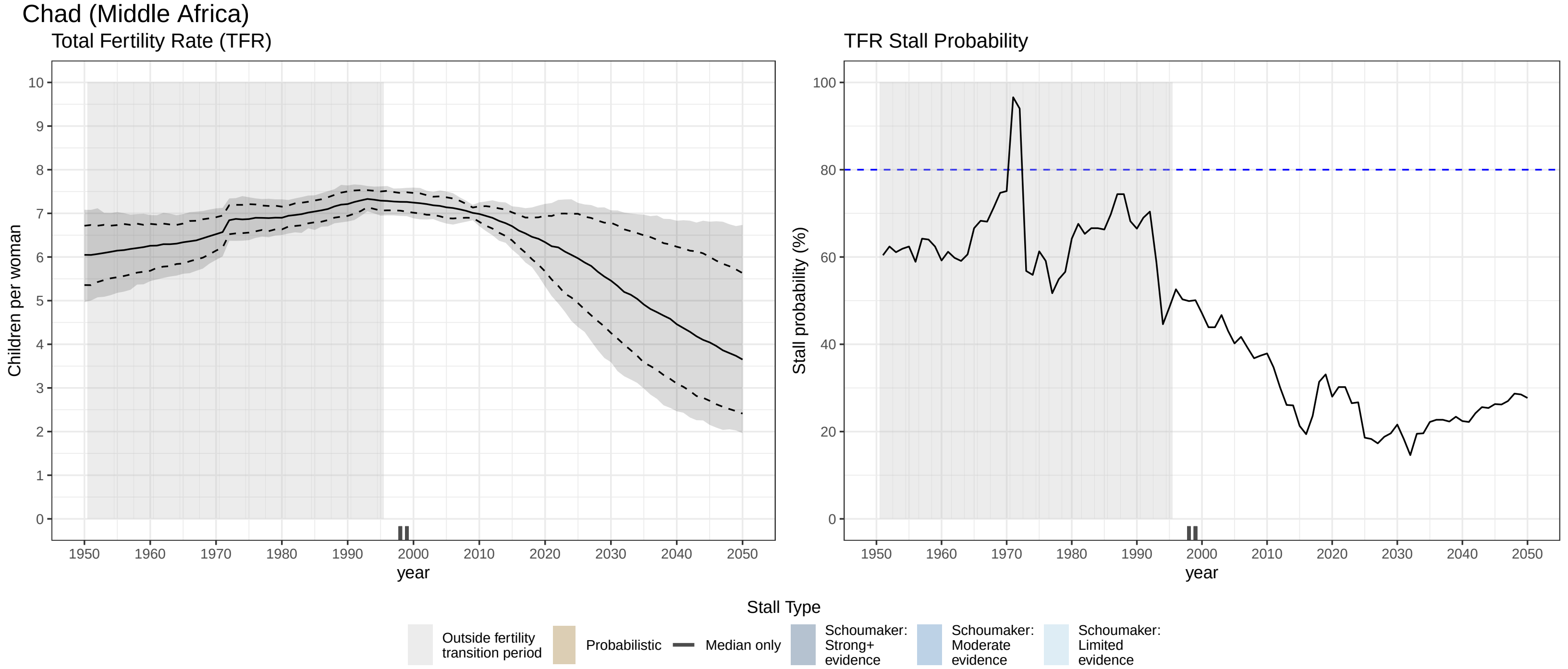
Cameroon (Middle Africa)



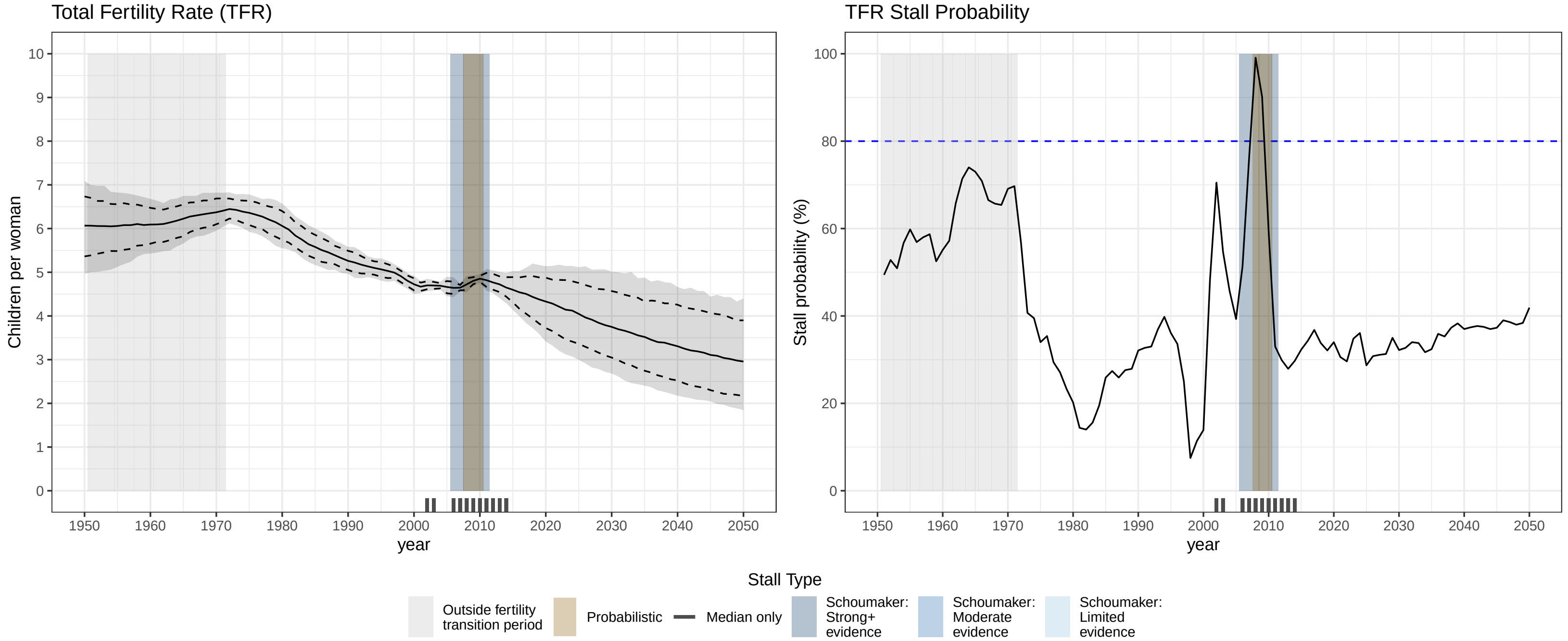
Central African Republic (Middle Africa)



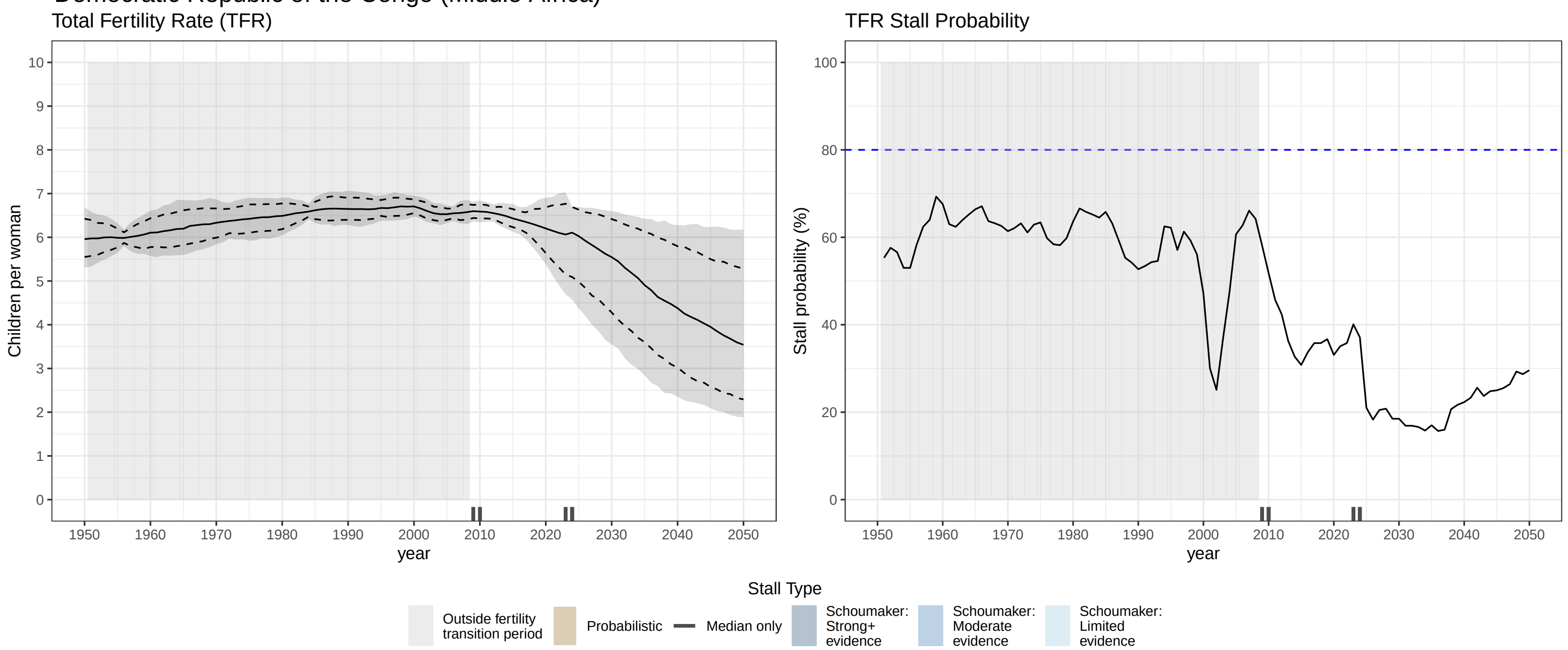
Chad (Middle Africa)



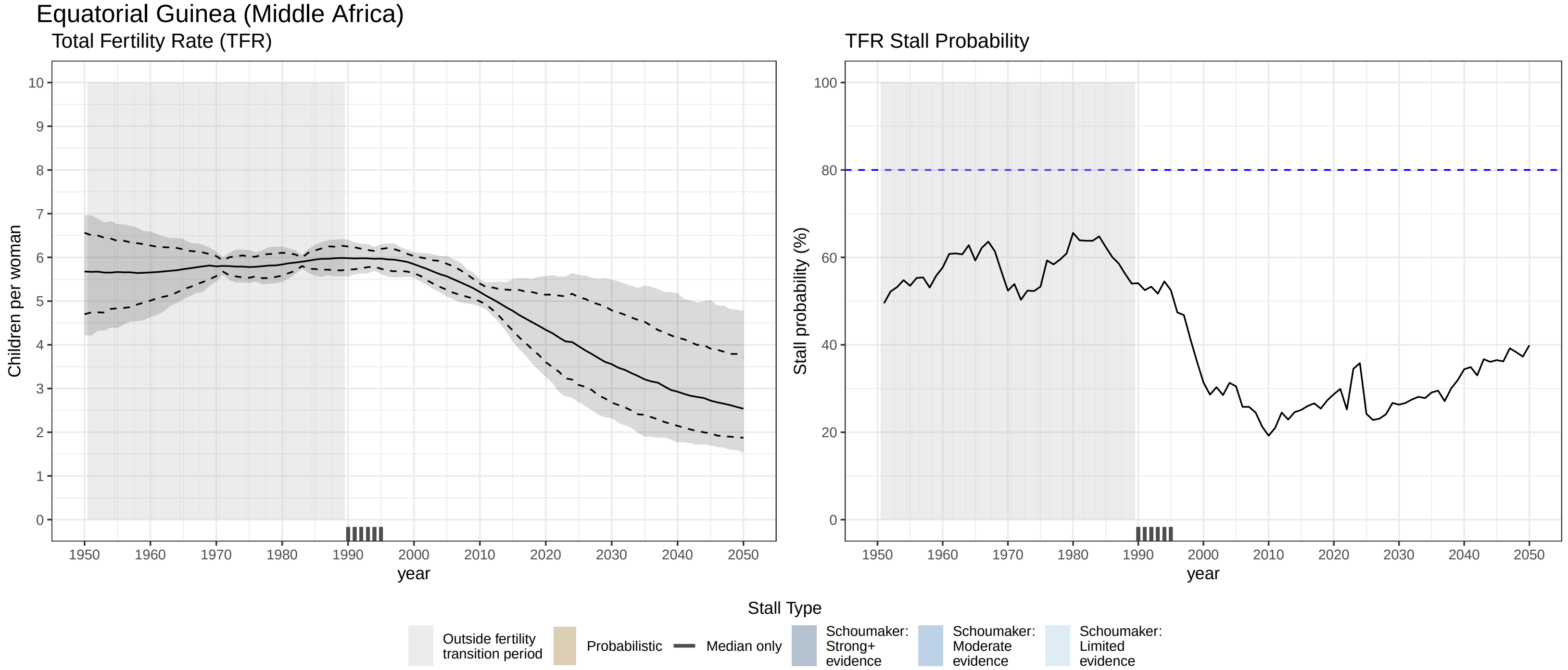
Congo (Middle Africa)



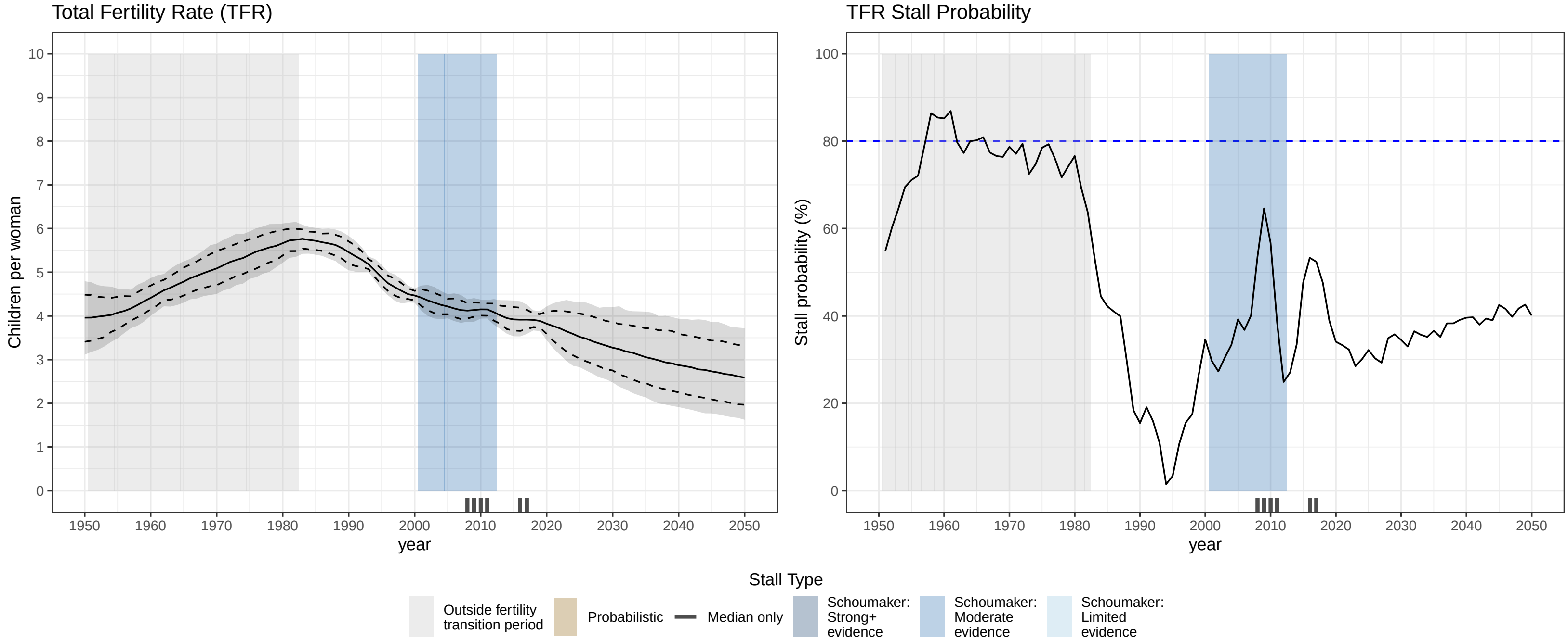
Democratic Republic of the Congo (Middle Africa)



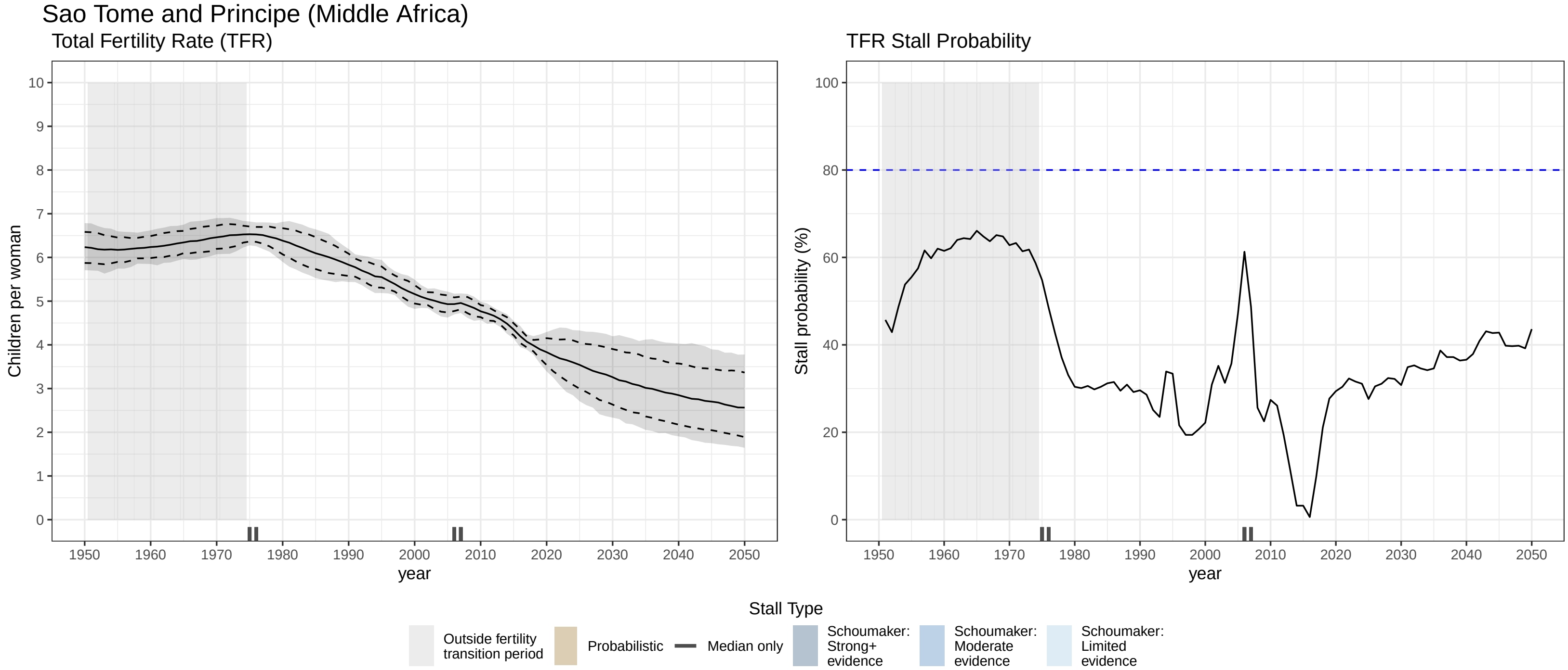
Equatorial Guinea (Middle Africa)



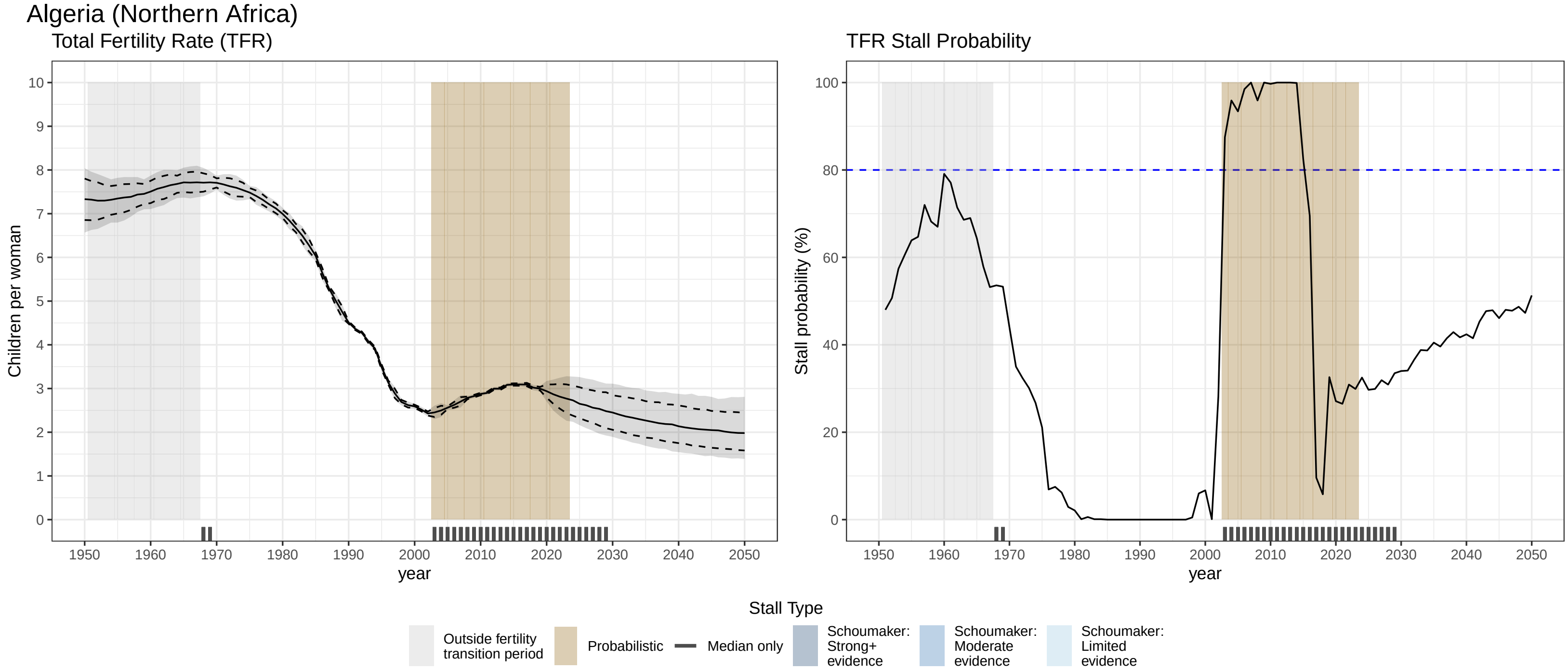
Gabon (Middle Africa)



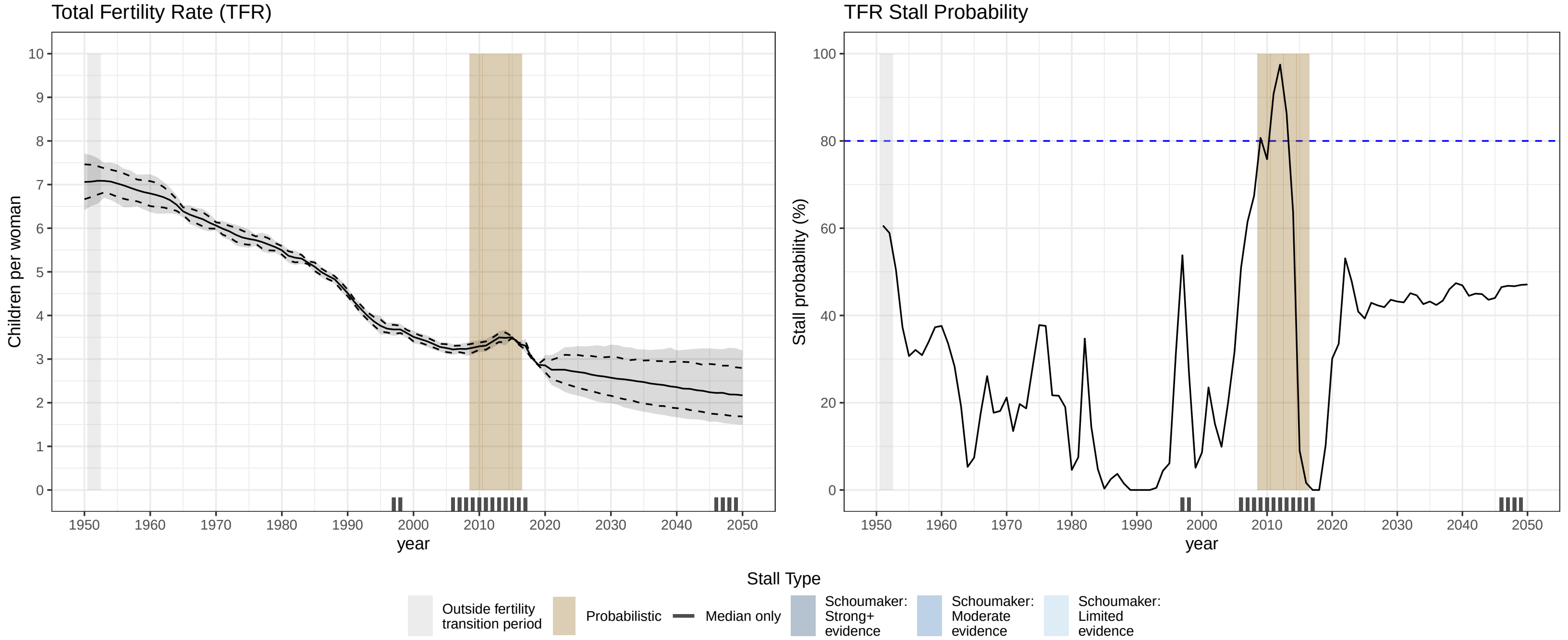
Sao Tome and Principe (Middle Africa)



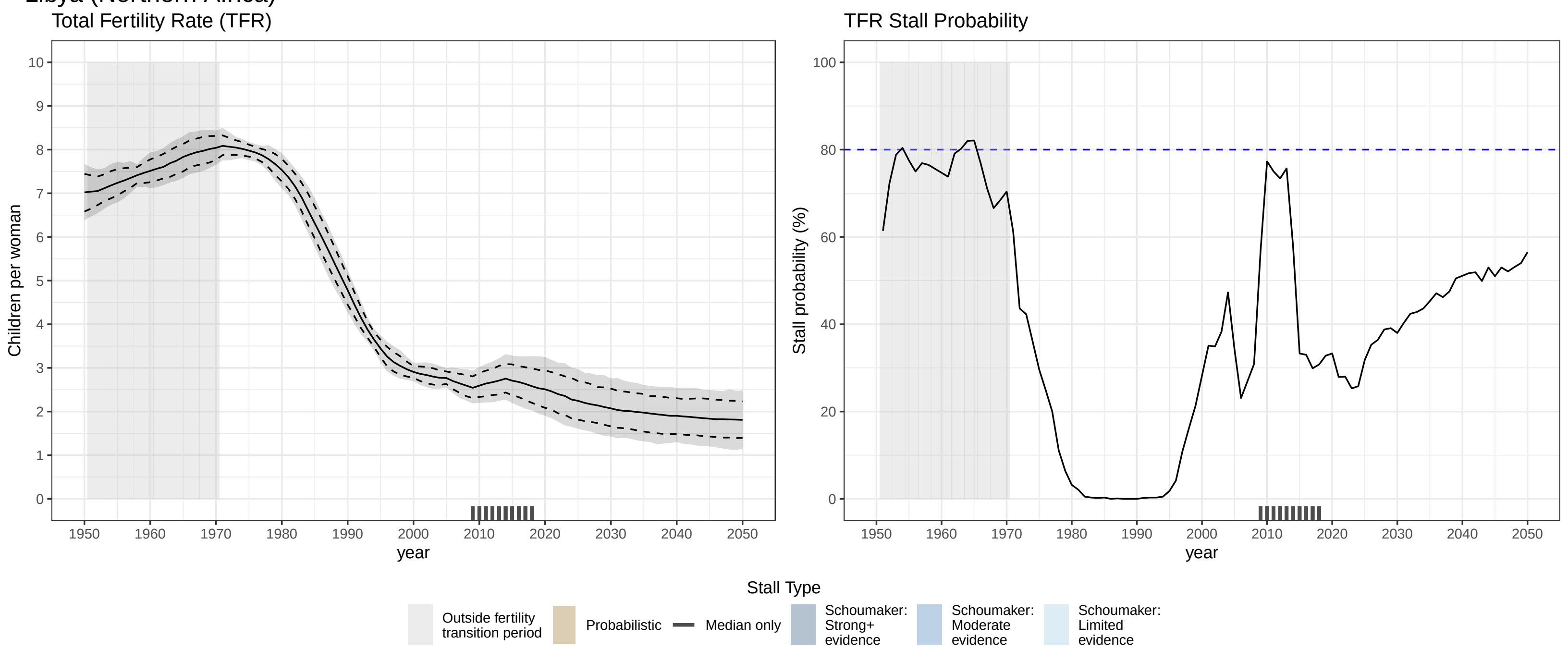
Algeria (Northern Africa)



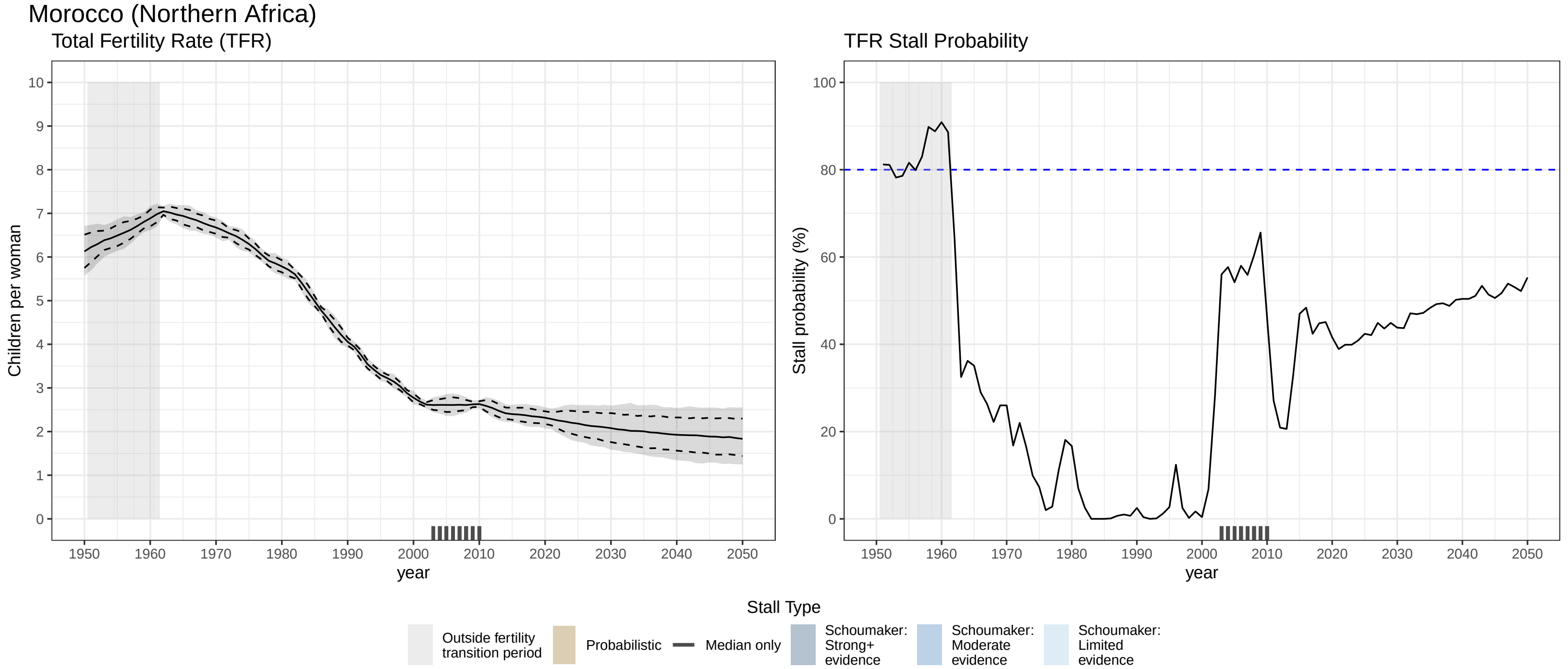
Egypt (Northern Africa)



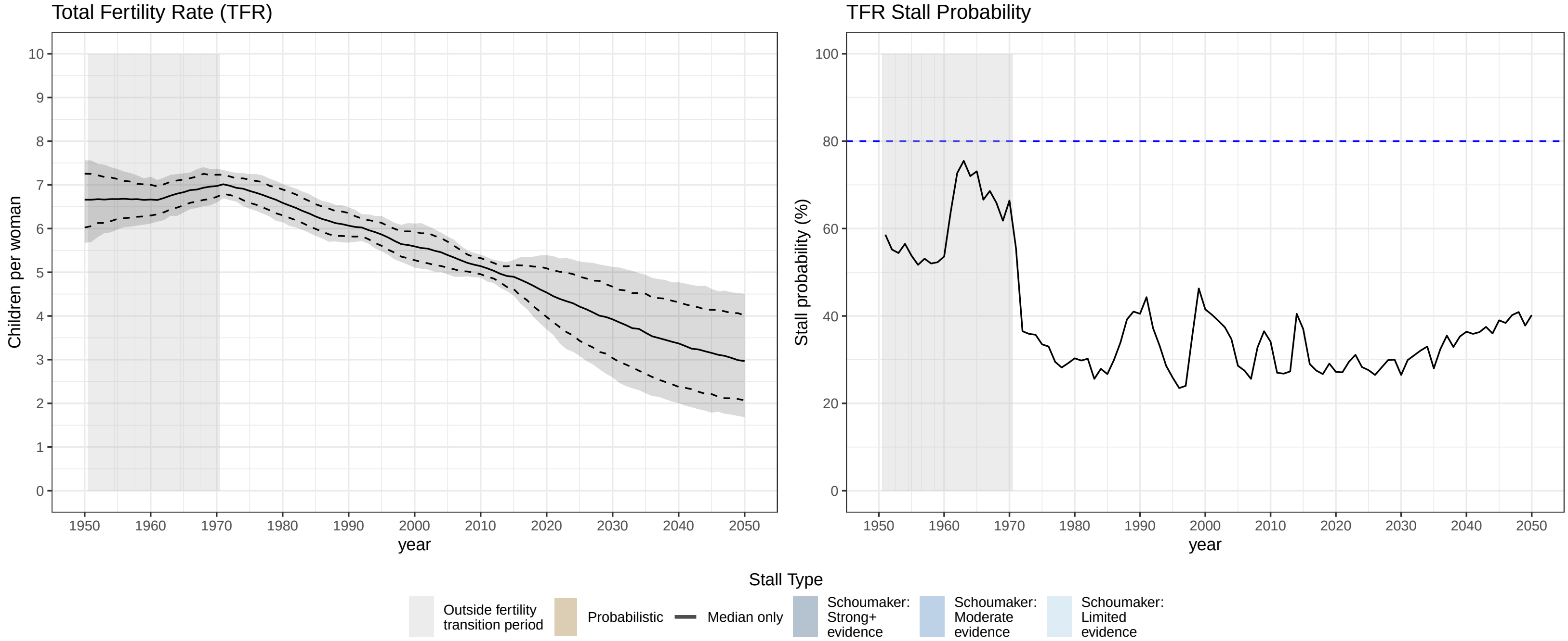
Libya (Northern Africa)



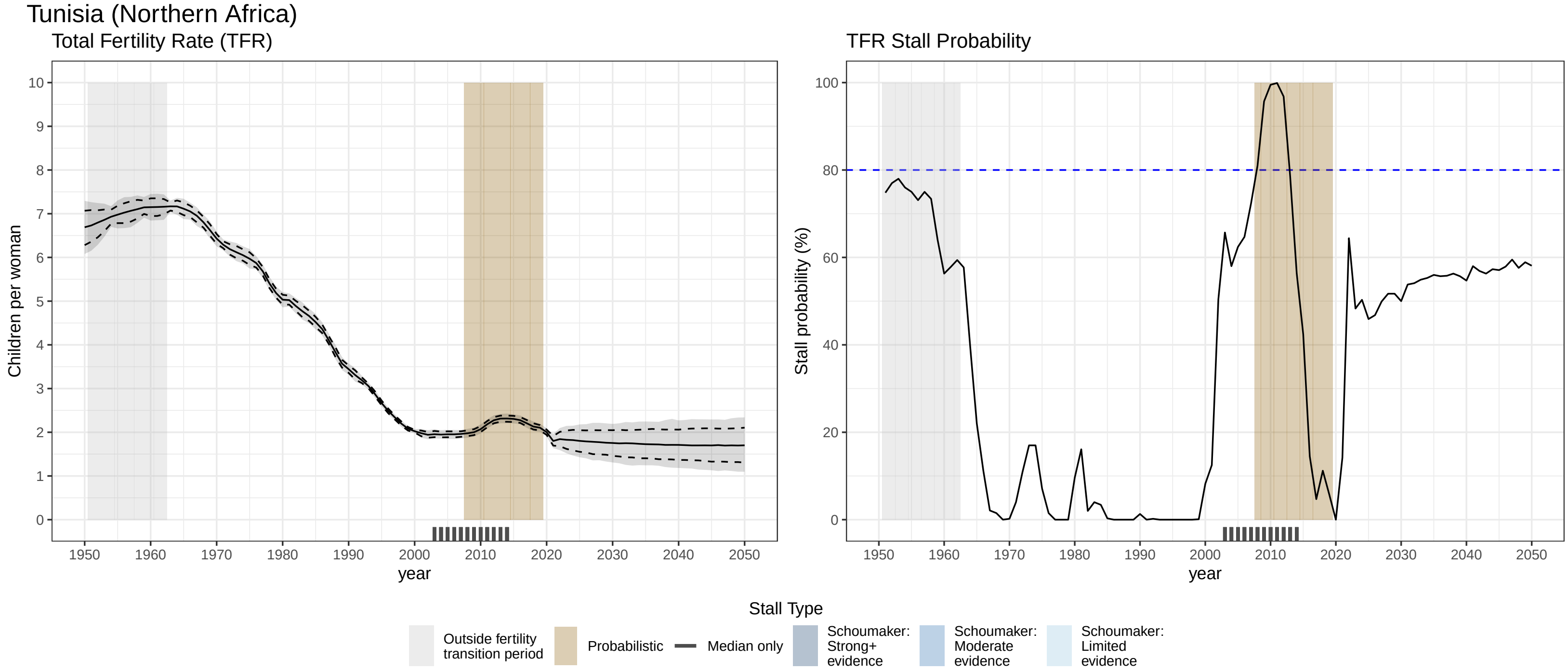
Morocco (Northern Africa)



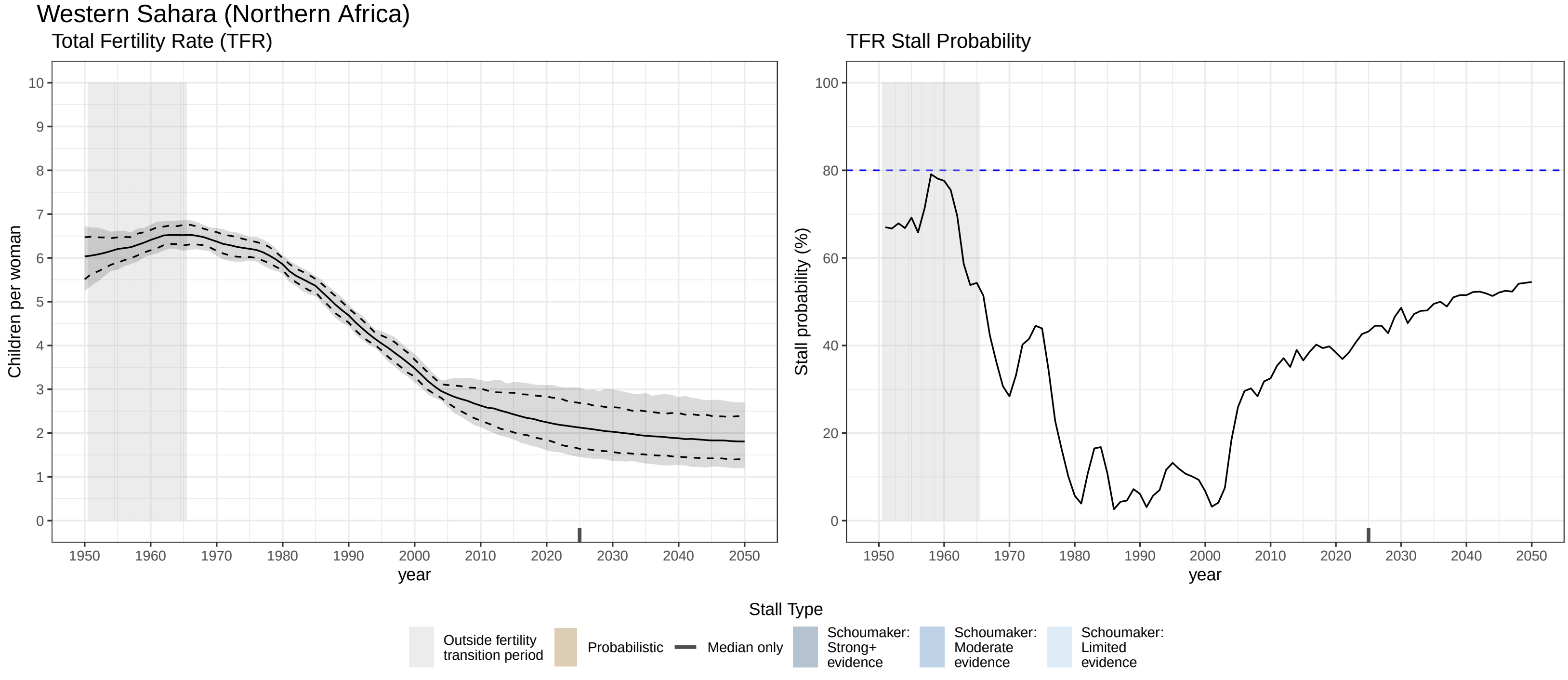
Sudan (Northern Africa)



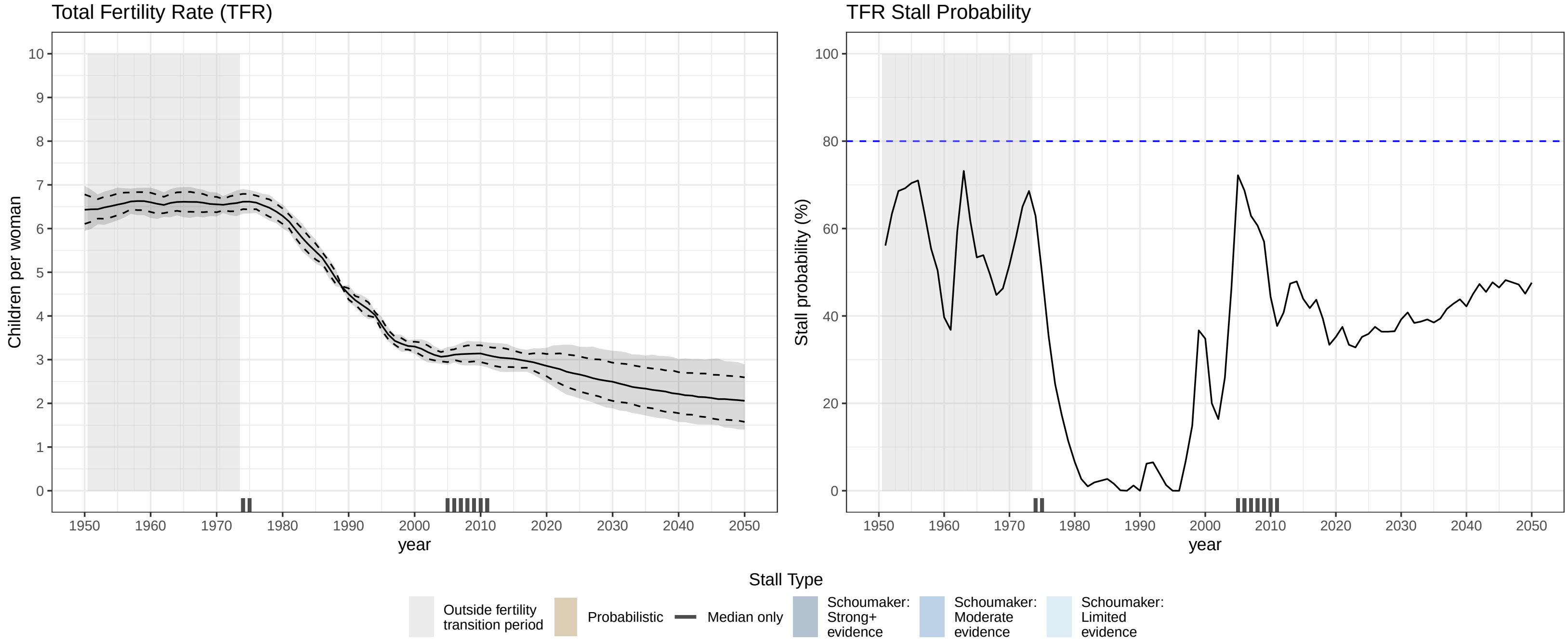
Tunisia (Northern Africa)



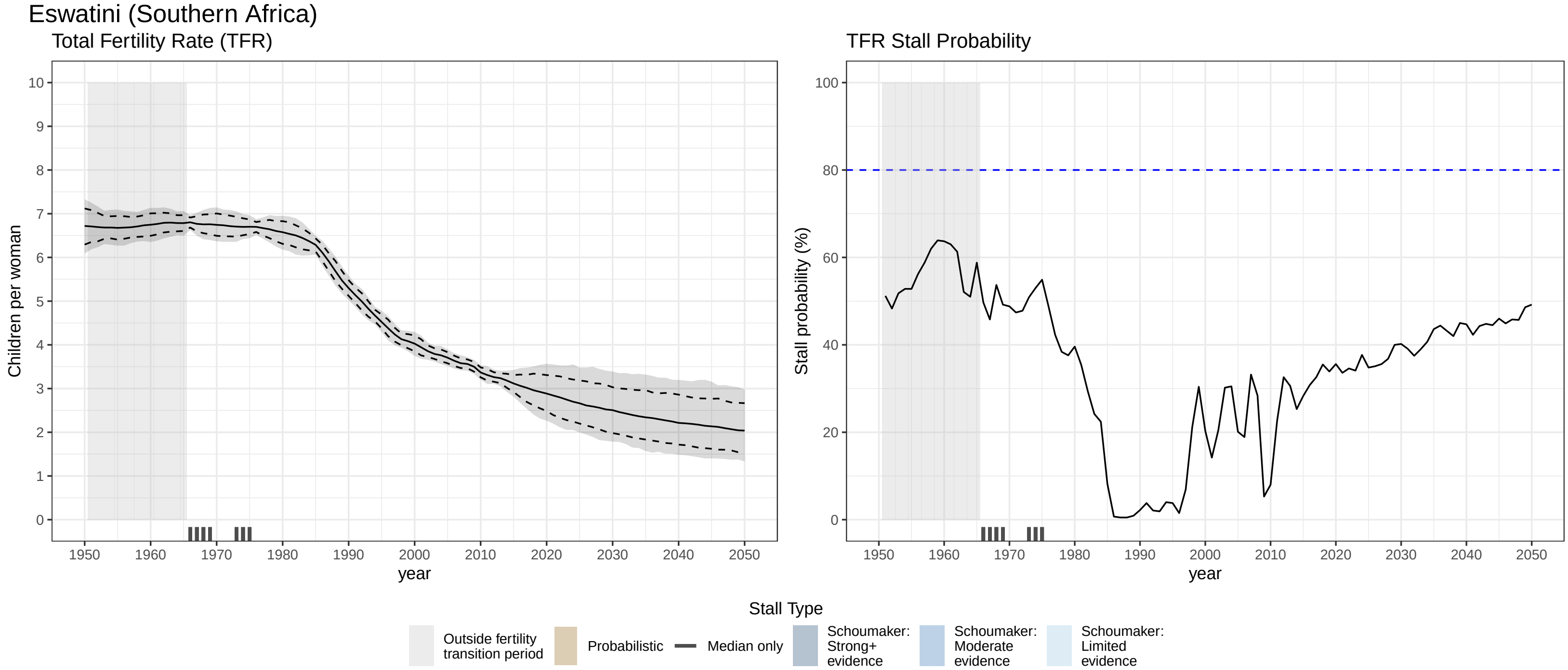
Western Sahara (Northern Africa)



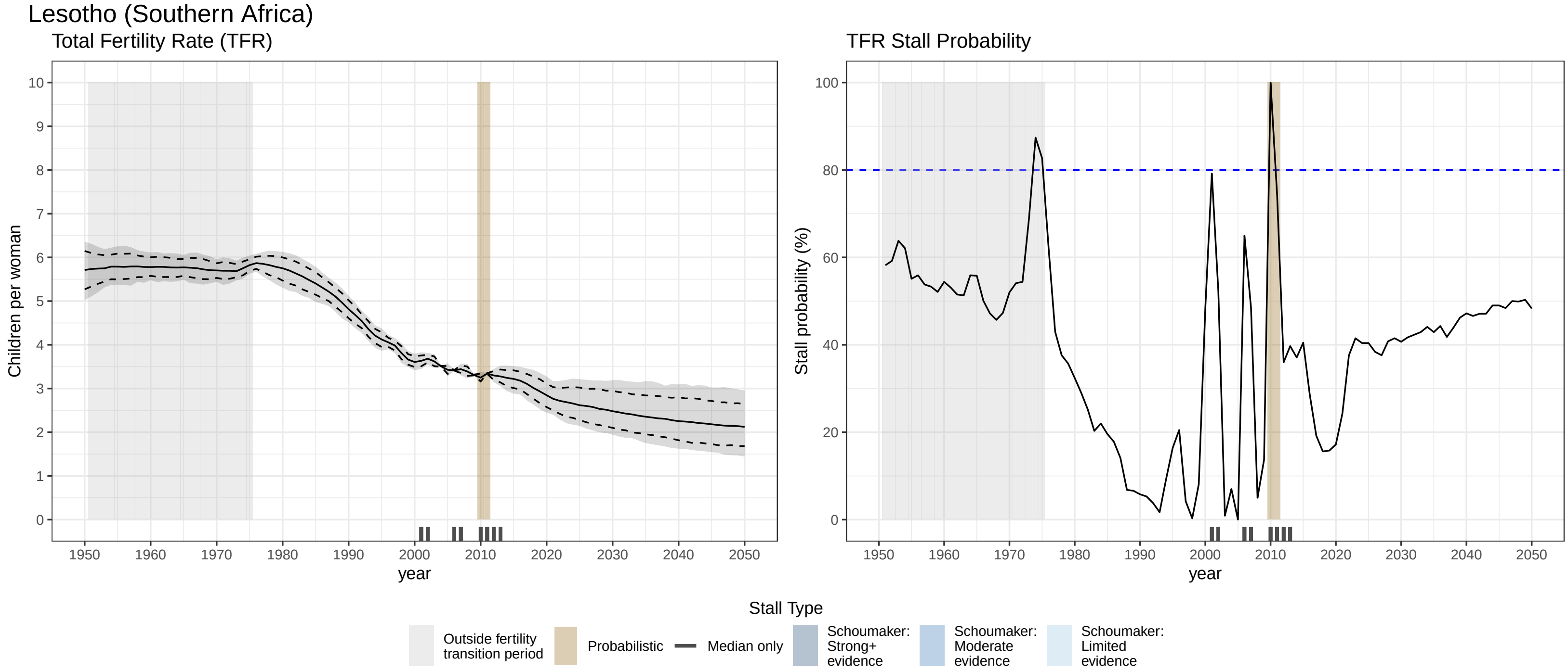
Botswana (Southern Africa)



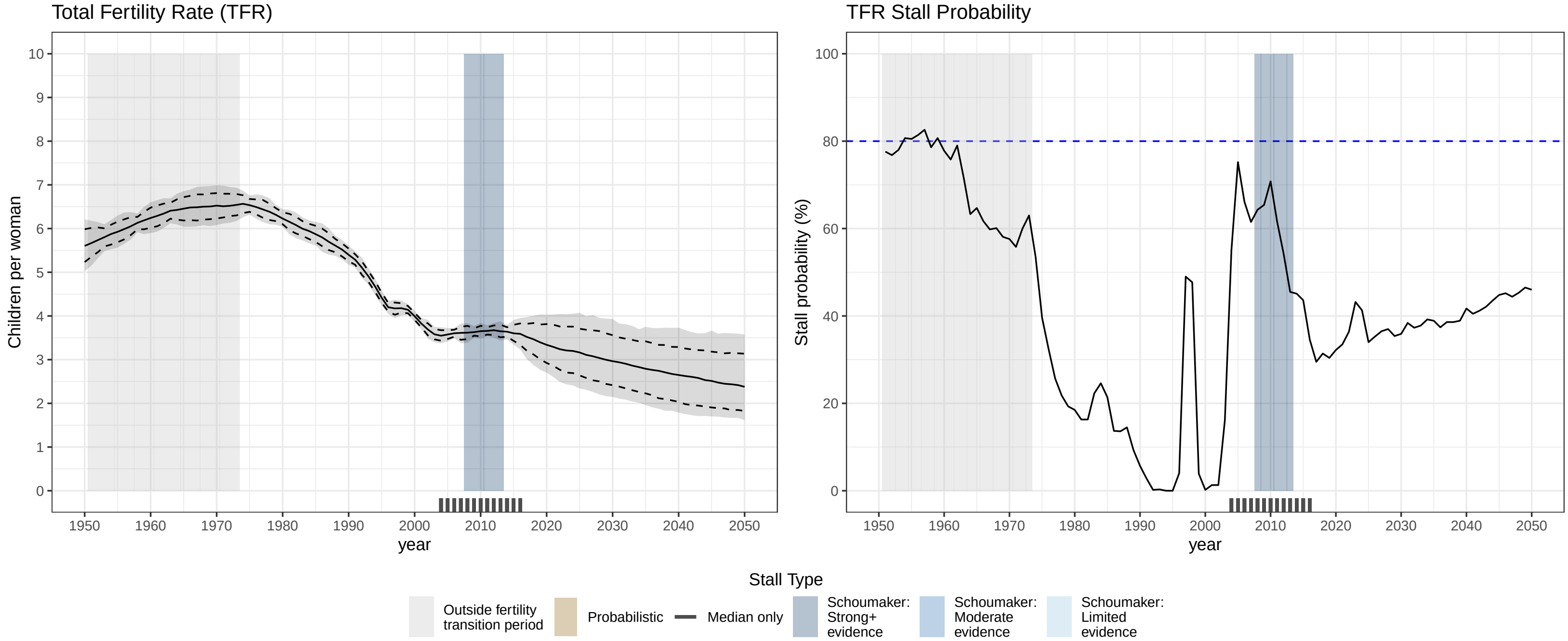
Eswatini (Southern Africa)



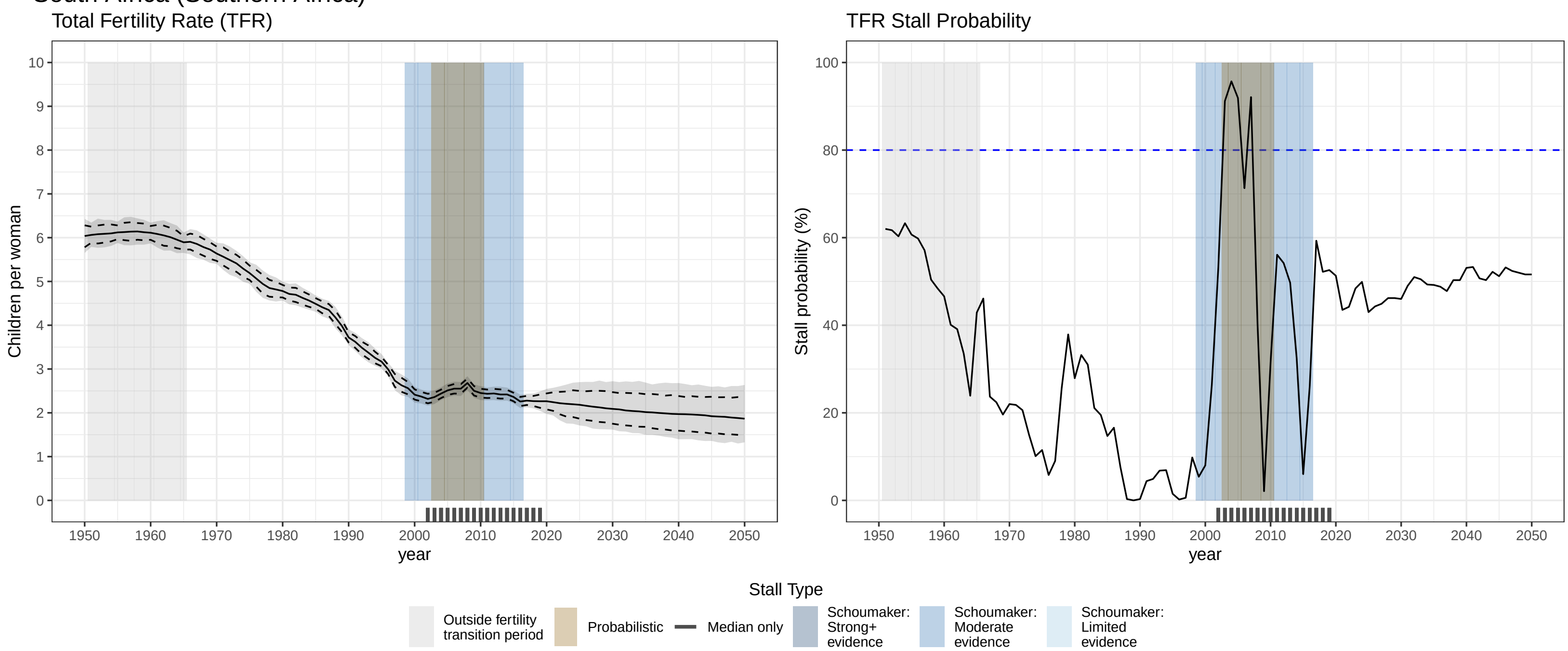
Lesotho (Southern Africa)



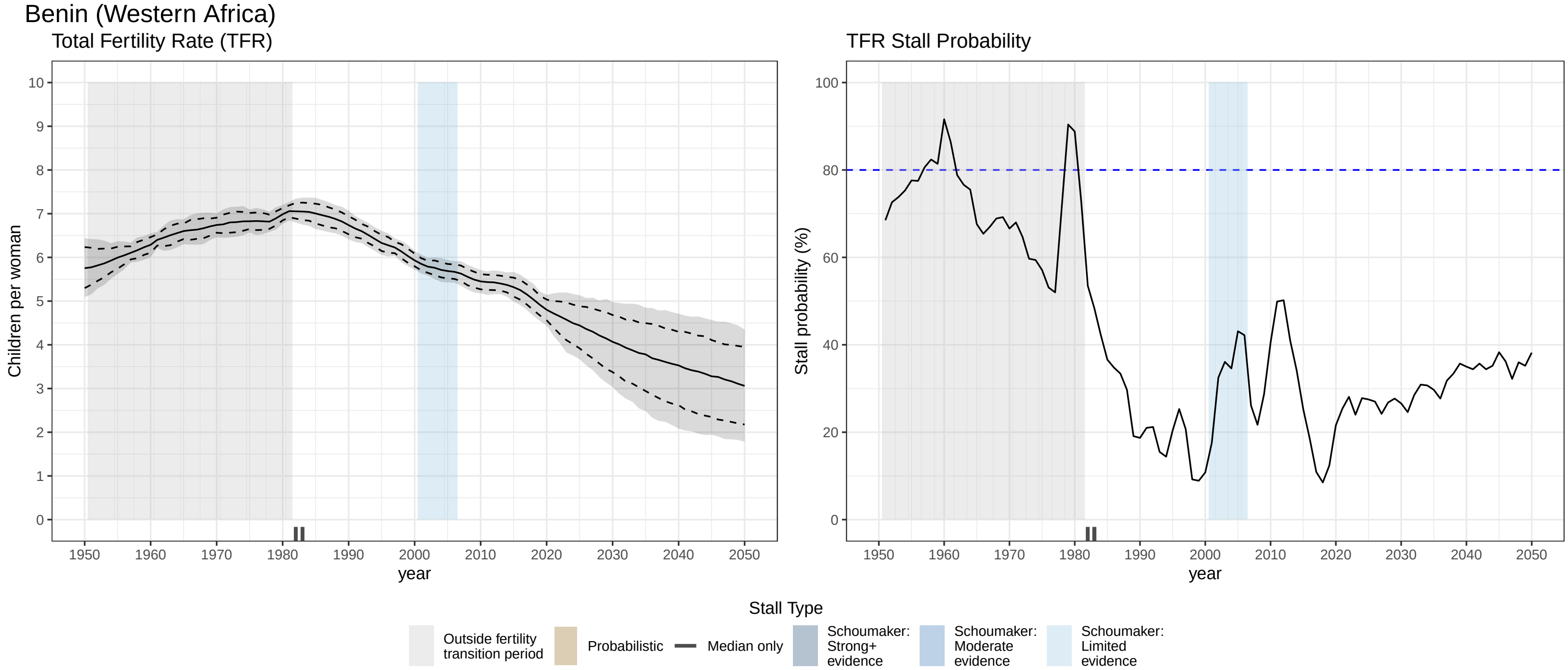
Namibia (Southern Africa)



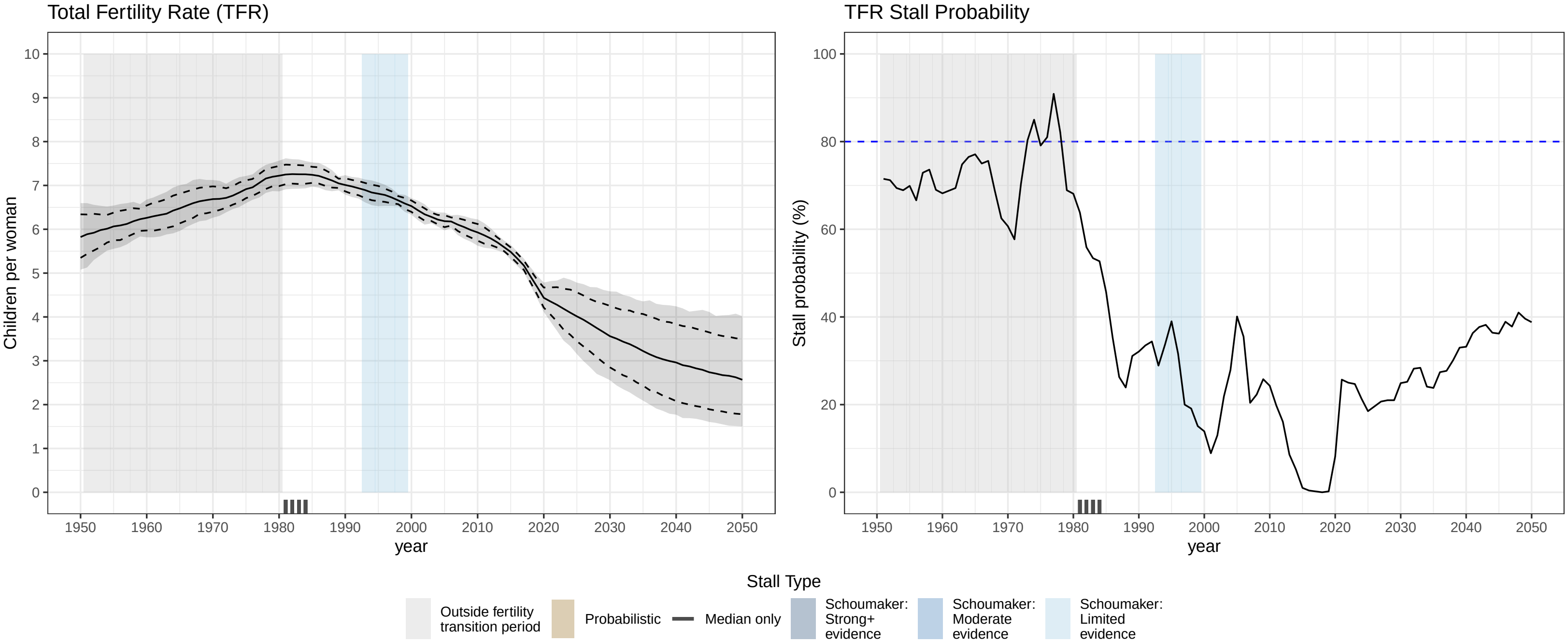
South Africa (Southern Africa)



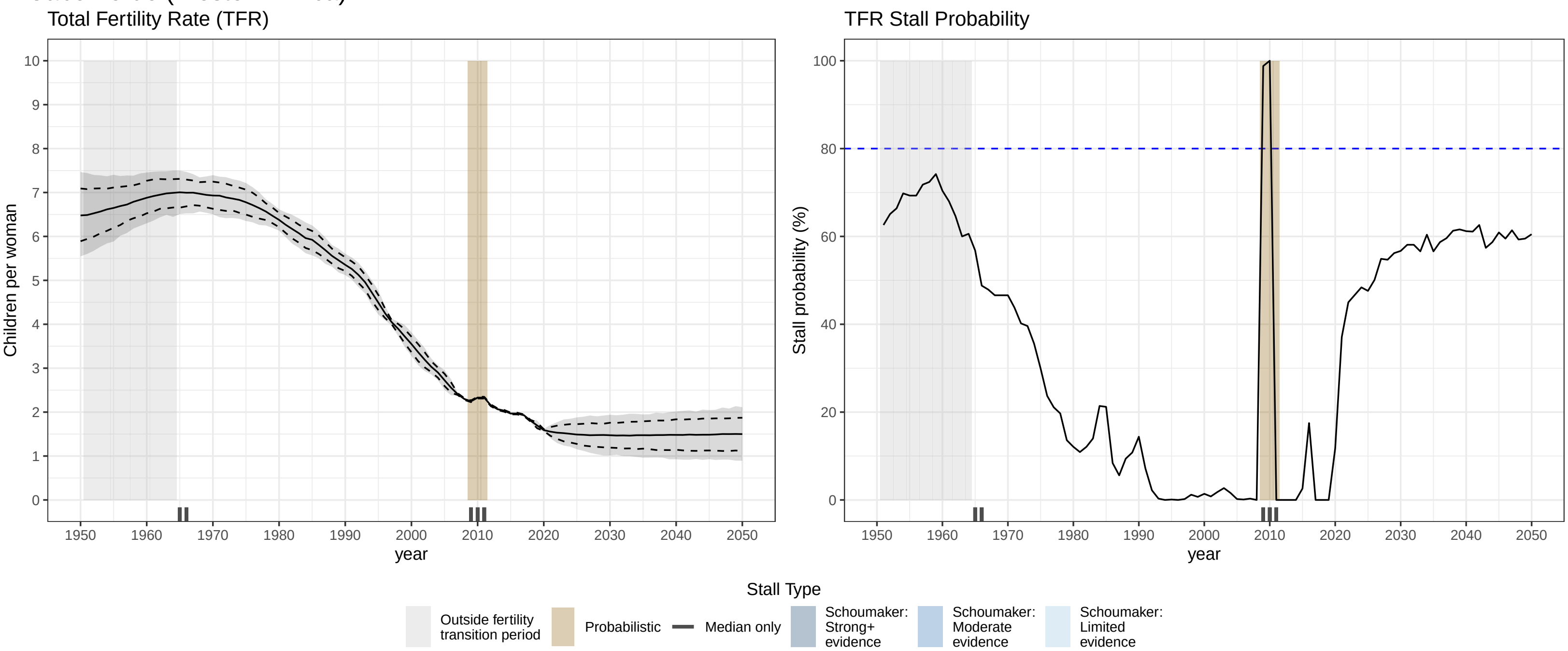
Benin (Western Africa)



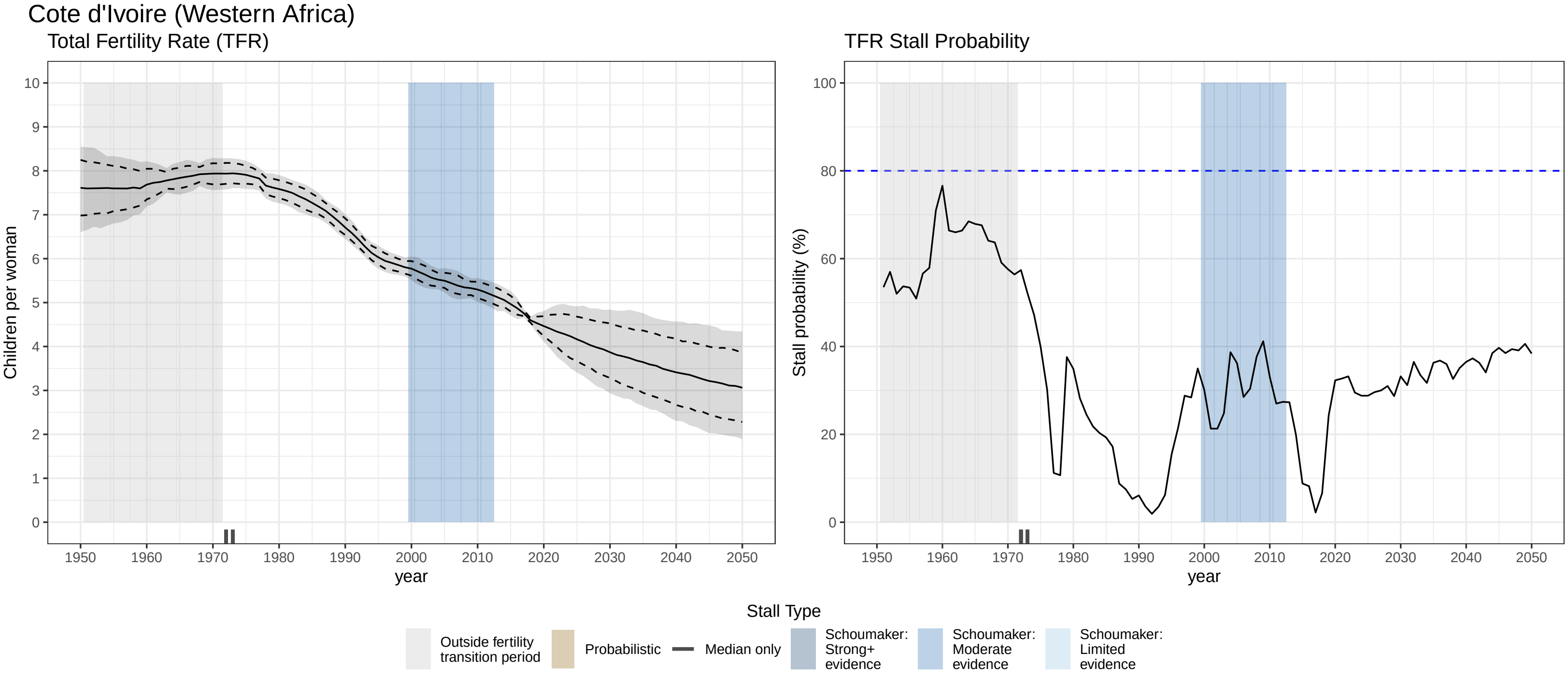
Burkina Faso (Western Africa)



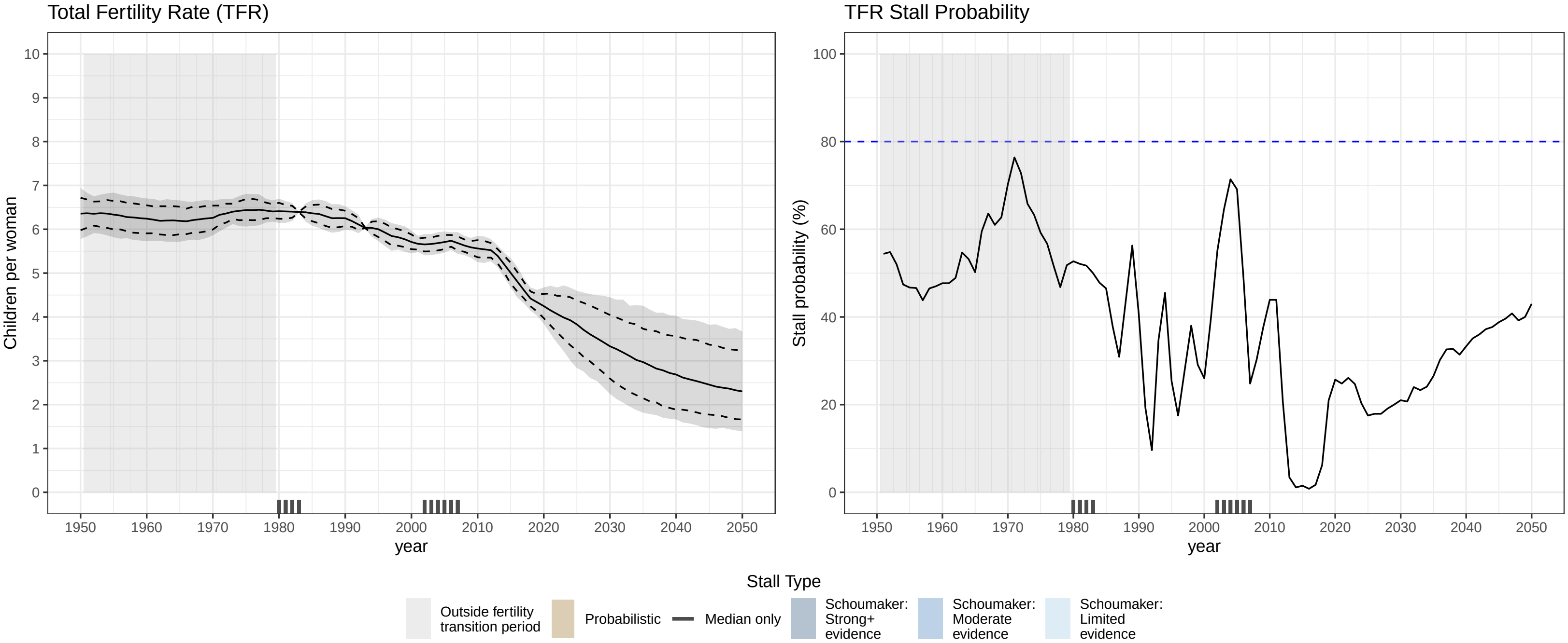
Cabo Verde (Western Africa)



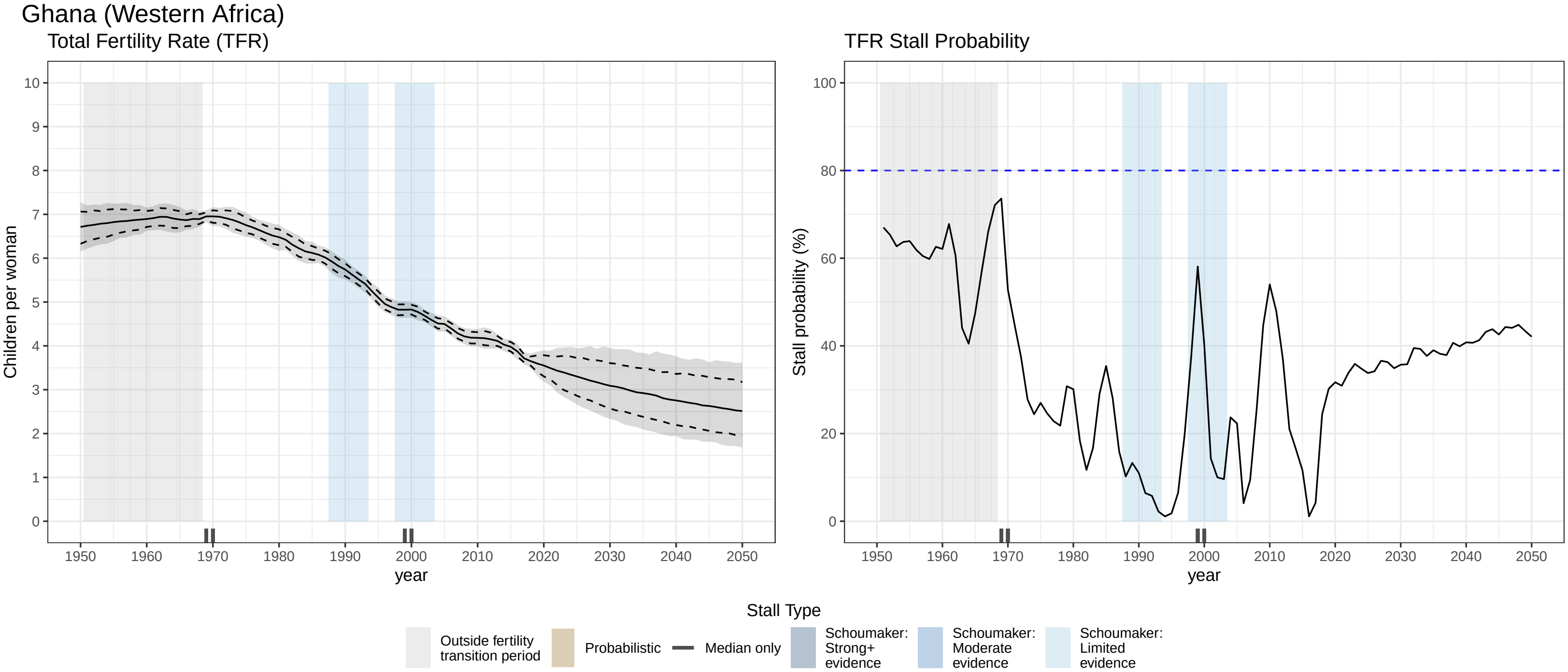
Cote d'Ivoire (Western Africa)



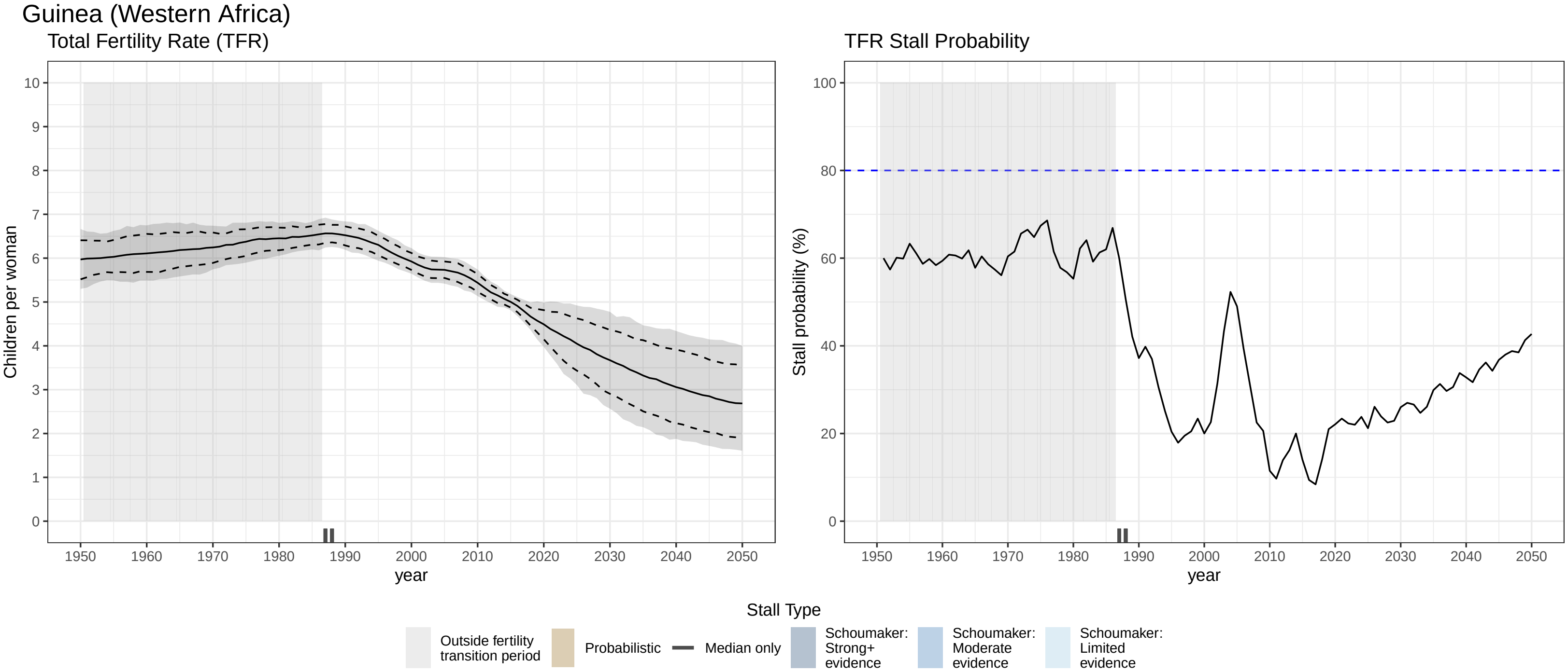
Gambia (Western Africa)



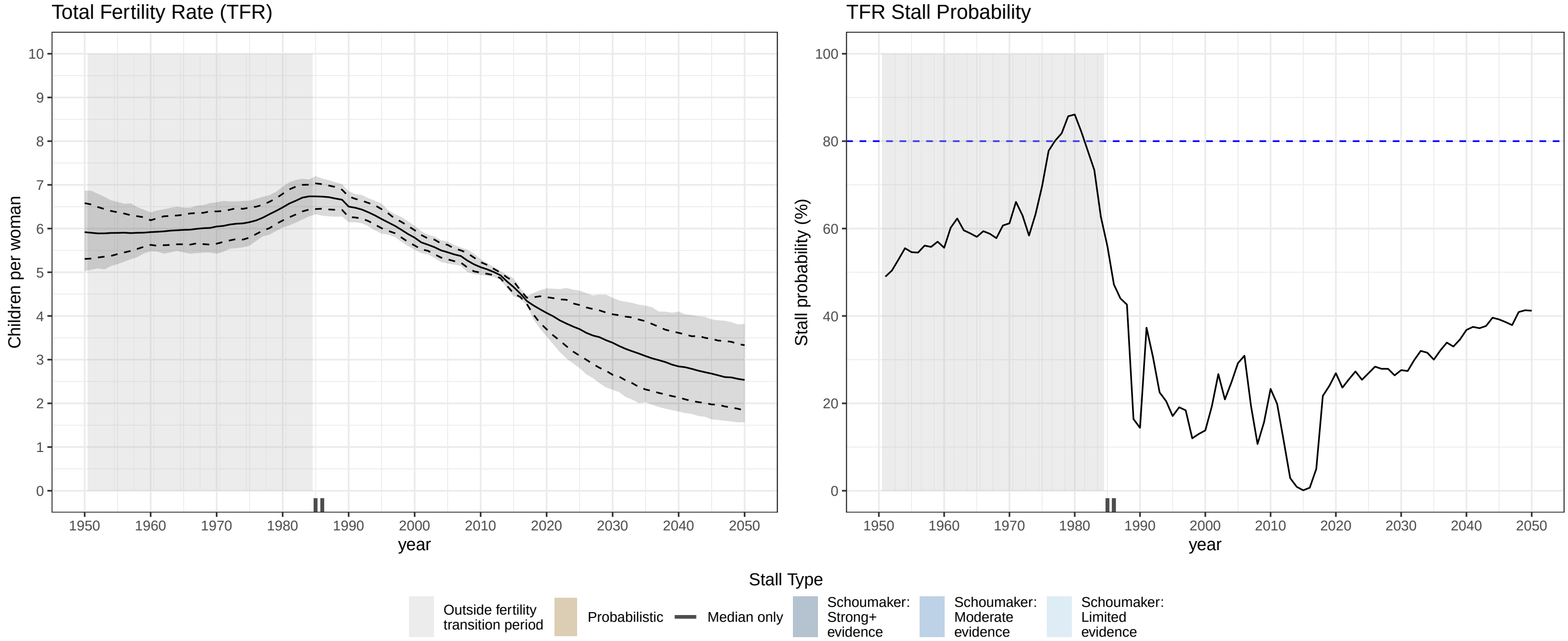
Ghana (Western Africa)



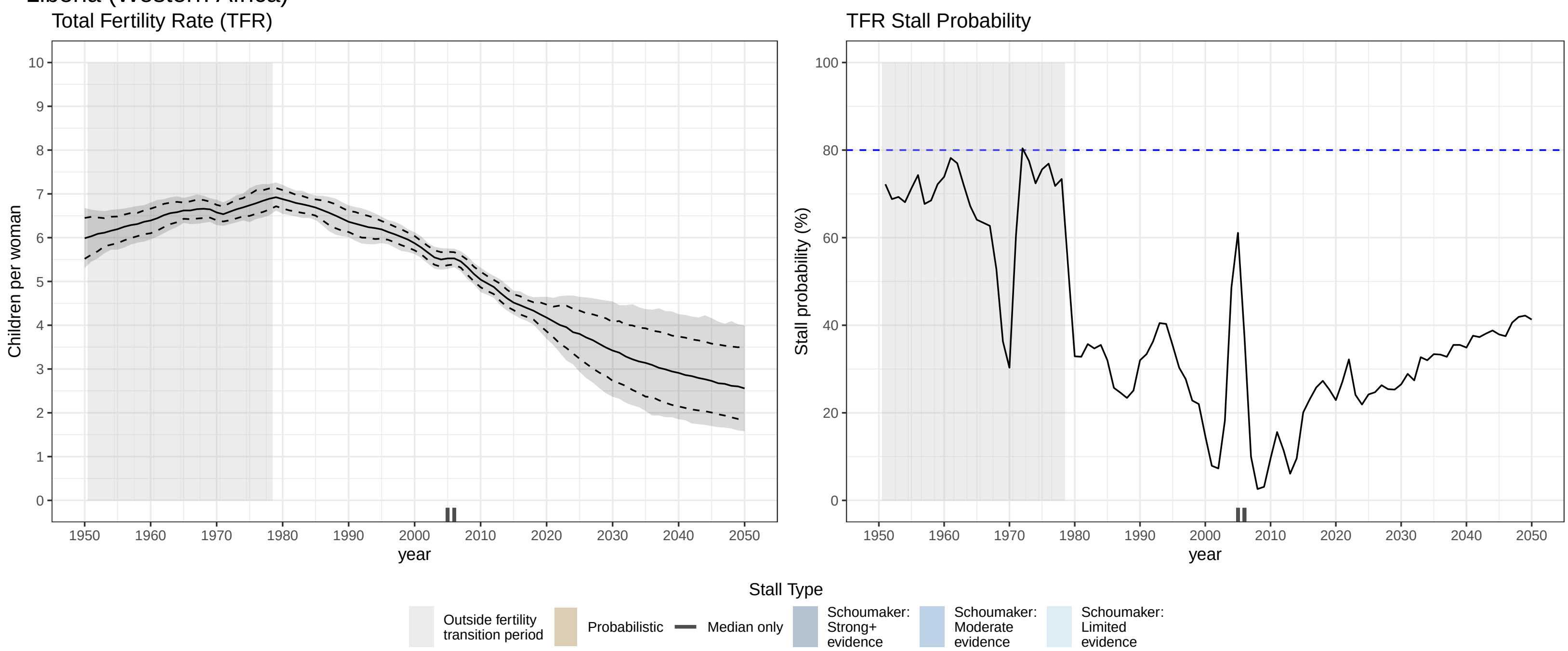
Guinea (Western Africa)



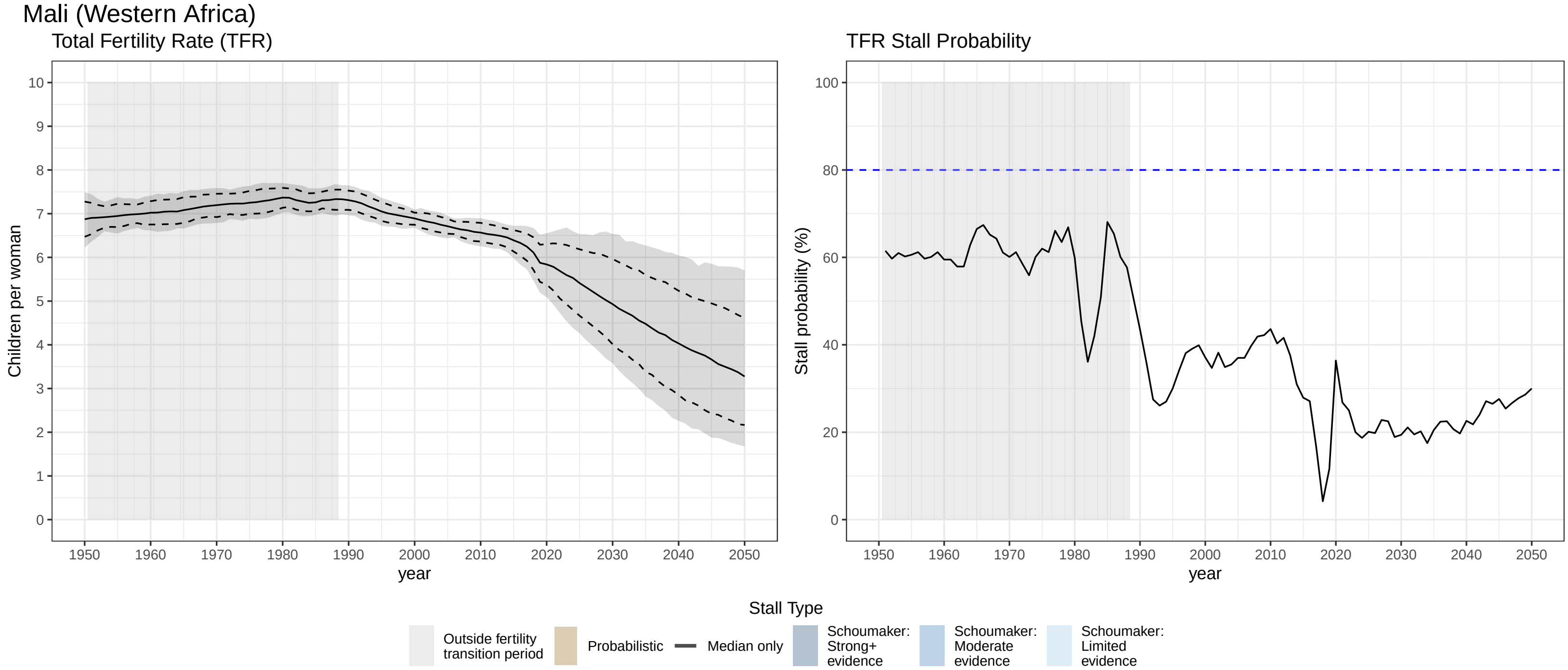
Guinea−Bissau (Western Africa)



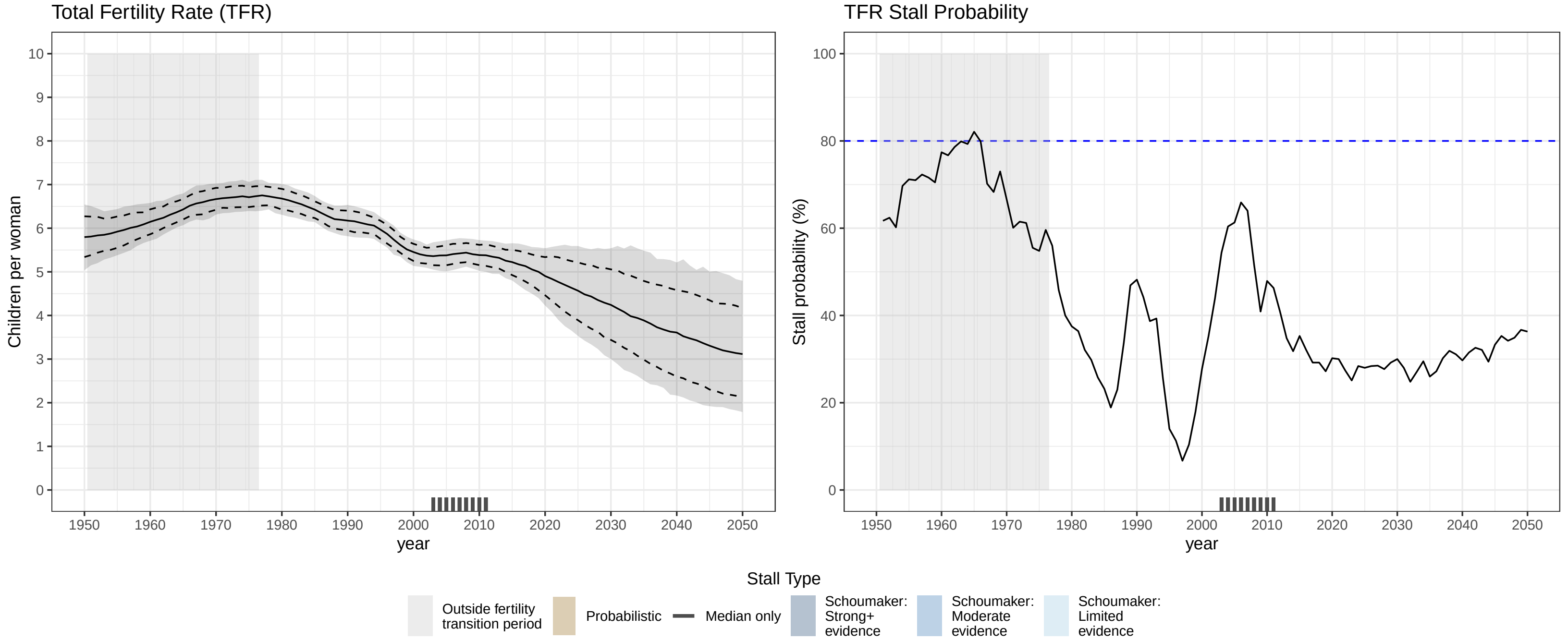
Liberia (Western Africa)



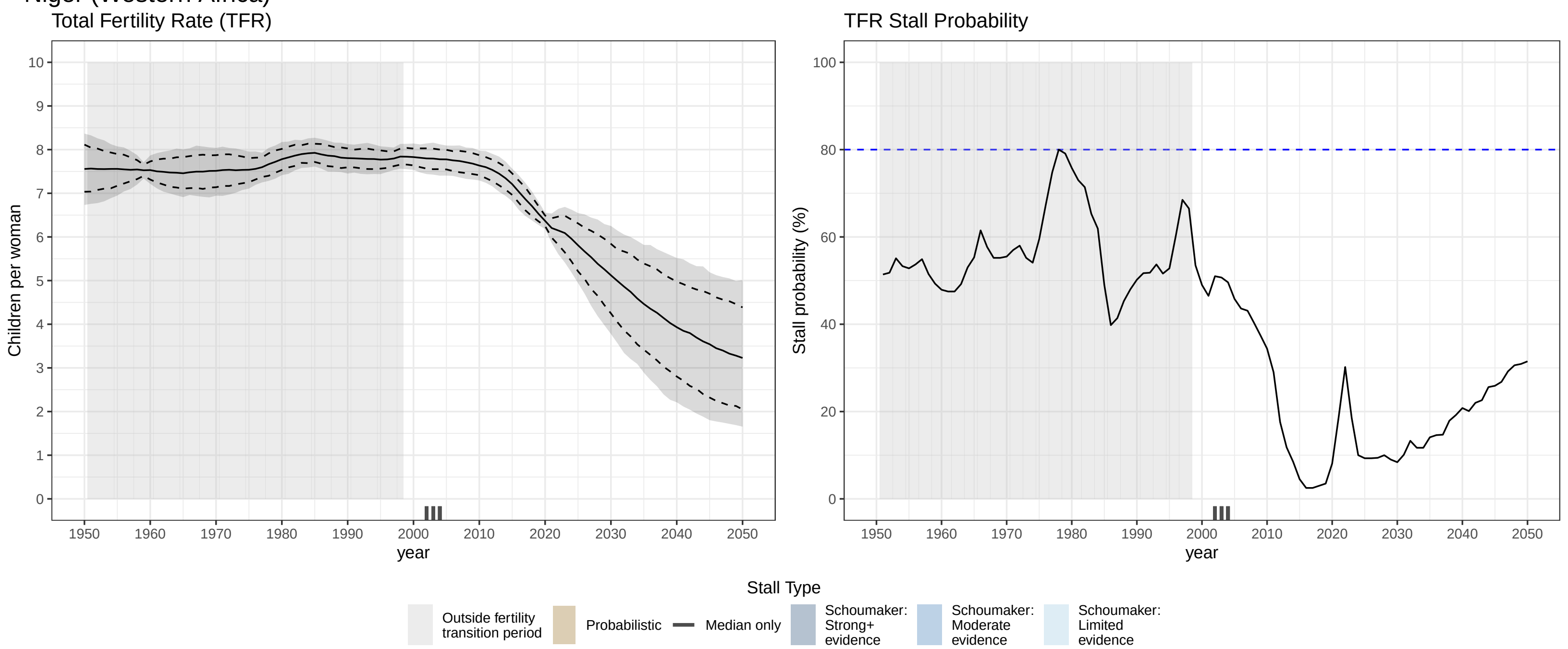
Mali (Western Africa)



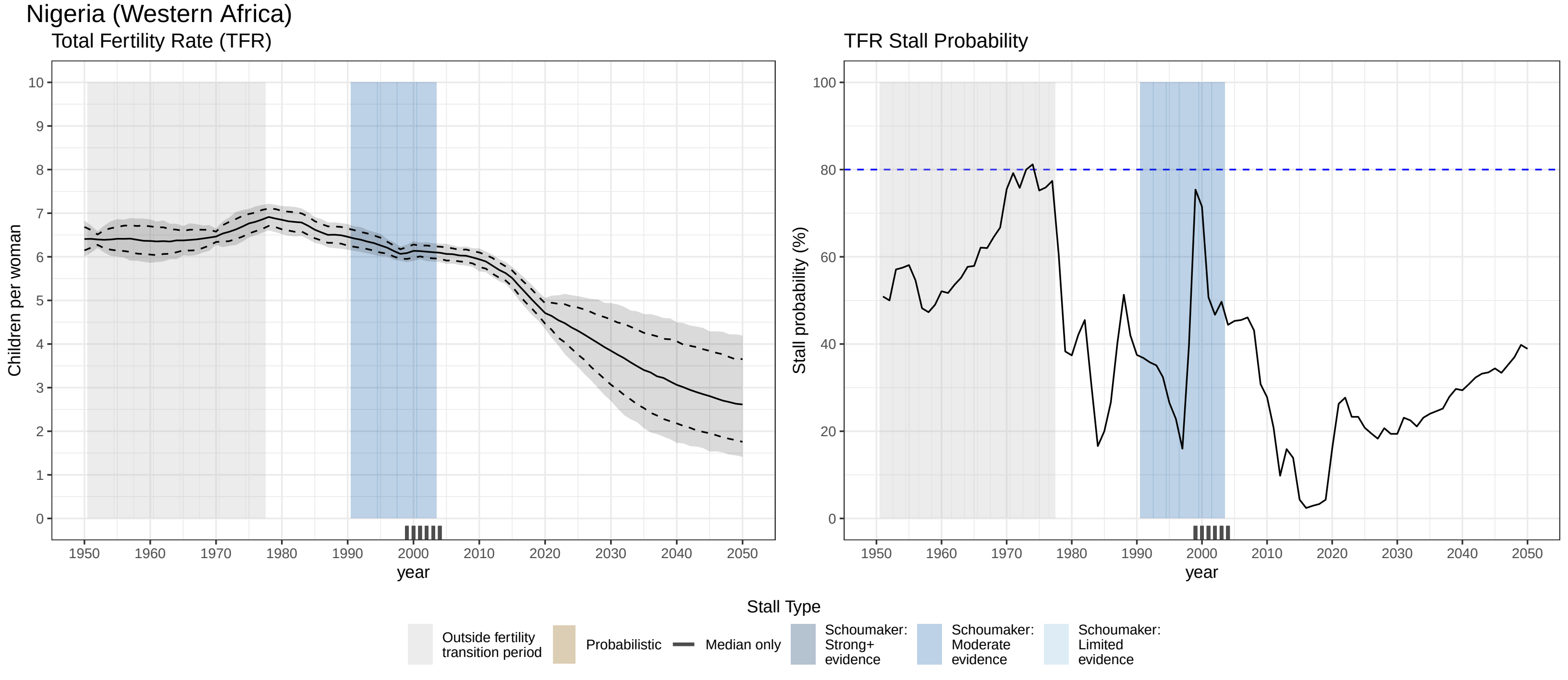
Mauritania (Western Africa)



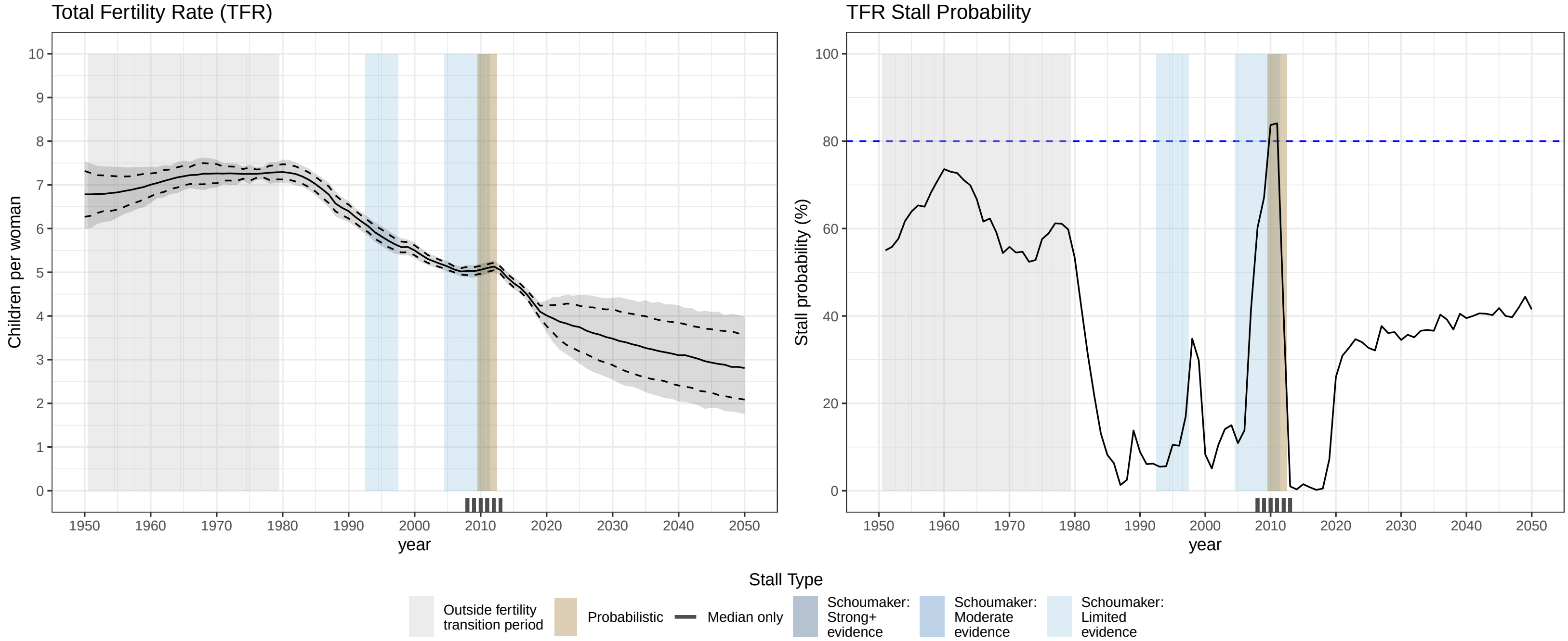
Niger (Western Africa)



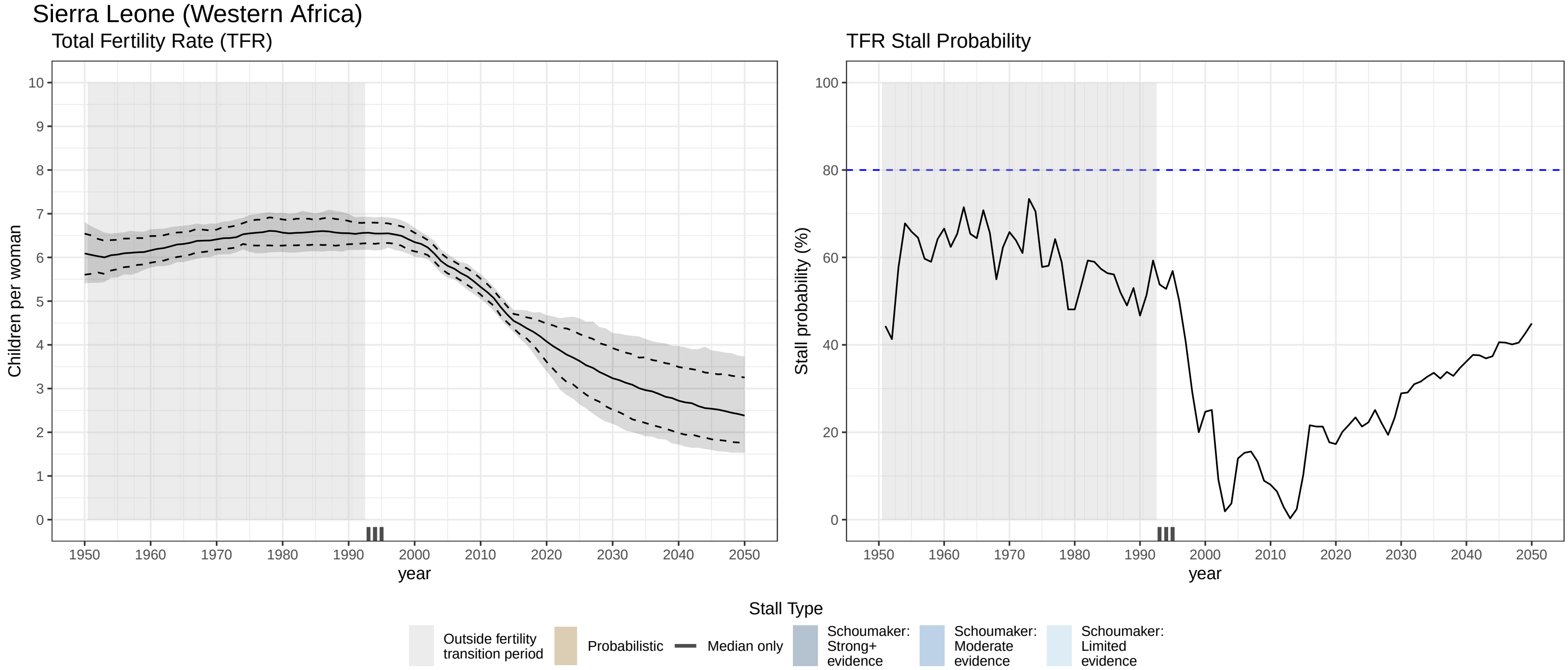
Nigeria (Western Africa)



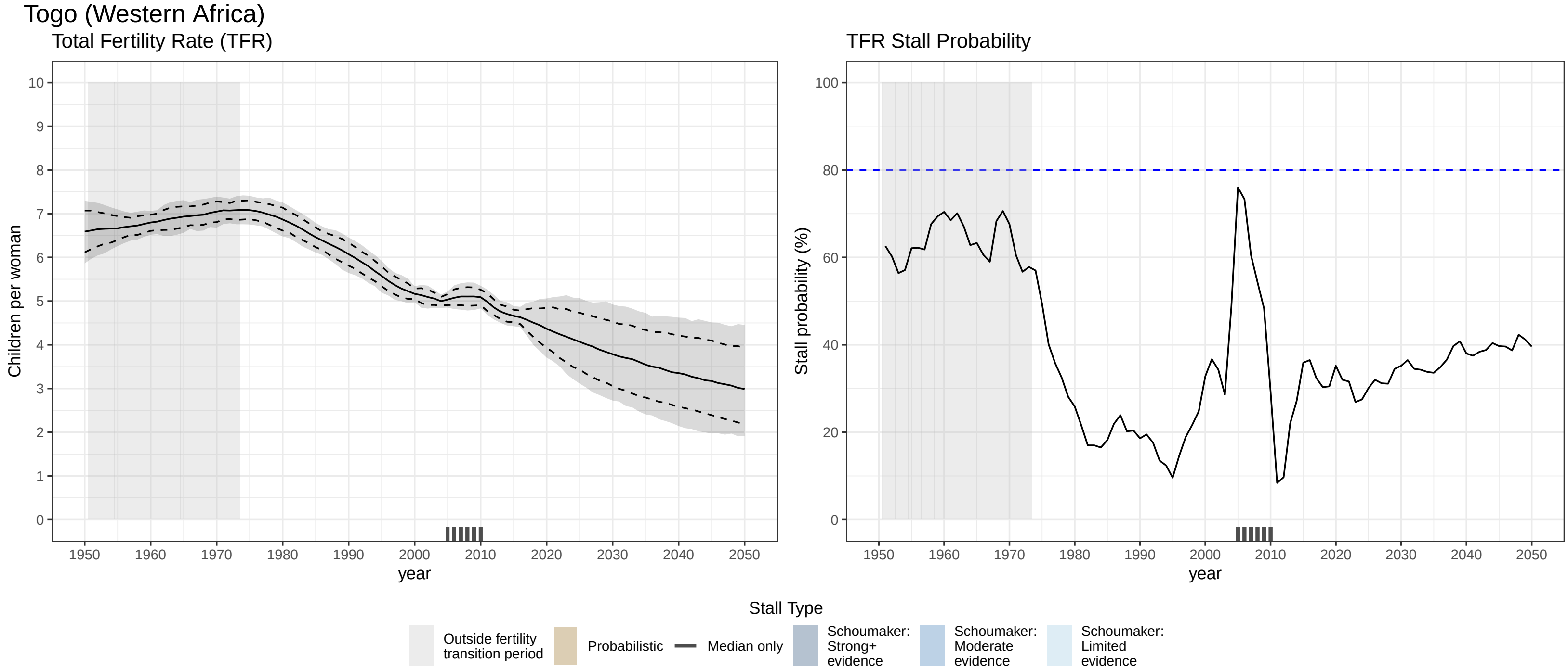
Senegal (Western Africa)



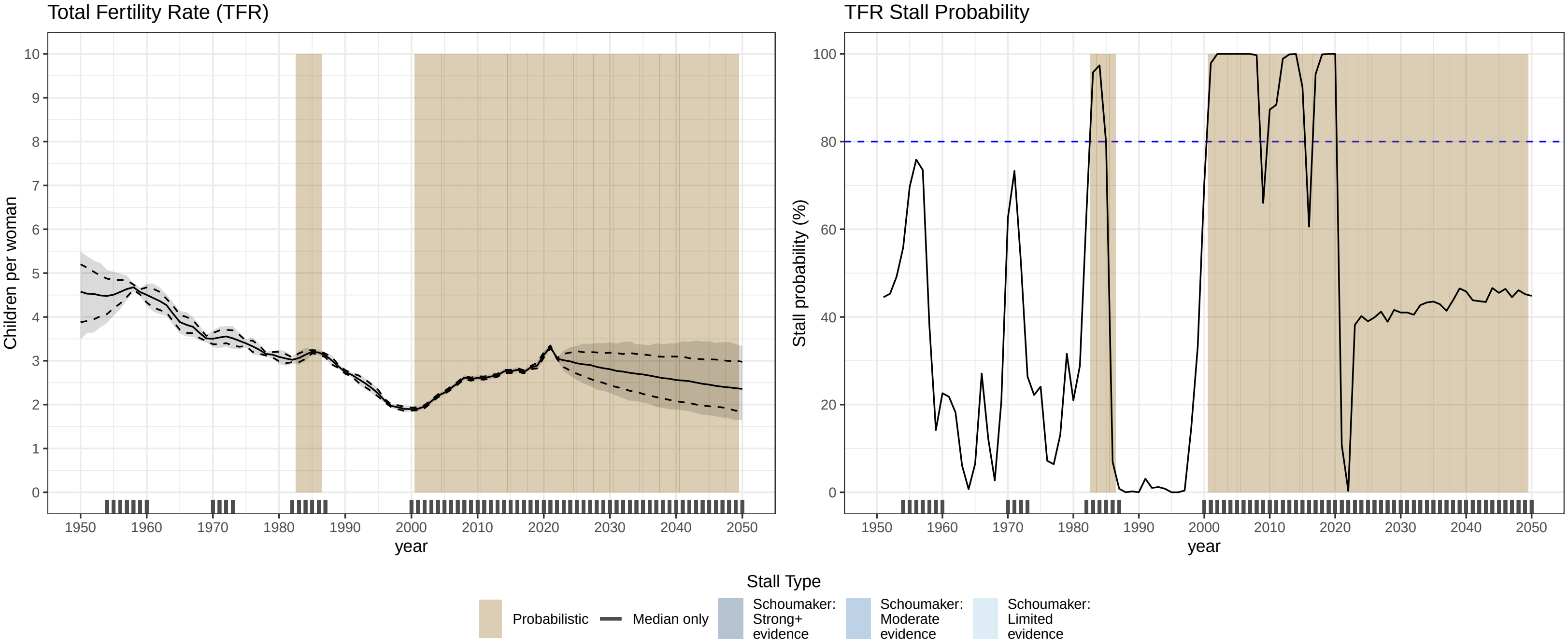
Sierra Leone (Western Africa)



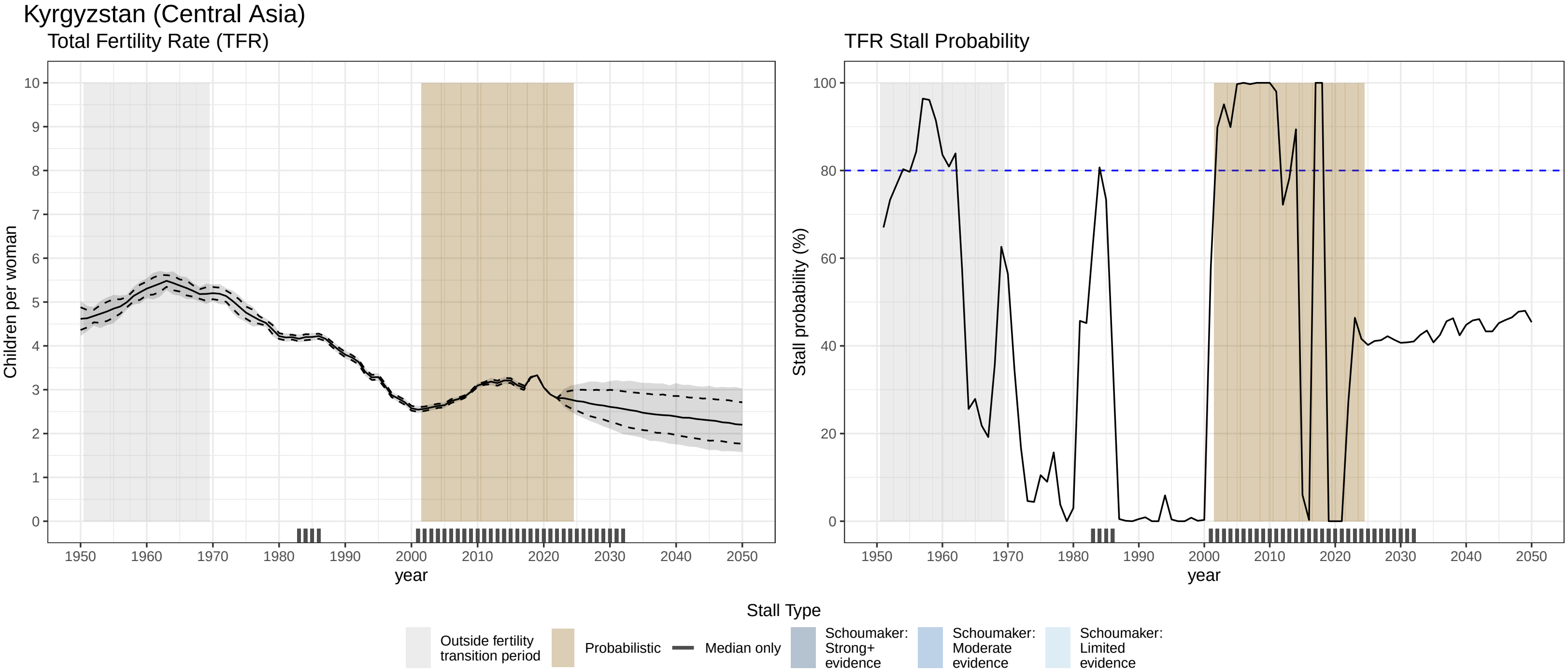
Togo (Western Africa)



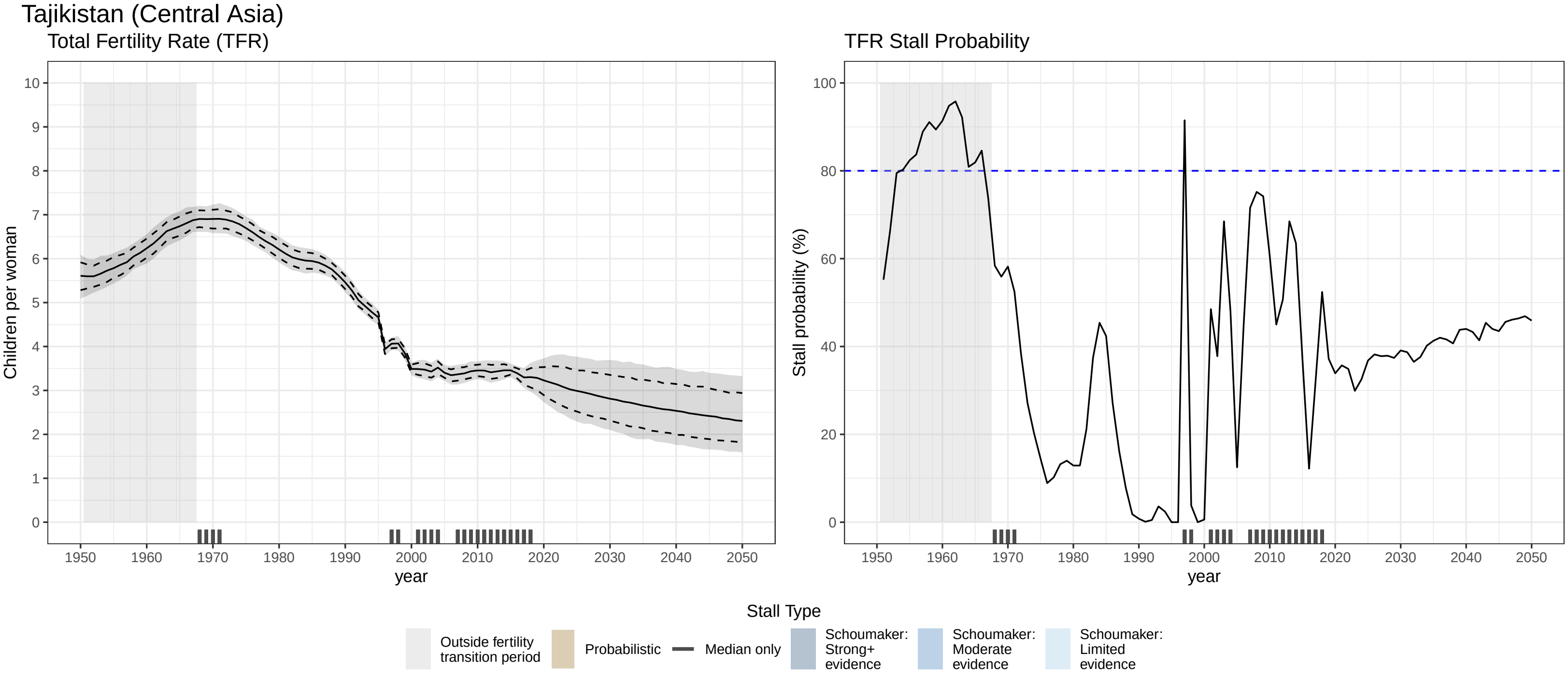
Kazakhstan (Central Asia)

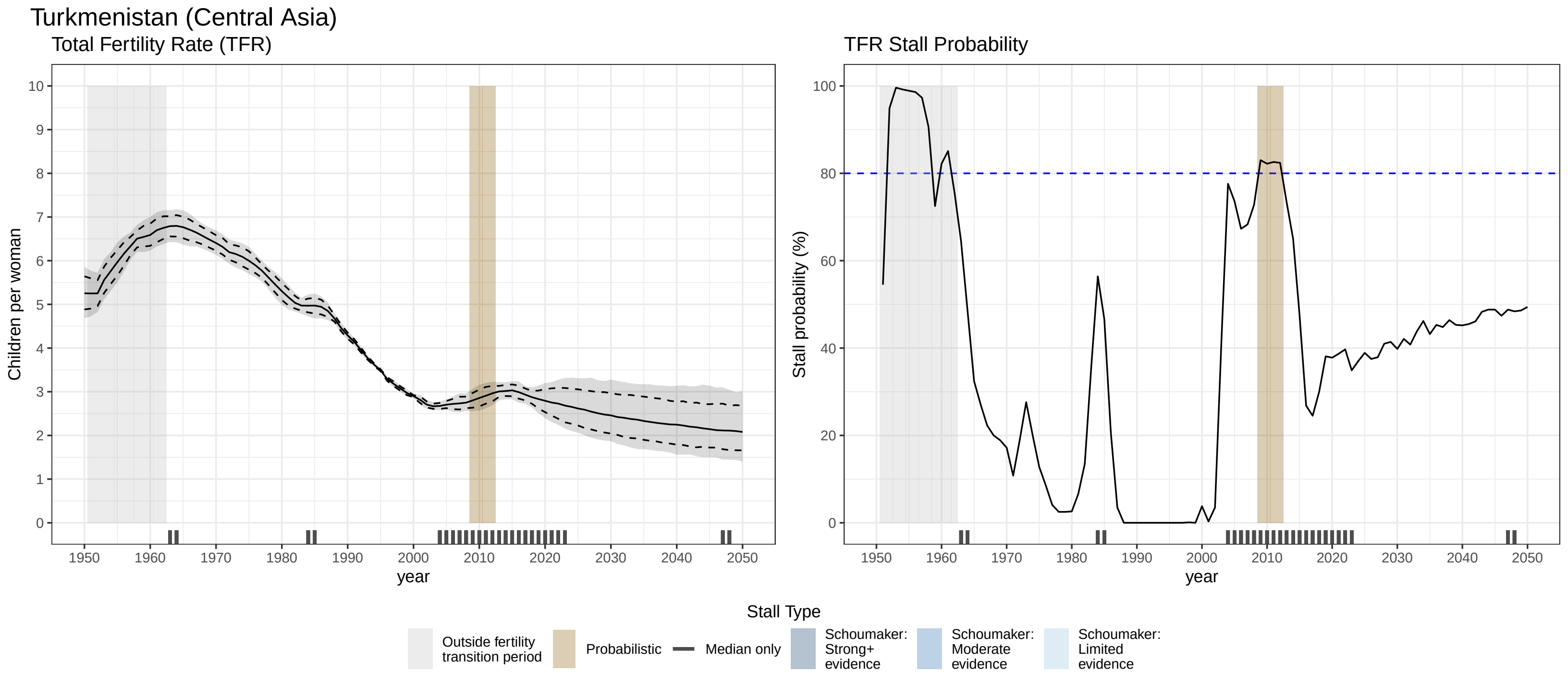


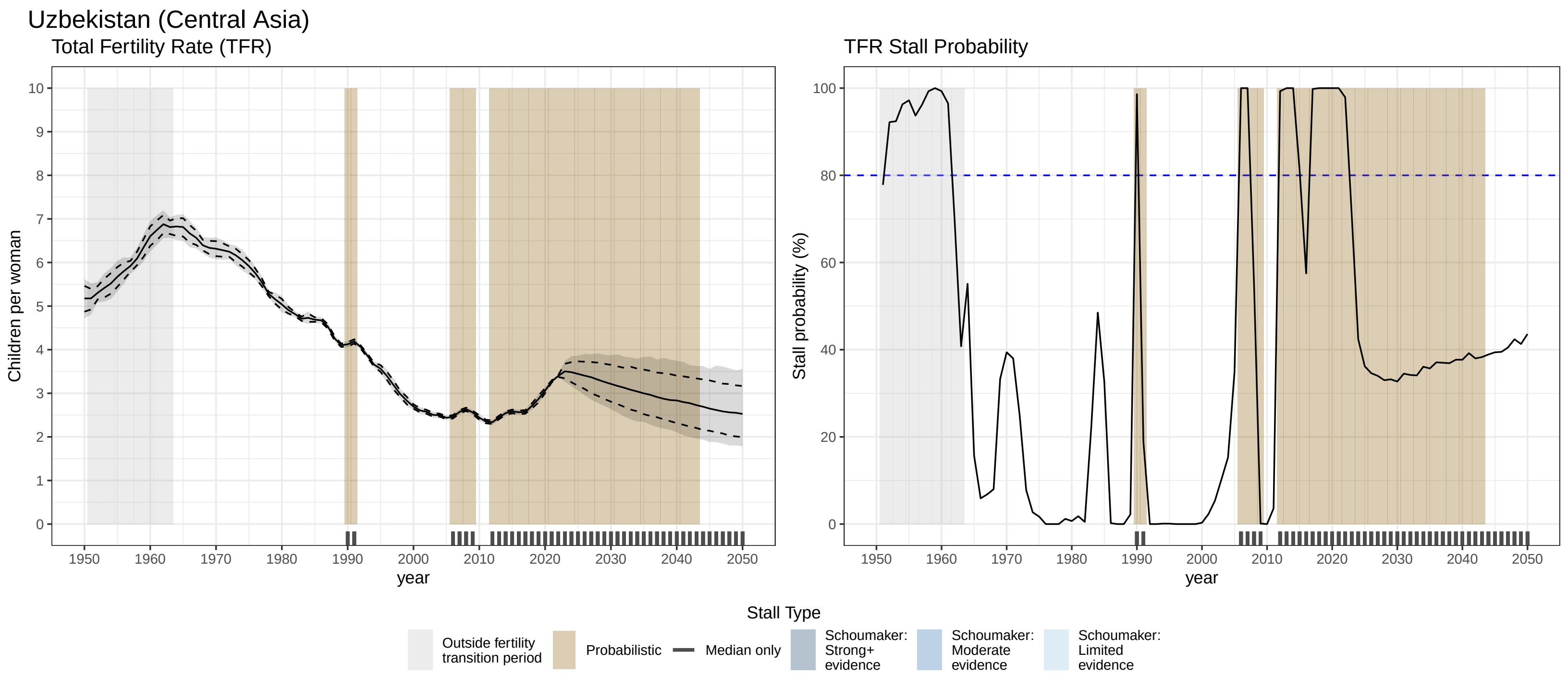
Kyrgyzstan (Central Asia)

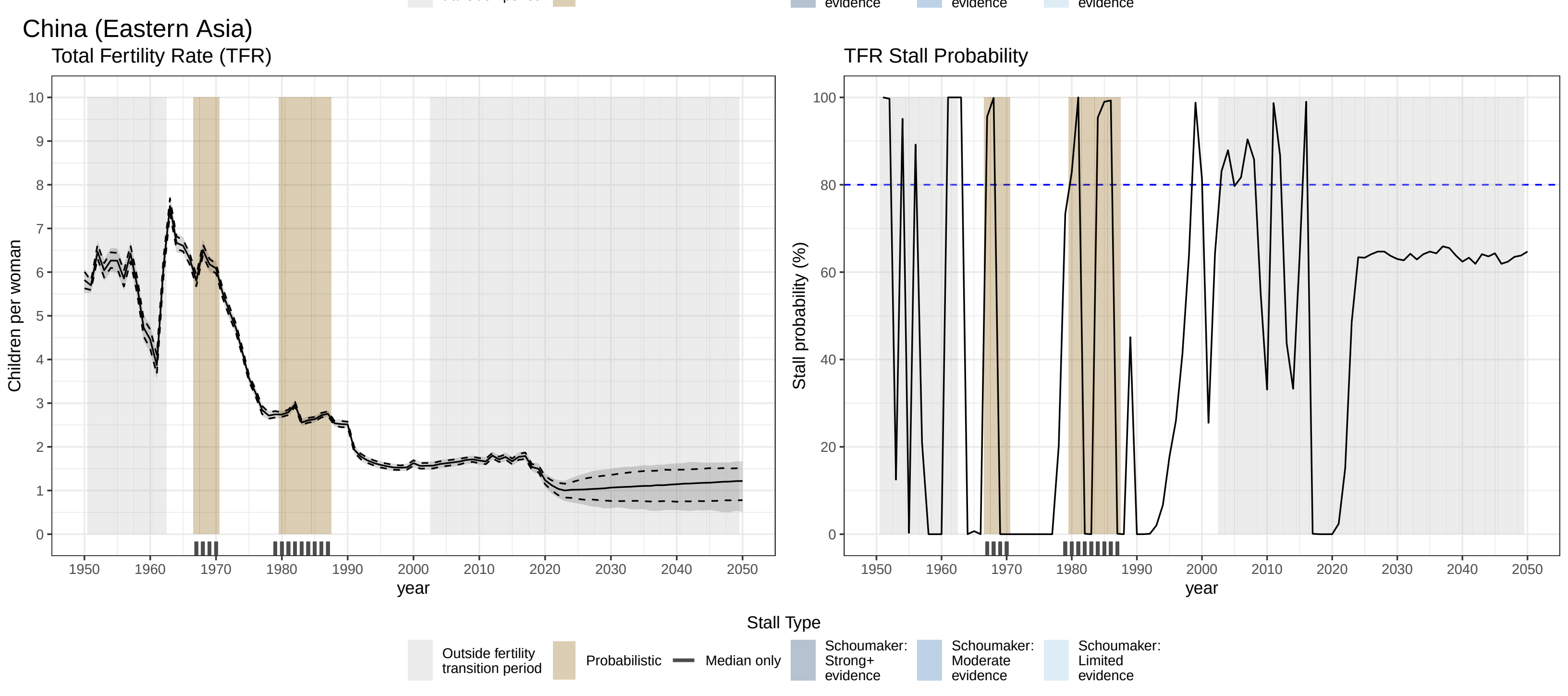


Tajikistan (Central Asia)

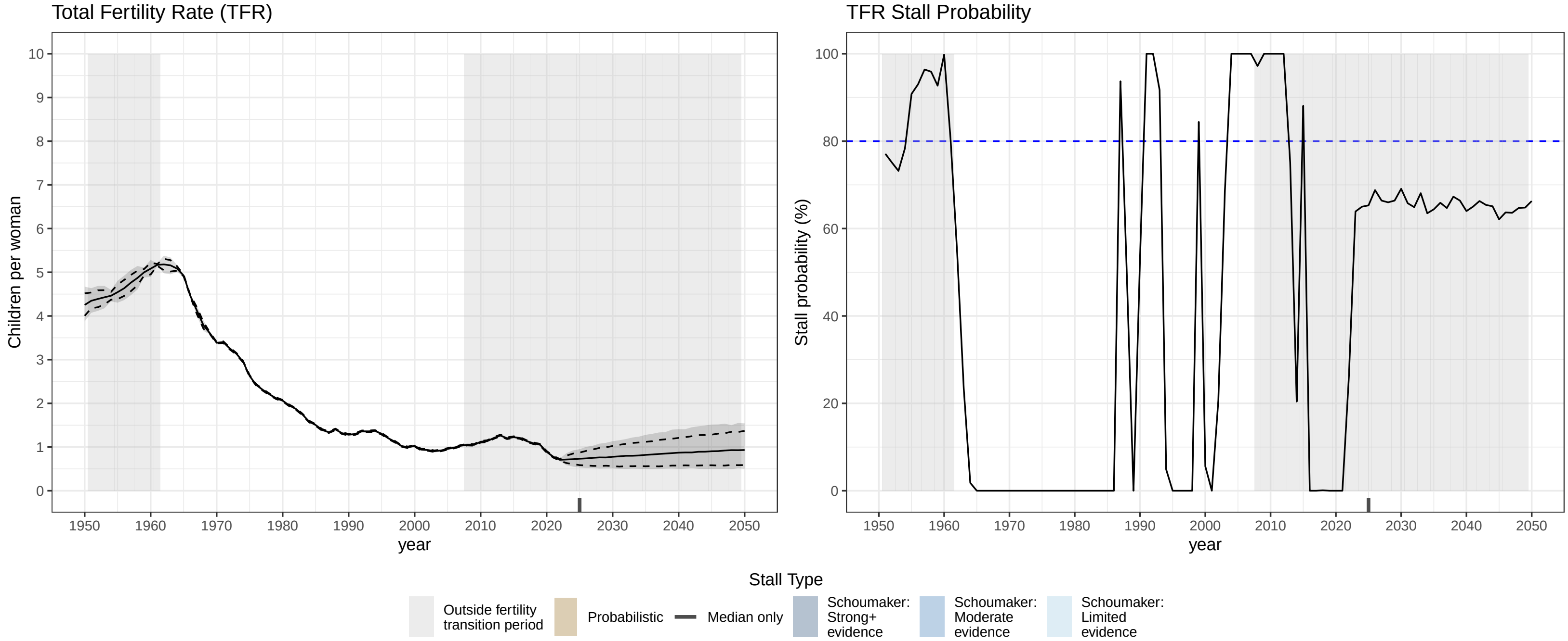



Turkmenistan (Central Asia)
Total Fertility Rate (TFR)
Children per woman
year
TFR Stall Probability
Stall probability (%)
year
Stall Type
Outside fertility transition period
Probabilistic
Median only
Schoumaker: Strong+ evidence
Schoumaker: Moderate evidence
Schoumaker: Limited evidence

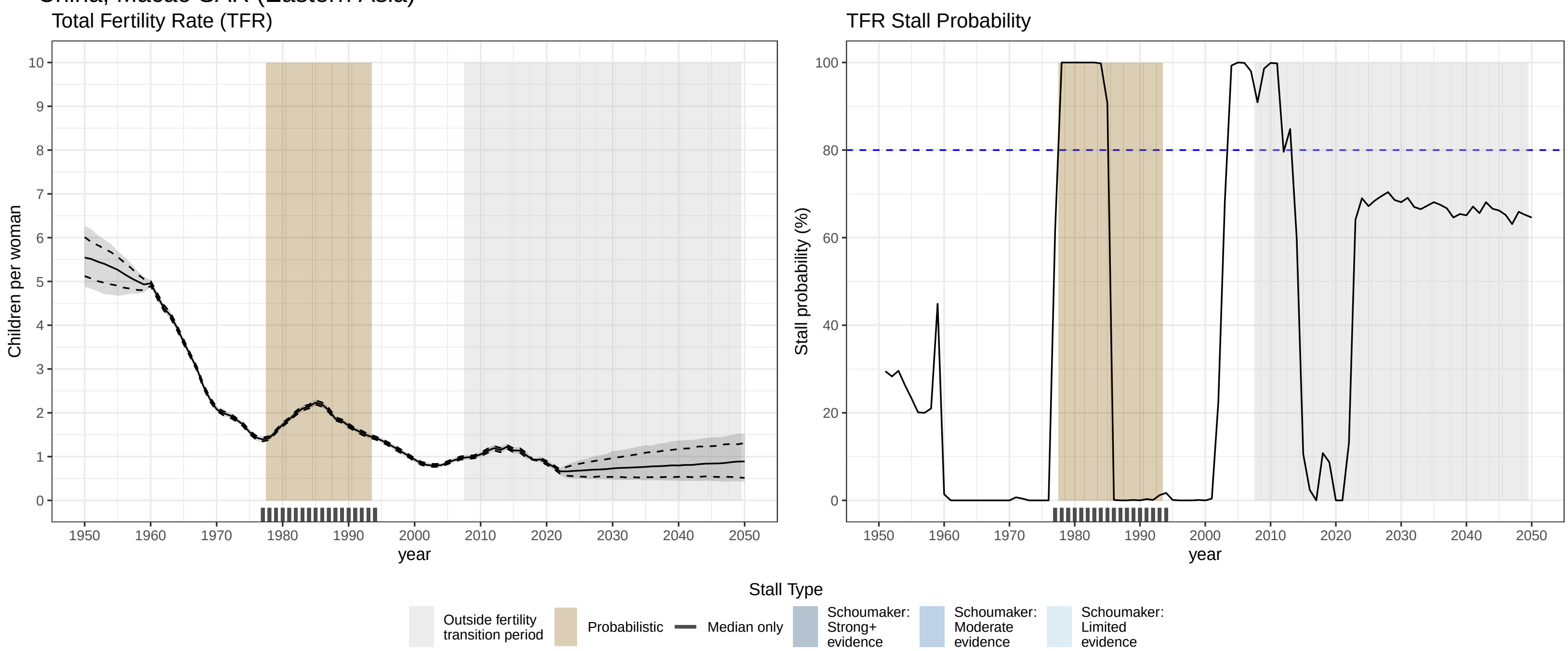

Uzbekistan (Central Asia)
Total Fertility Rate (TFR)
Children per woman
year
TFR Stall Probability
Stall probability (%)
year
Stall Type
Outside fertility transition period
Probabilistic
Median only
Schoumaker: Strong+ evidence
Schoumaker: Moderate evidence
Schoumaker: Limited evidence


China (Eastern Asia)
Total Fertility Rate (TFR)
Children per woman
year
TFR Stall Probability
Stall probability (%)
year
Stall Type
Outside fertility transition period
Probabilistic
Median only
Schoumaker: Strong+ evidence
Schoumaker: Moderate evidence
Schoumaker: Limited evidence

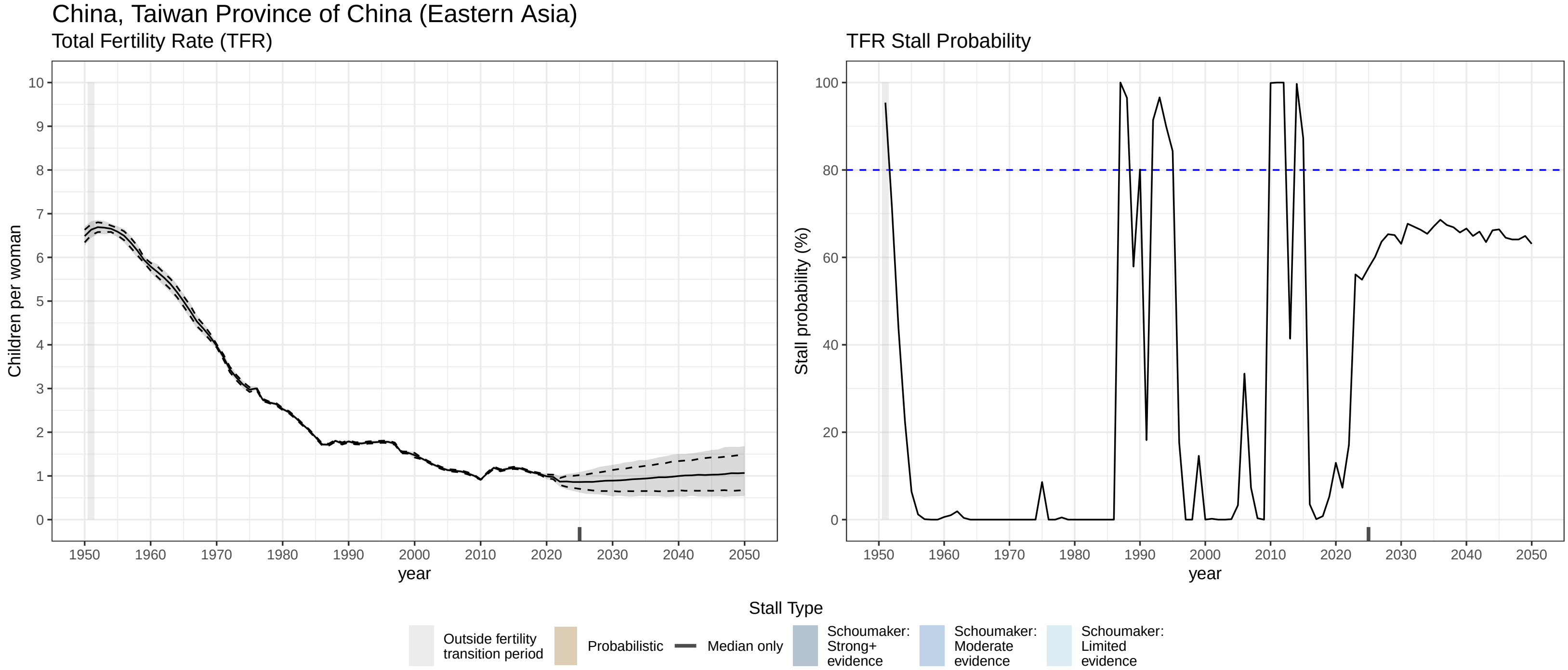
China, Hong Kong SAR (Eastern Asia)



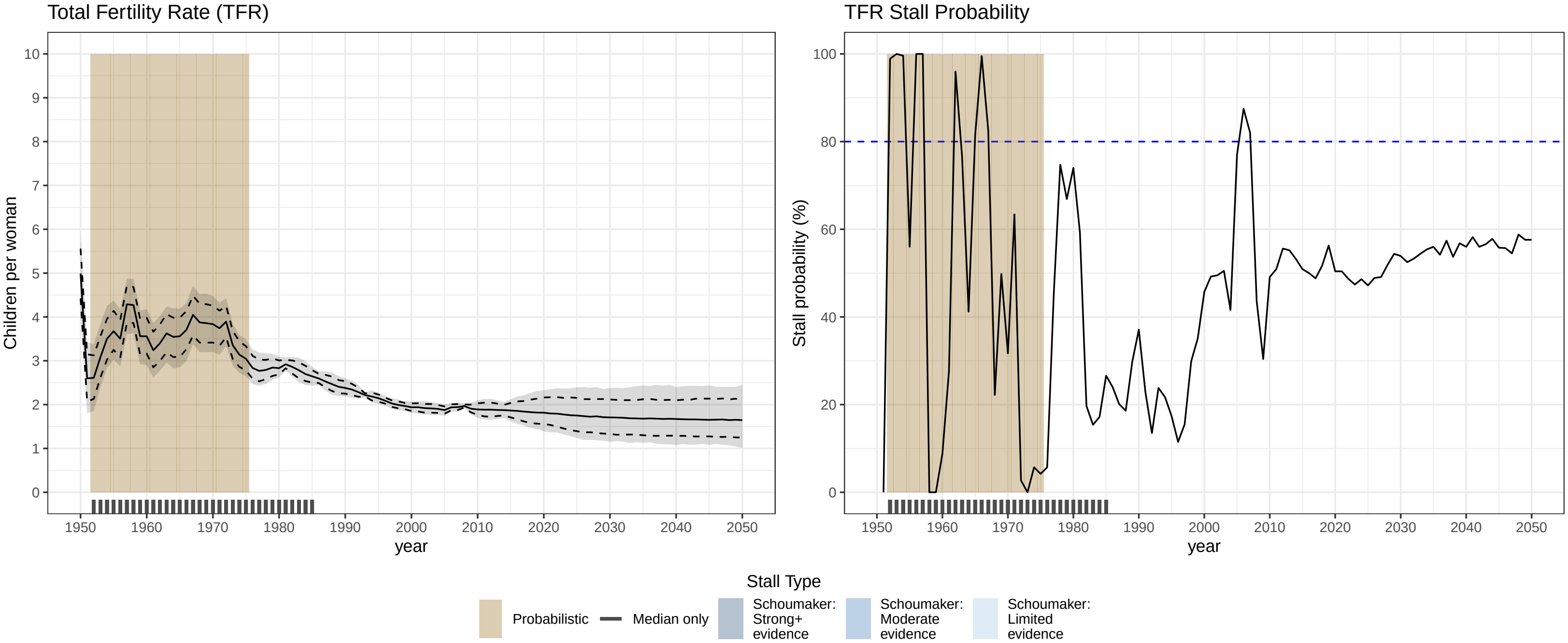
China, Macao SAR (Eastern Asia)



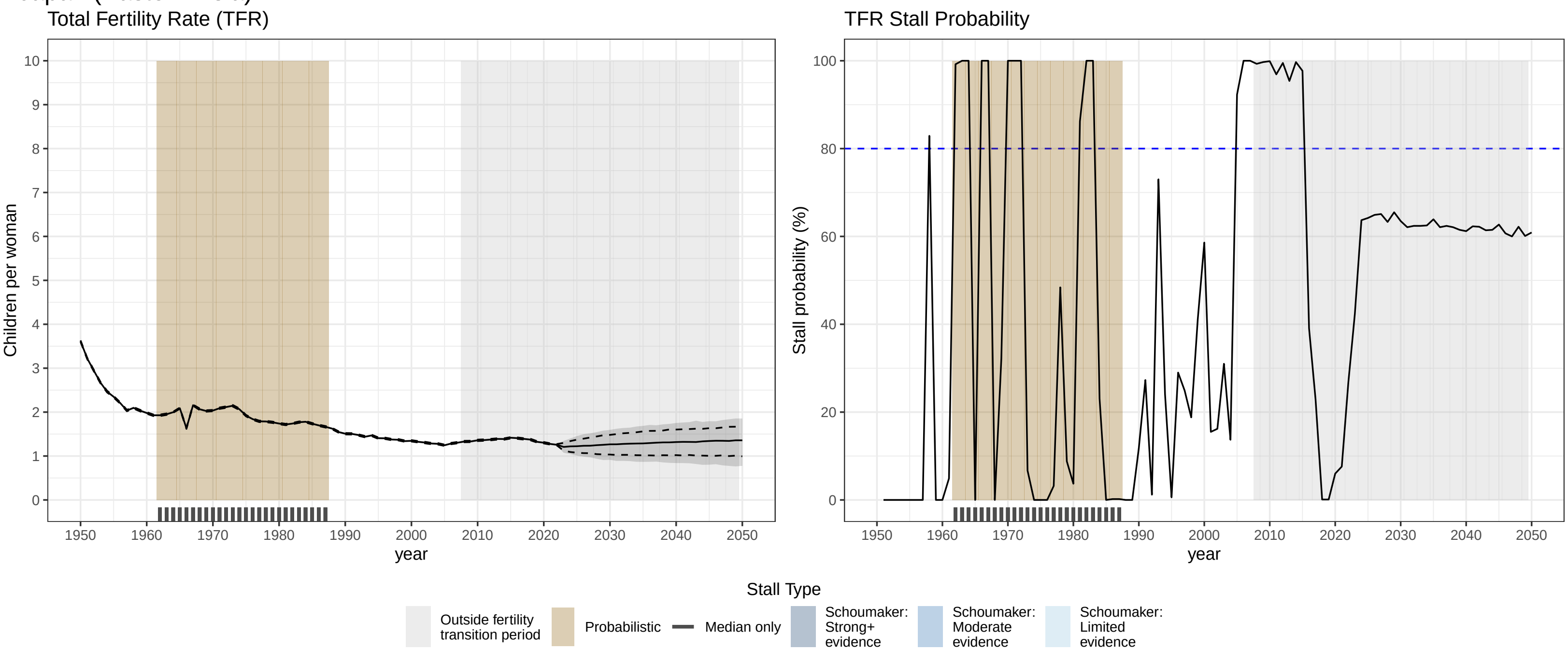
China, Taiwan Province of China (Eastern Asia)



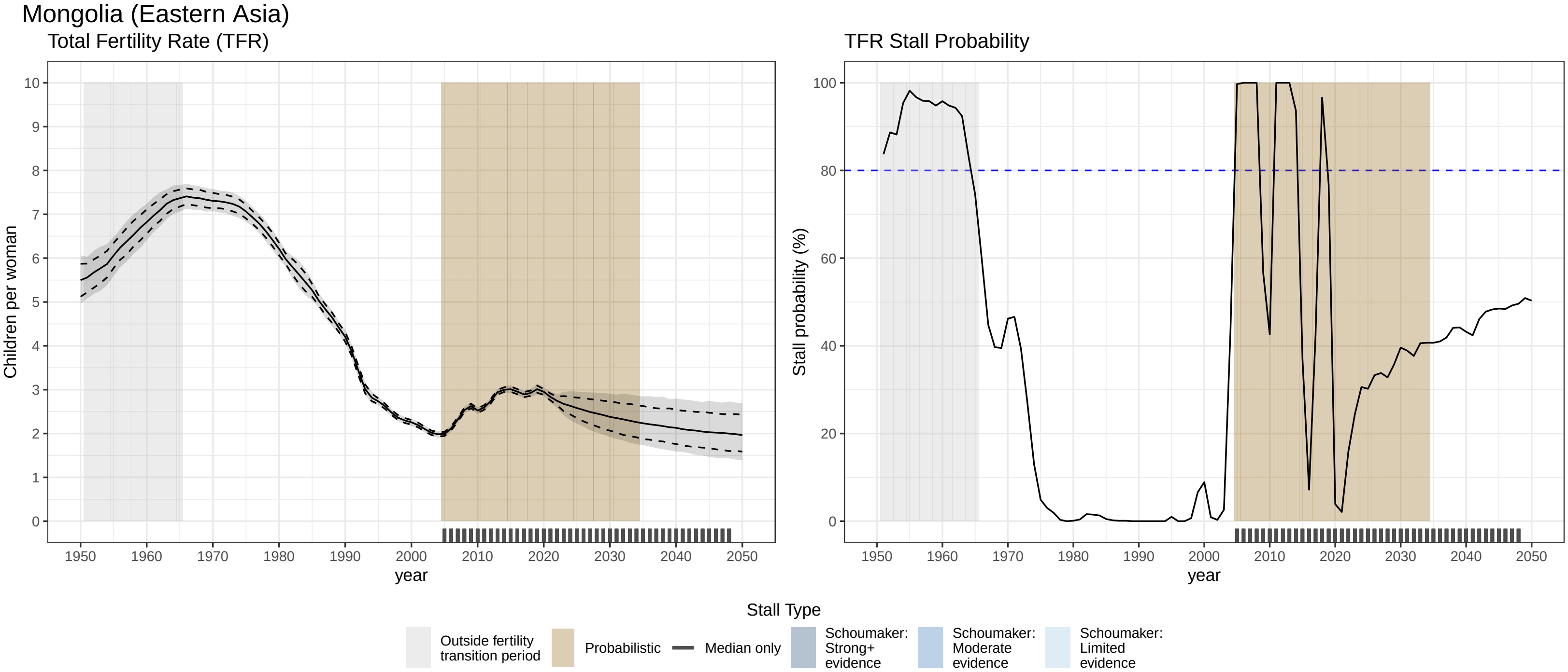
Dem. People's Republic of Korea (Eastern Asia)



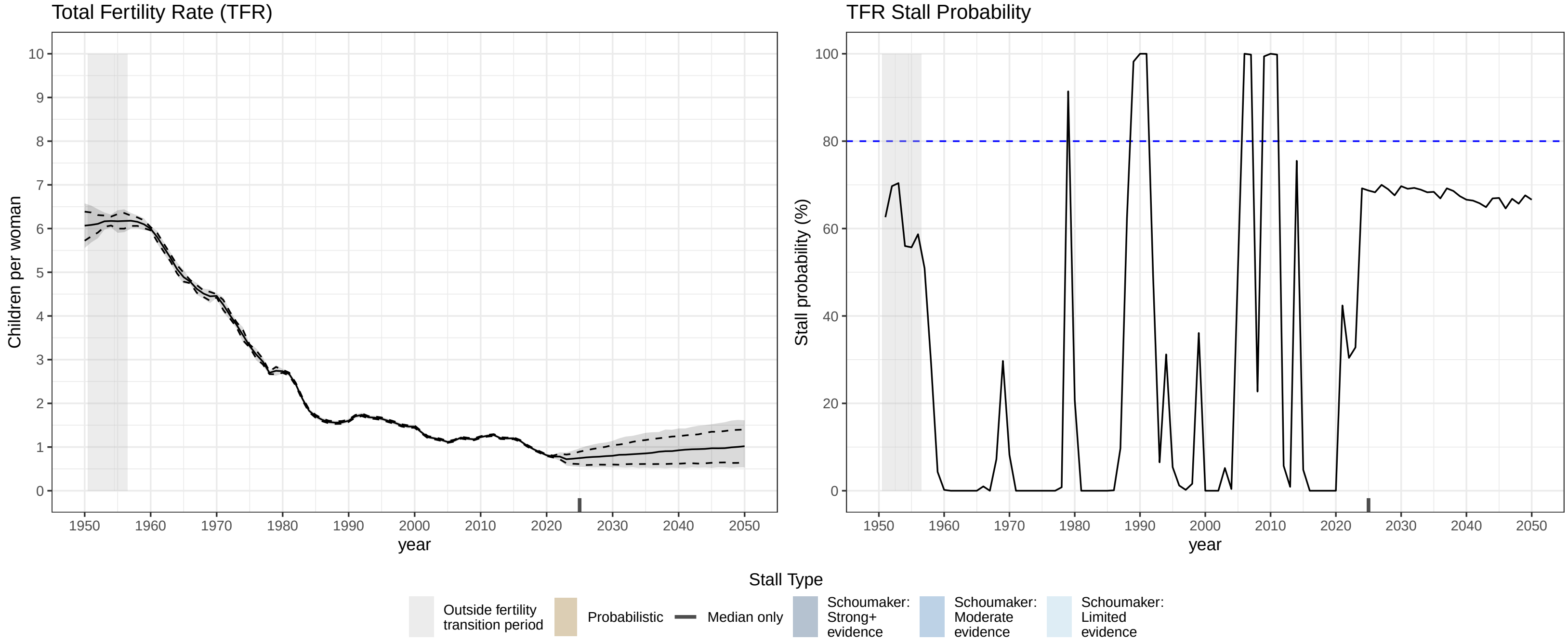
Japan (Eastern Asia)



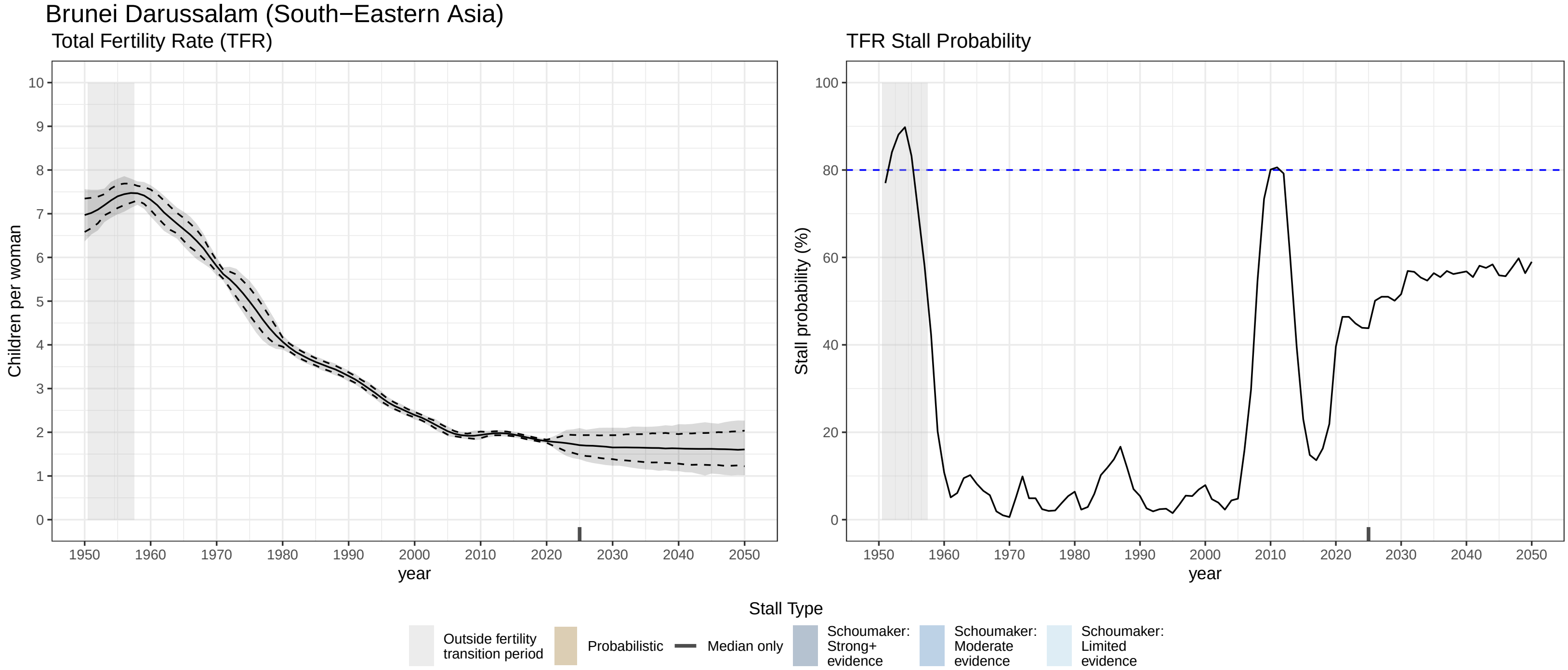
Mongolia (Eastern Asia)



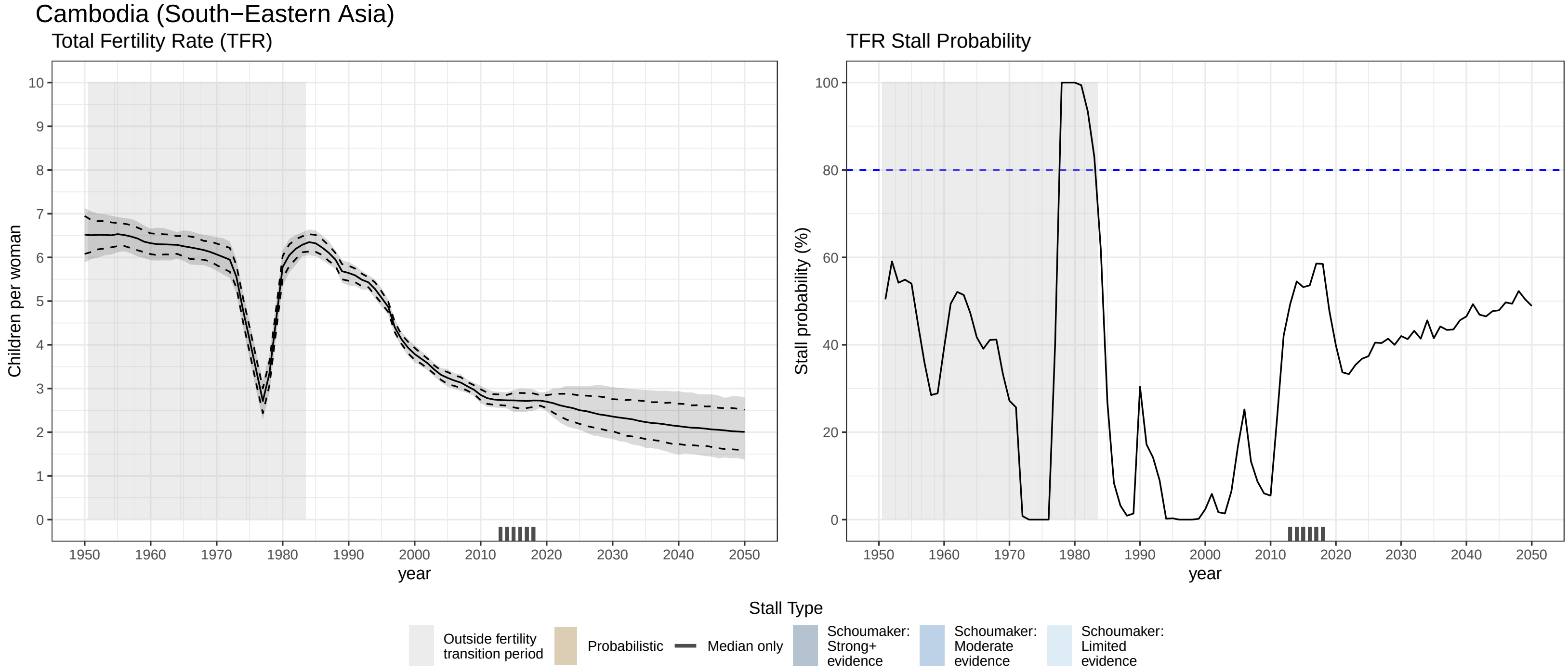
Republic of Korea (Eastern Asia)



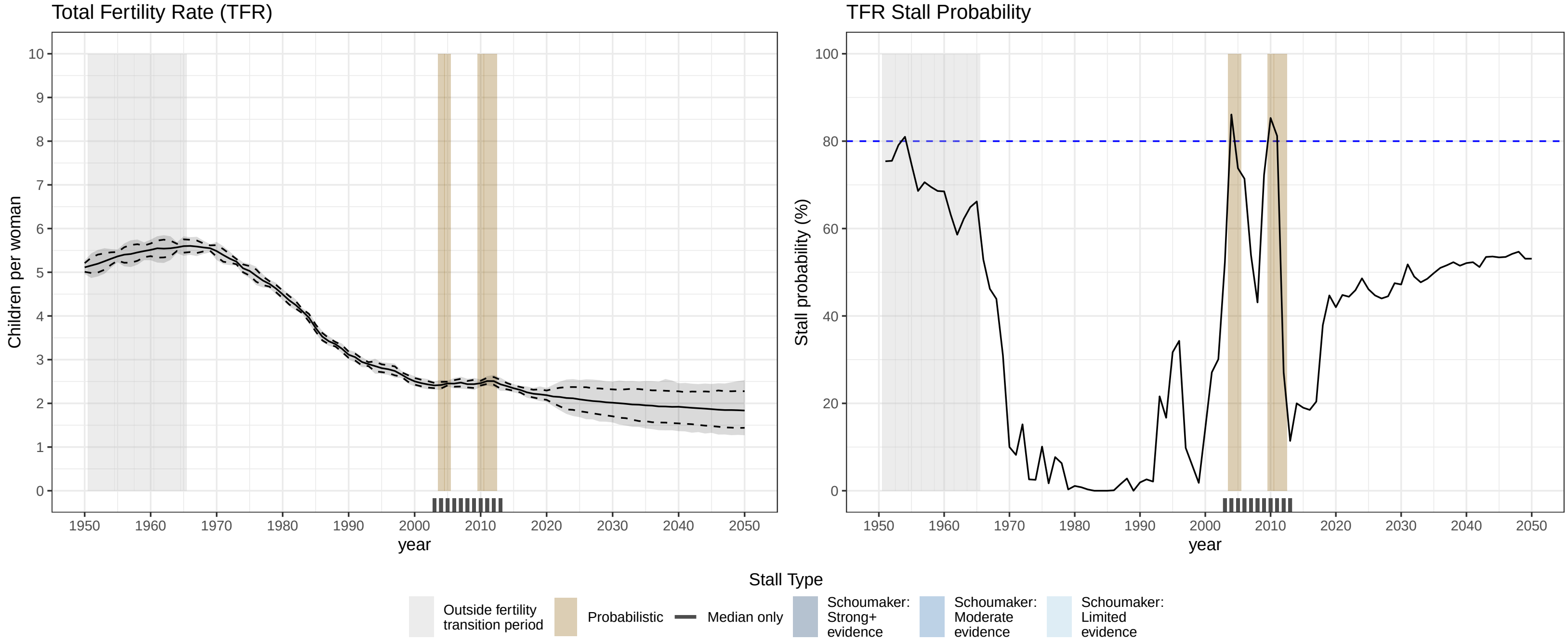
Brunei Darussalam (South−Eastern Asia)



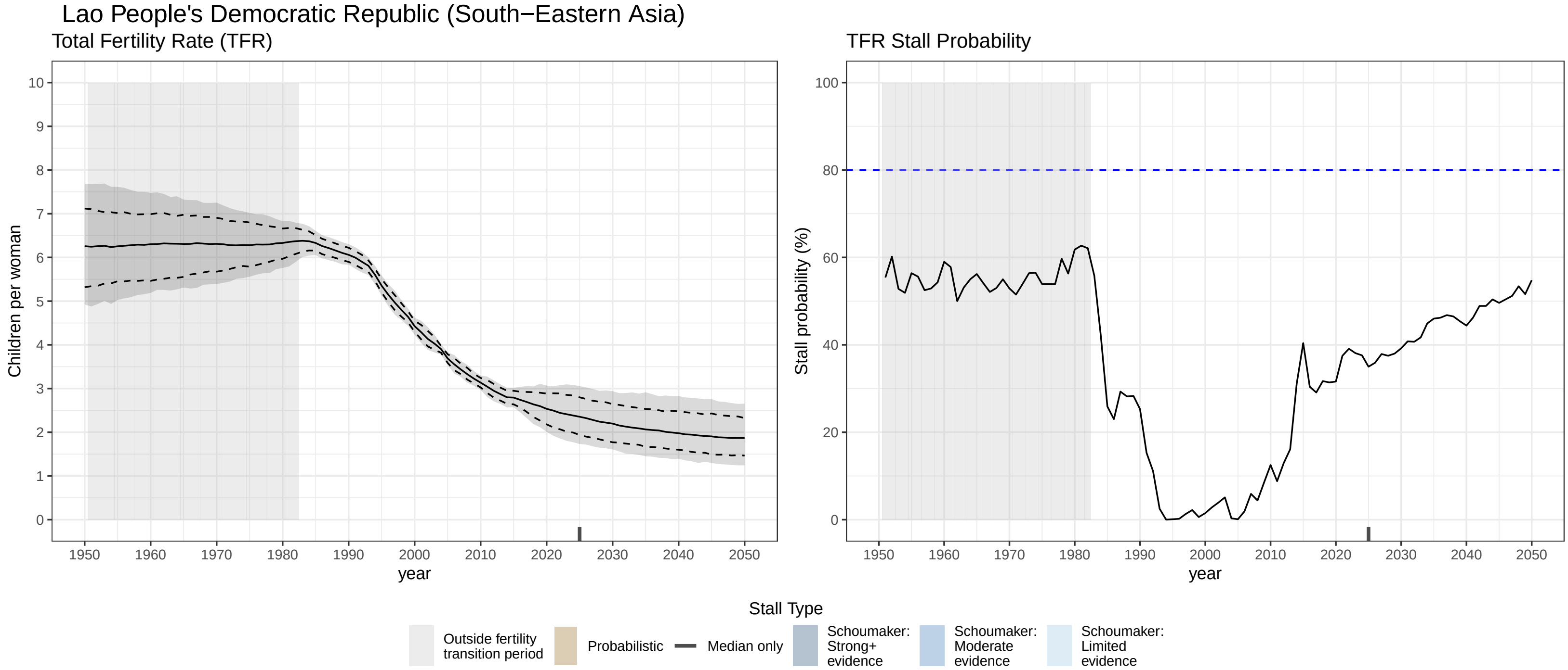
Cambodia (South−Eastern Asia)



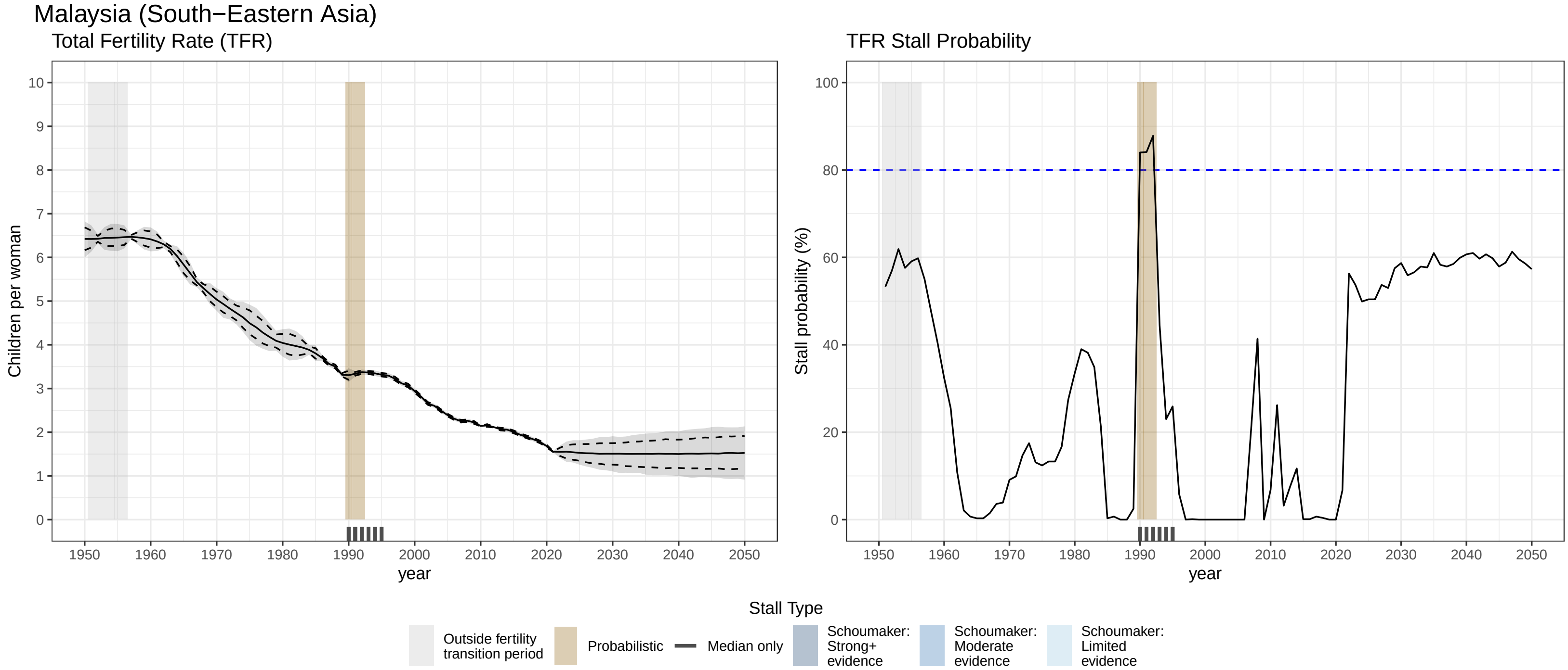
Indonesia (South−Eastern Asia)



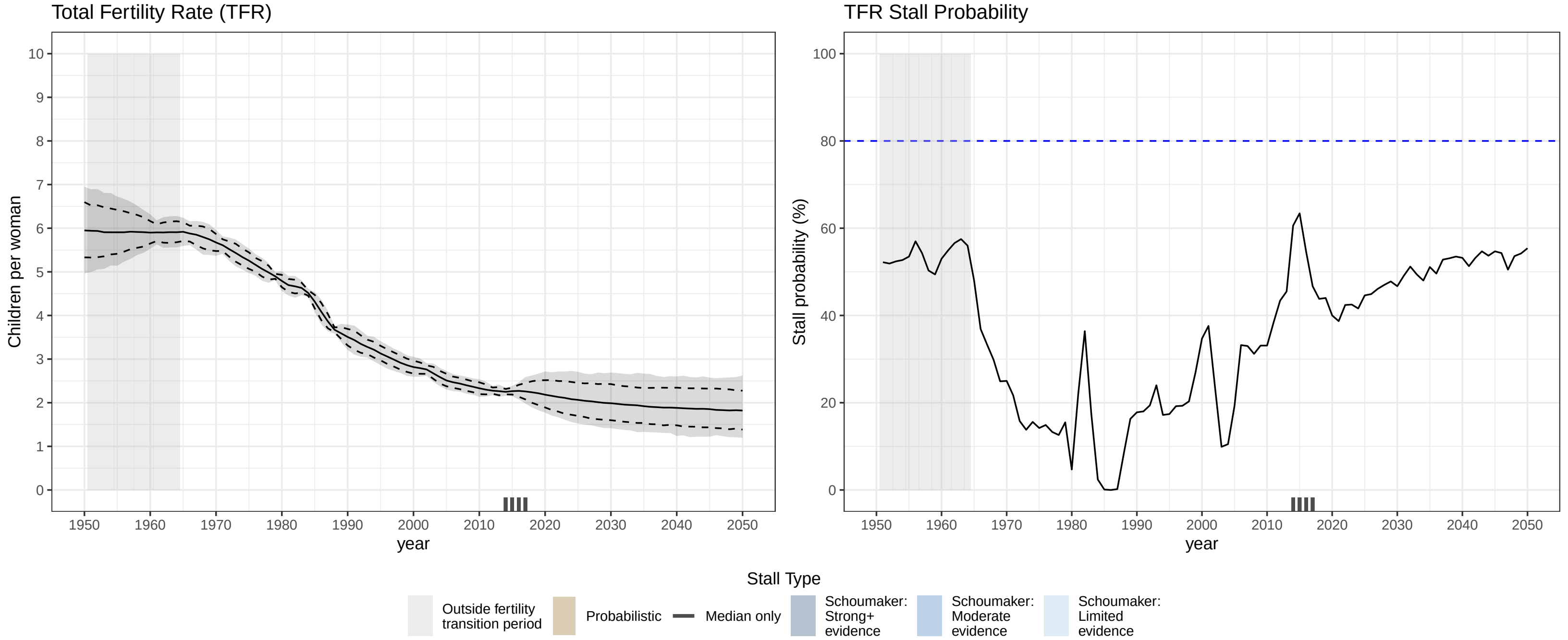
Lao People's Democratic Republic (South−Eastern Asia)



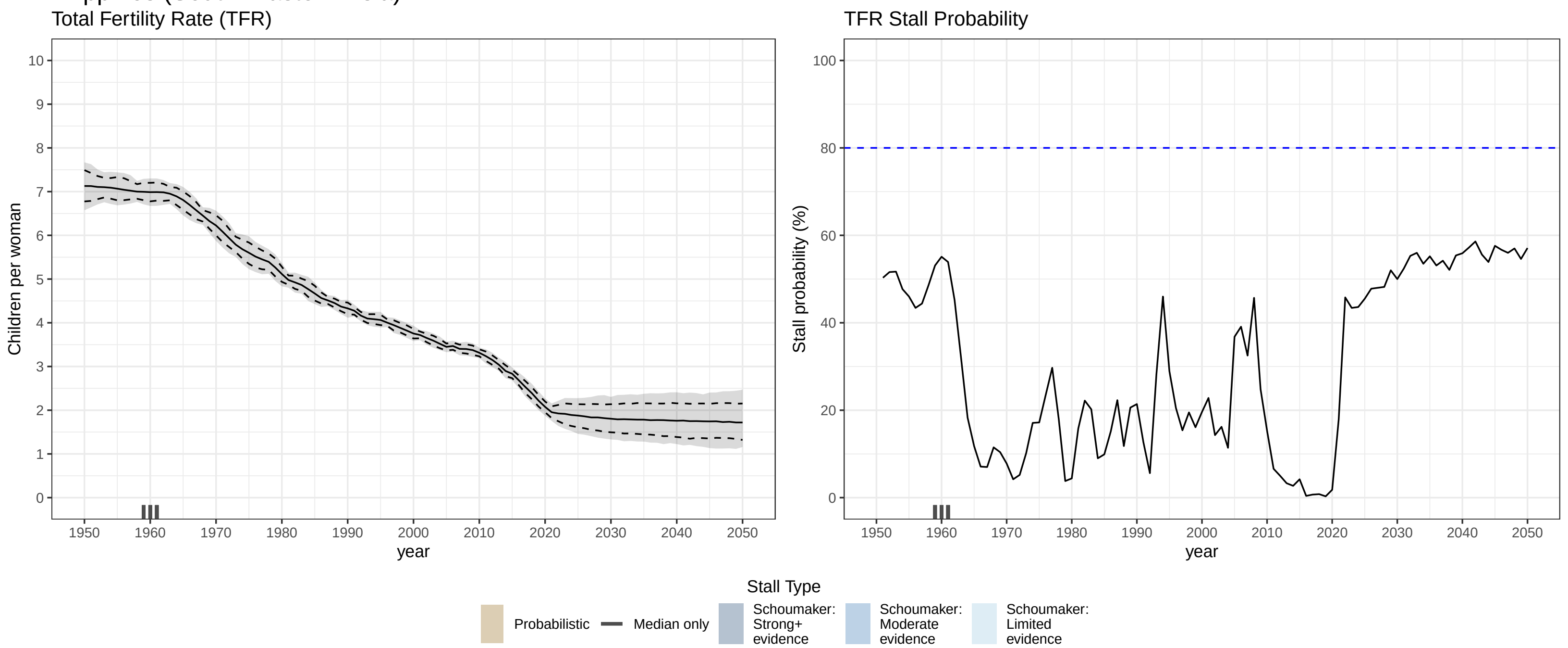
Malaysia (South−Eastern Asia)



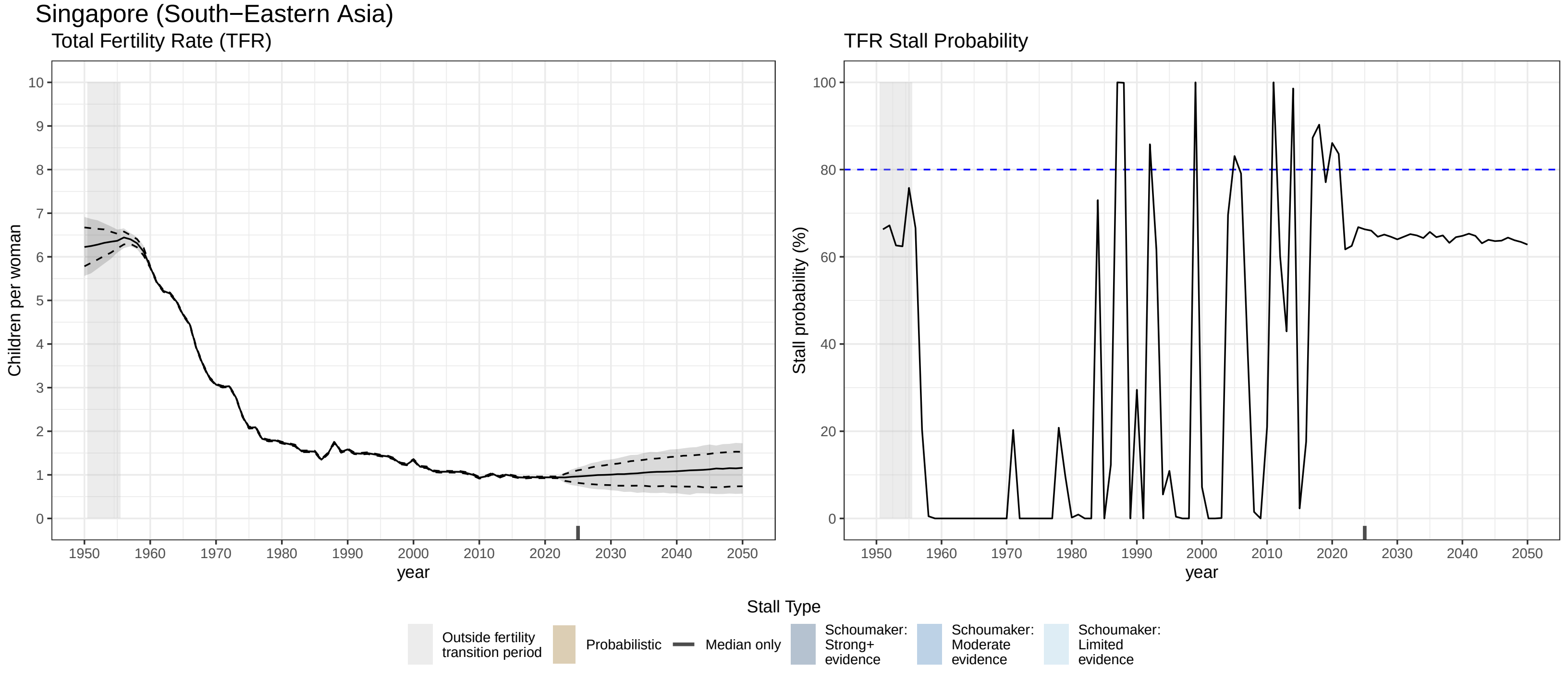
Myanmar (South−Eastern Asia)

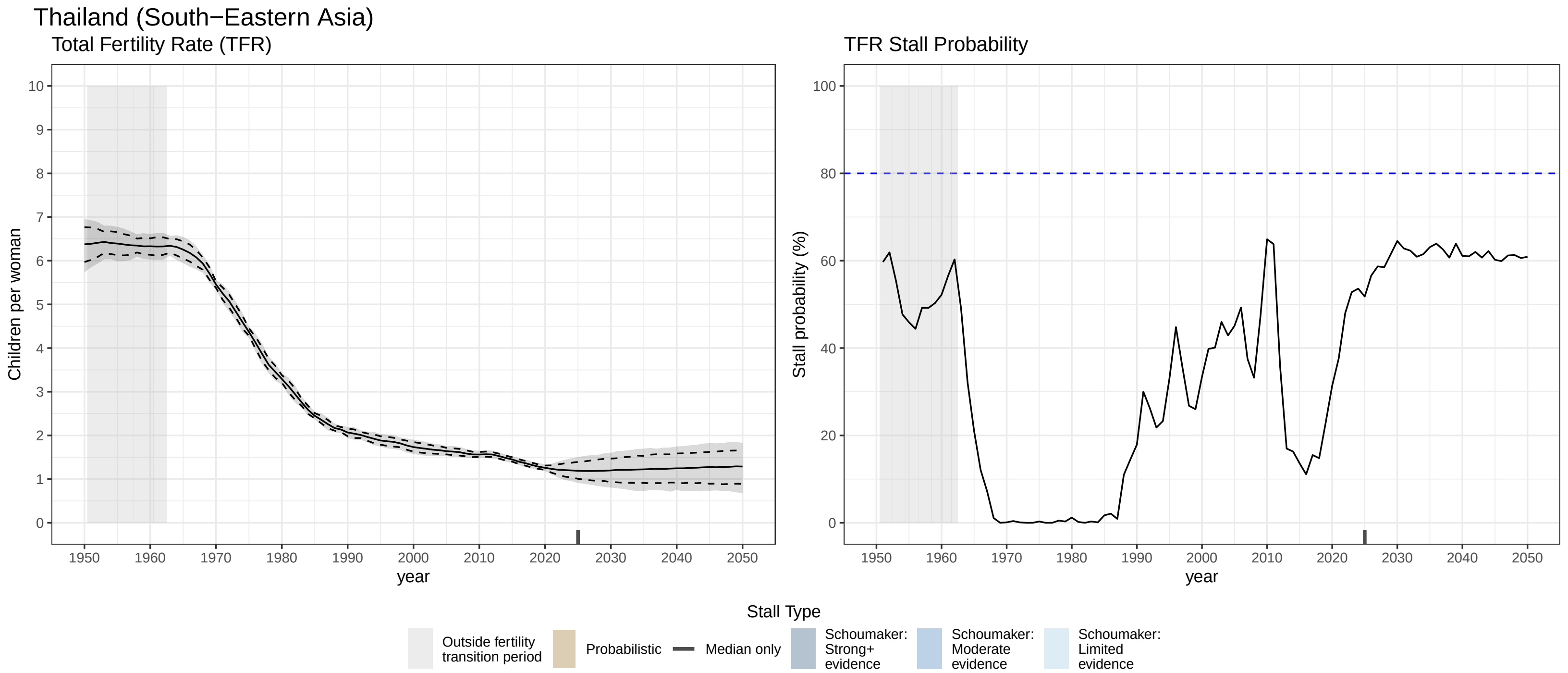


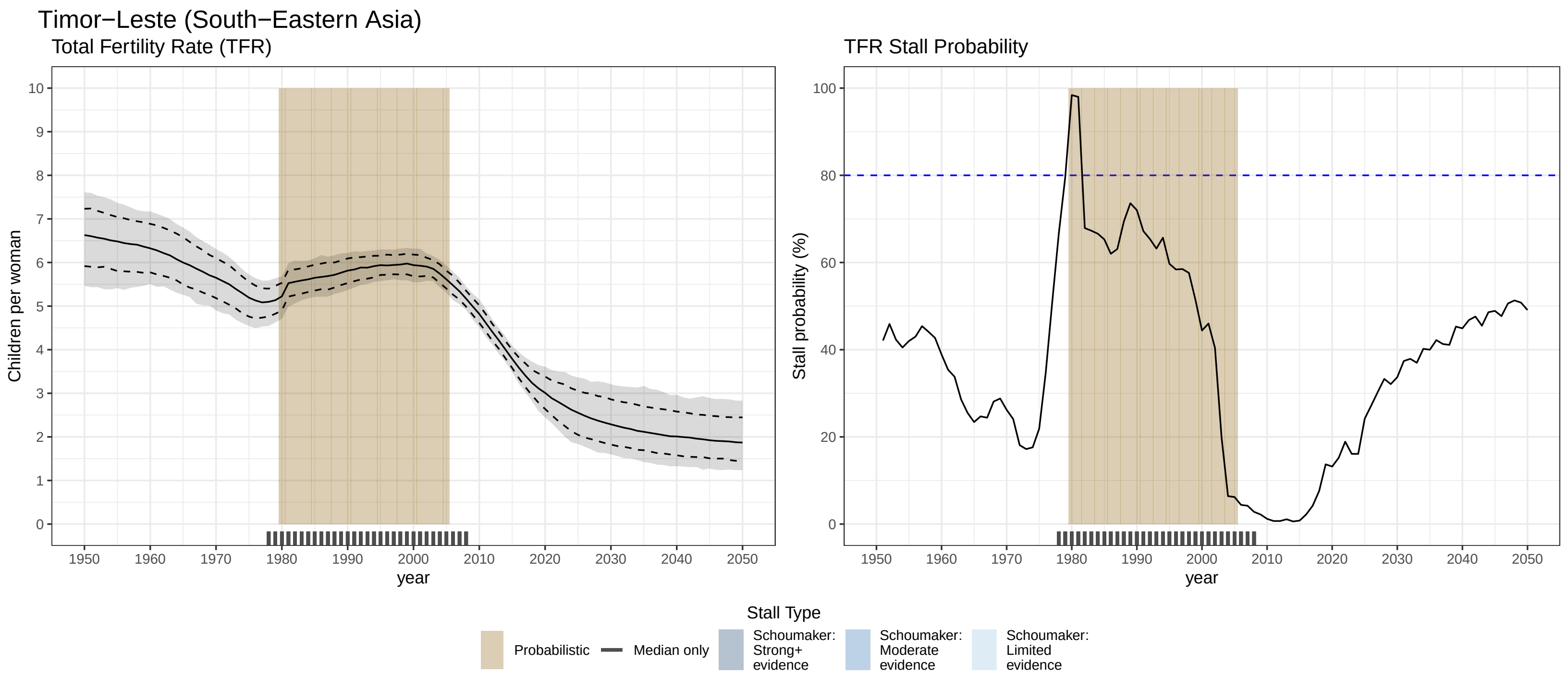
Philippines (South−Eastern Asia)

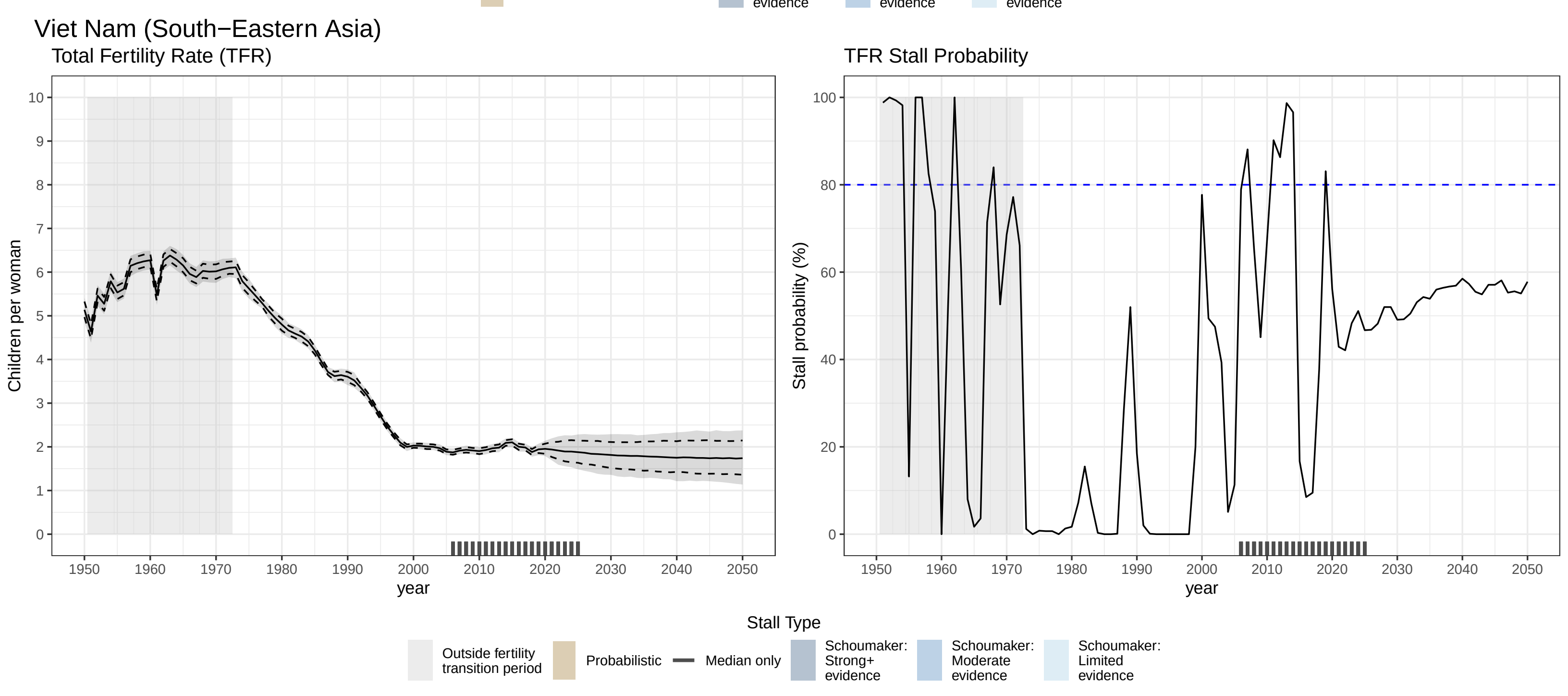


Singapore (South−Eastern Asia)

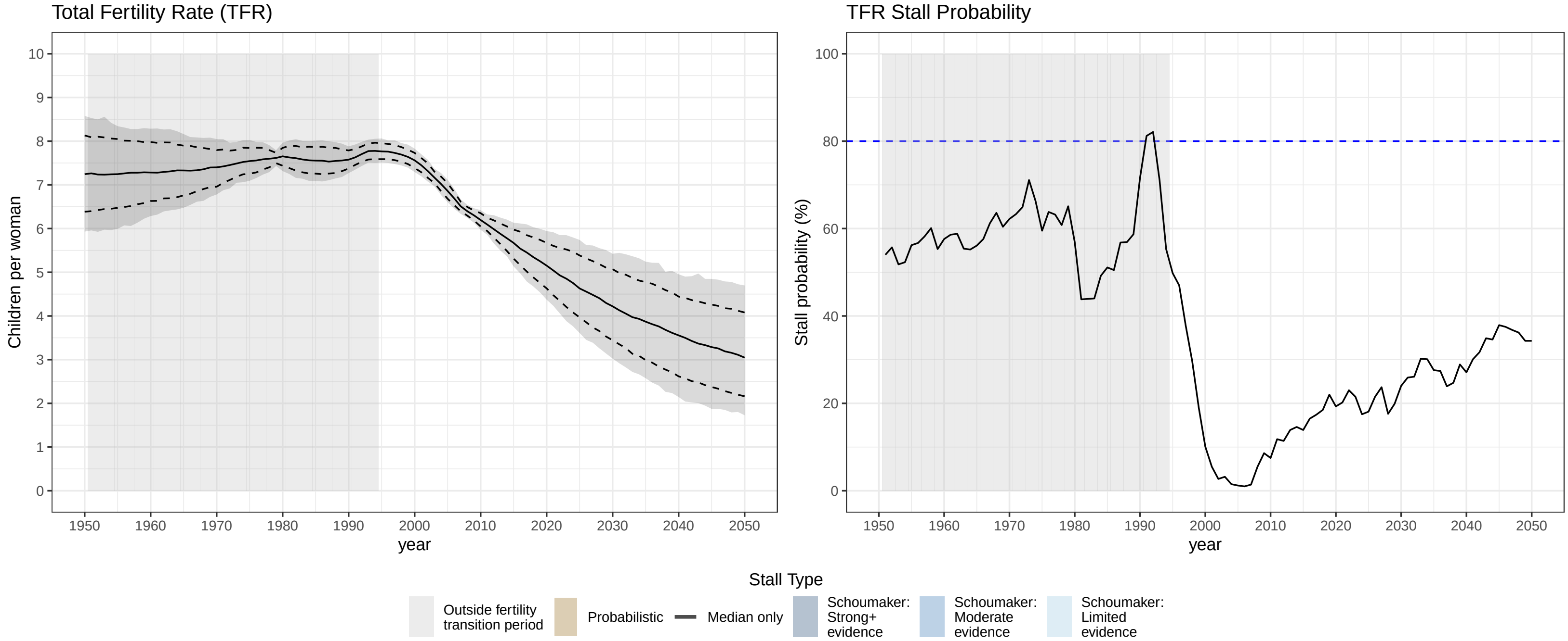



Thailand (South−Eastern Asia)
Total Fertility Rate (TFR)
Children per woman
year
TFR Stall Probability
Stall probability (%)
year
Stall Type
Outside fertility transition period
Probabilistic
Median only
Schoumaker: Strong+ evidence
Schoumaker: Moderate evidence
Schoumaker: Limited evidence

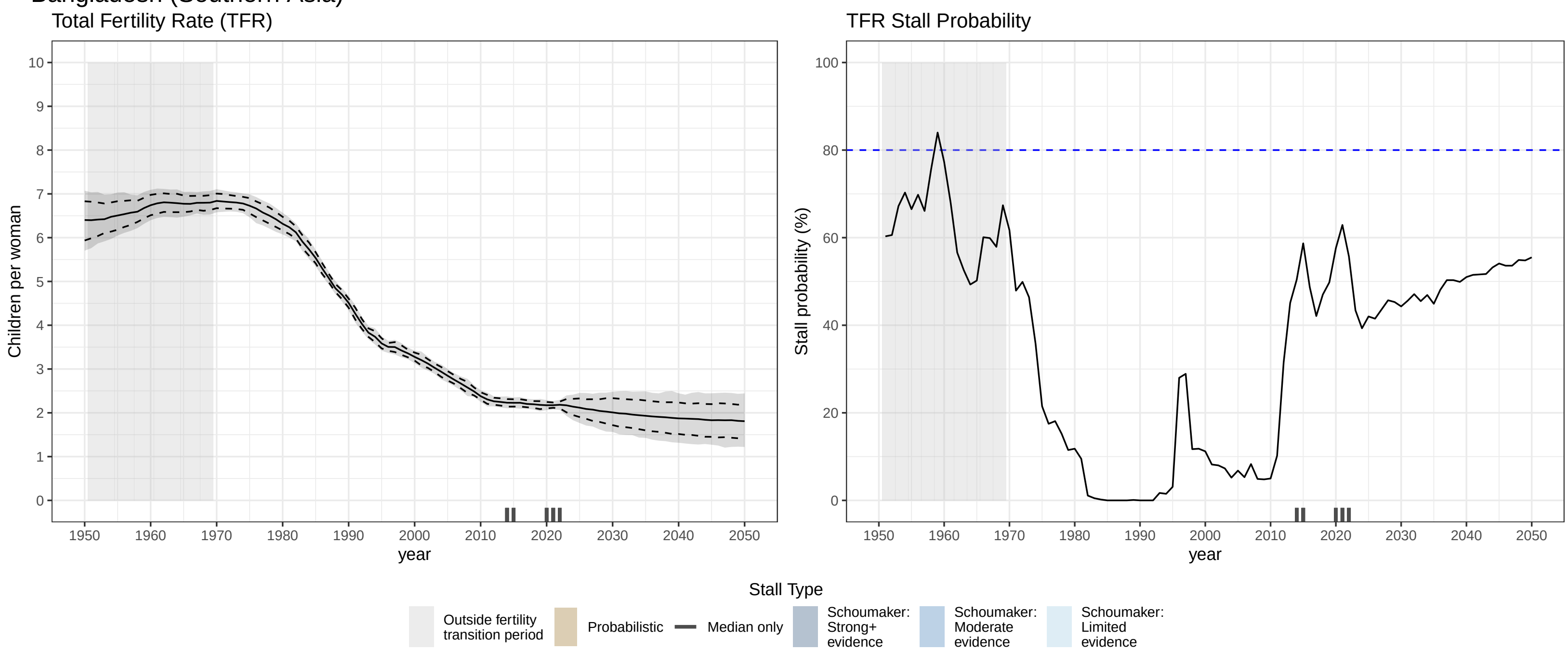

Timor−Leste (South−Eastern Asia)
Total Fertility Rate (TFR)
Children per woman
year
TFR Stall Probability
Stall probability (%)
year
Stall Type
Probabilistic
Median only
Schoumaker: Strong+ evidence
Schoumaker: Moderate evidence
Schoumaker: Limited evidence


Viet Nam (South−Eastern Asia)
Total Fertility Rate (TFR)
Children per woman
year
TFR Stall Probability
Stall probability (%)
year
Stall Type
Outside fertility transition period
Probabilistic
Median only
Schoumaker: Strong+ evidence
Schoumaker: Moderate evidence
Schoumaker: Limited evidence

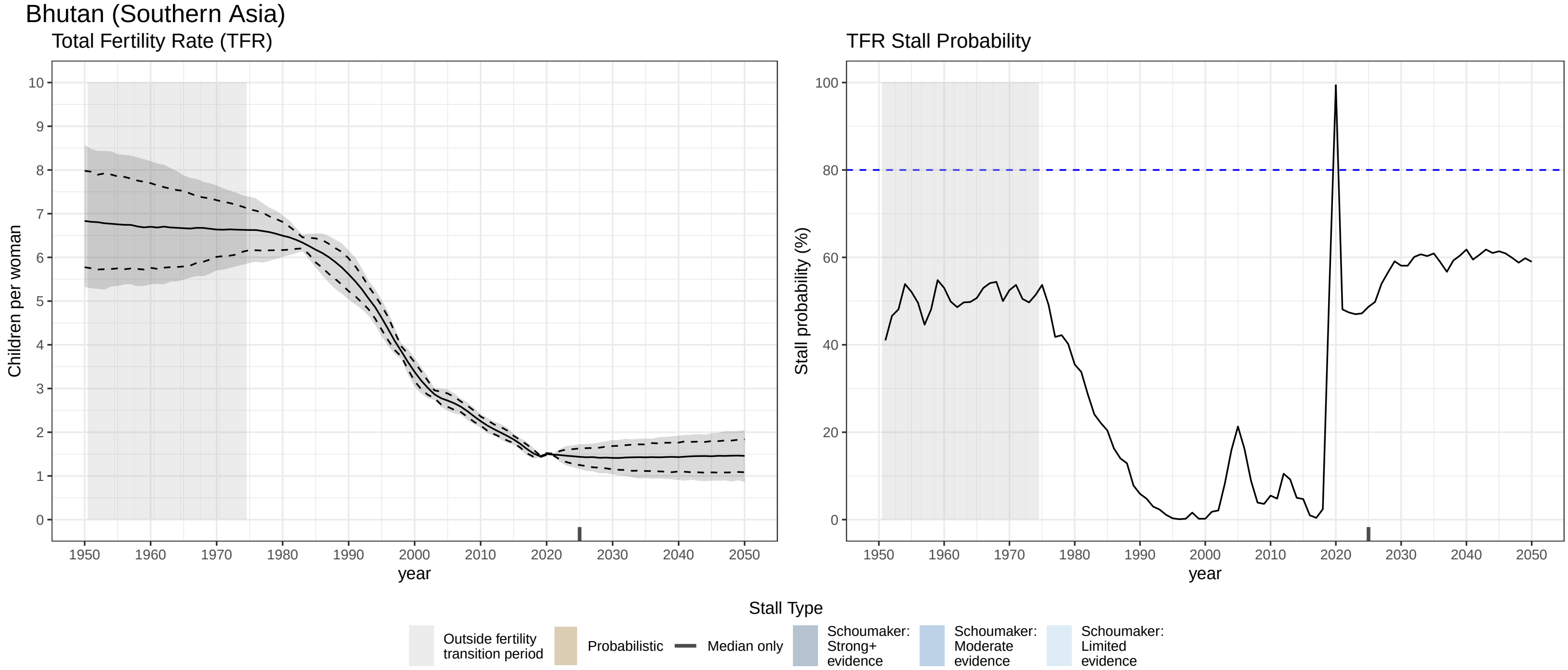
Afghanistan (Southern Asia)



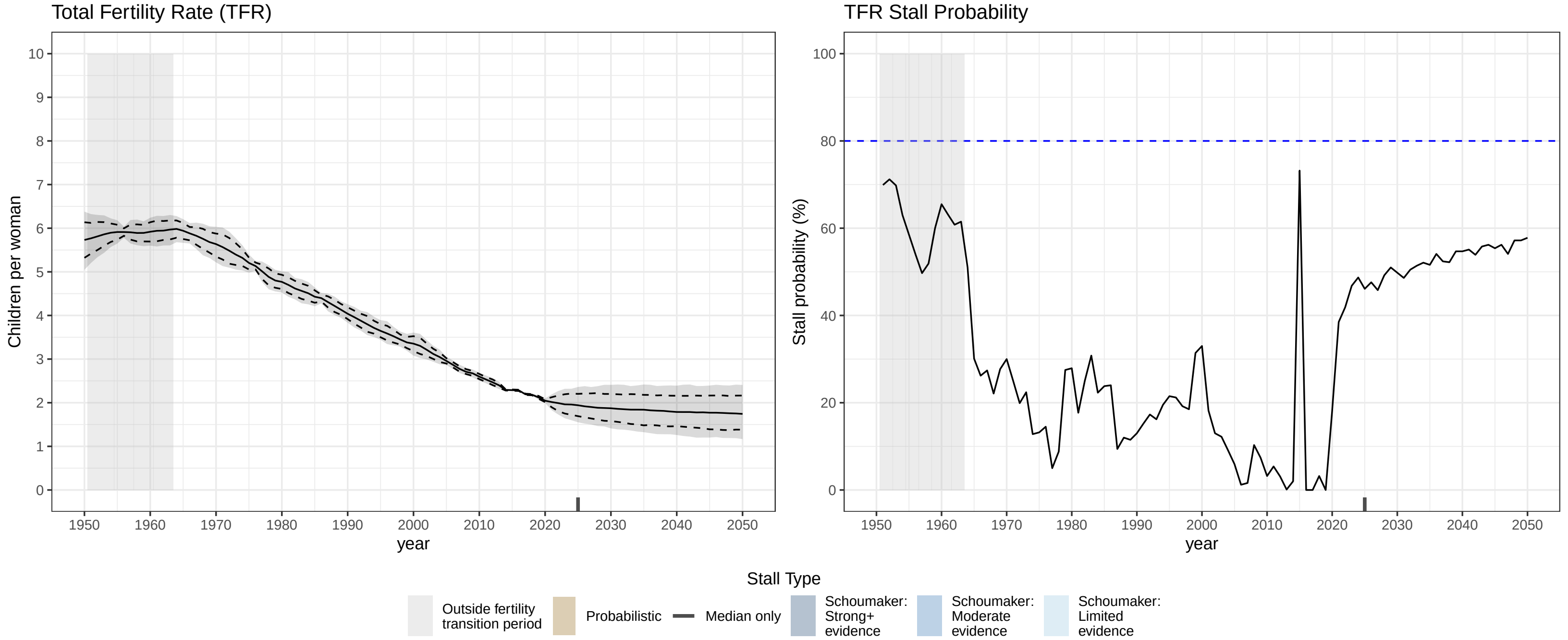
Bangladesh (Southern Asia)



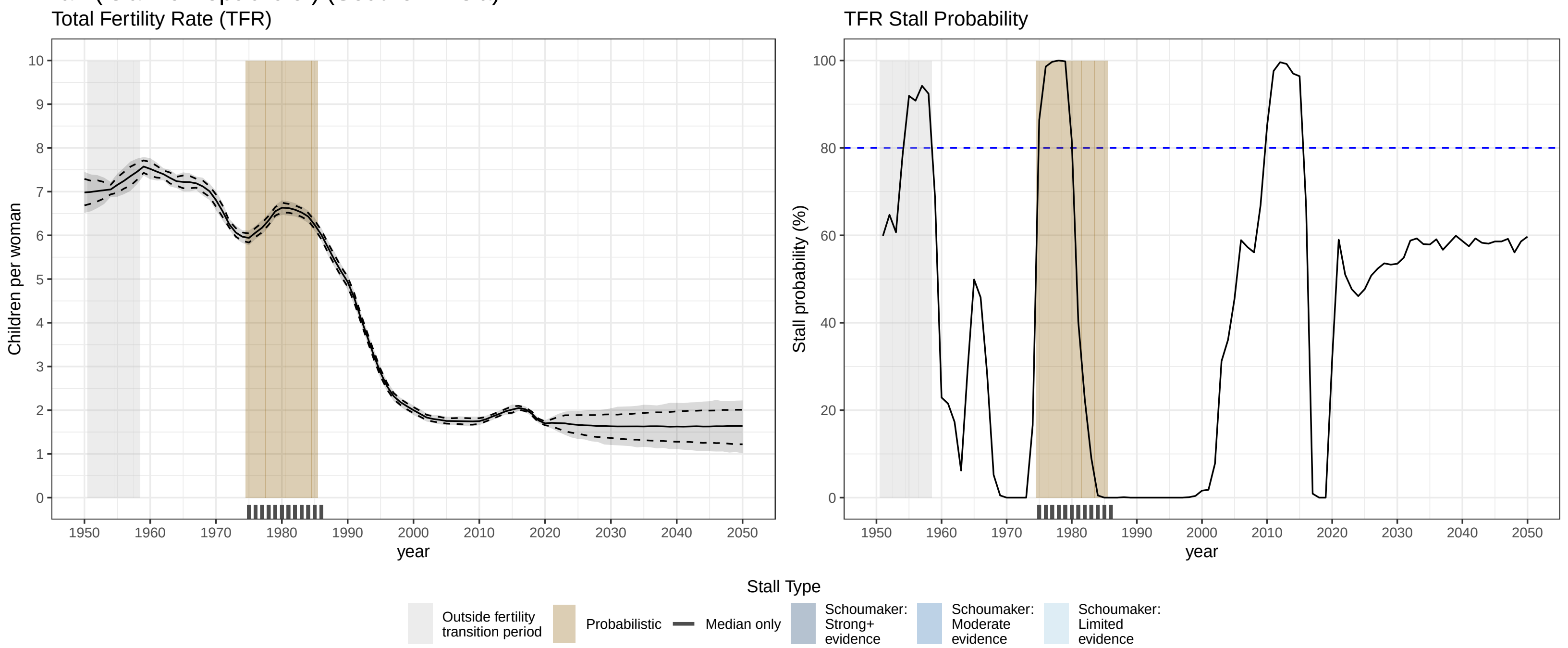
Bhutan (Southern Asia)



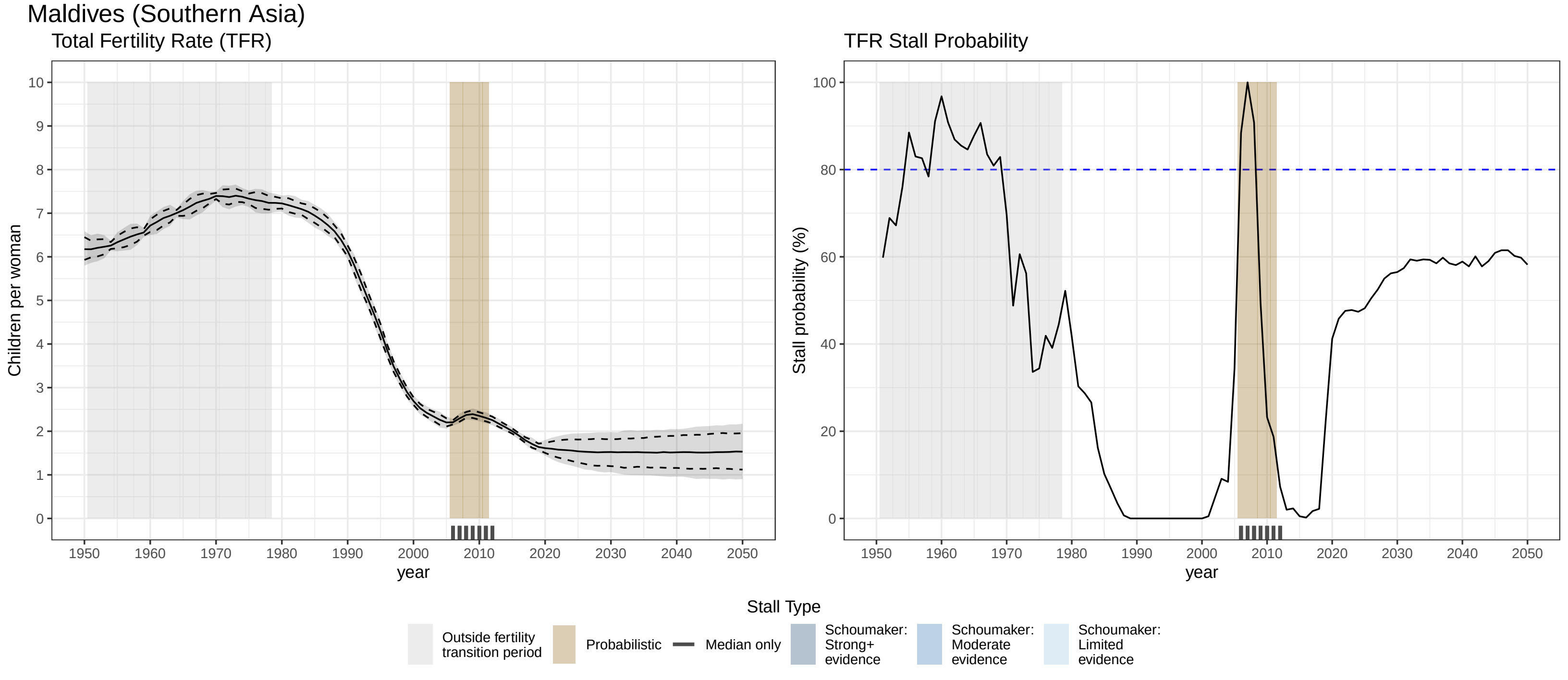
India (Southern Asia)



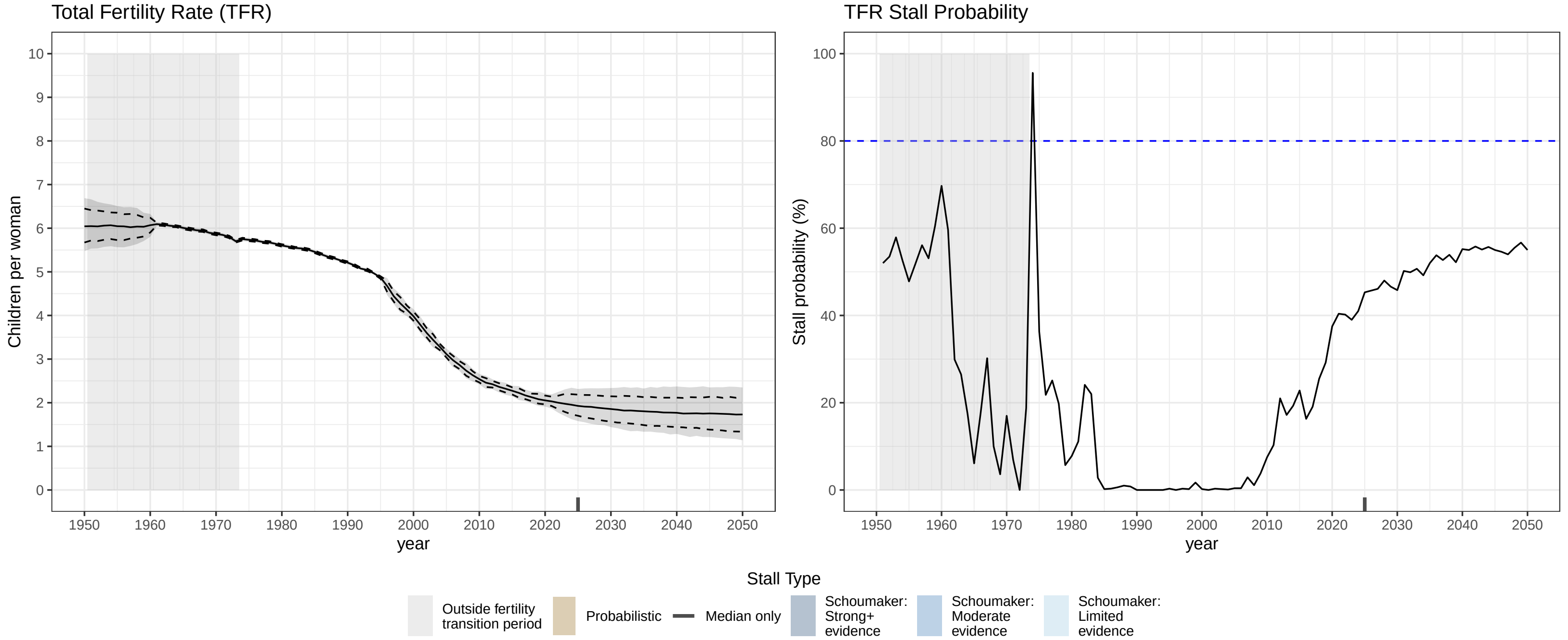
Iran (Islamic Republic of) (Southern Asia)



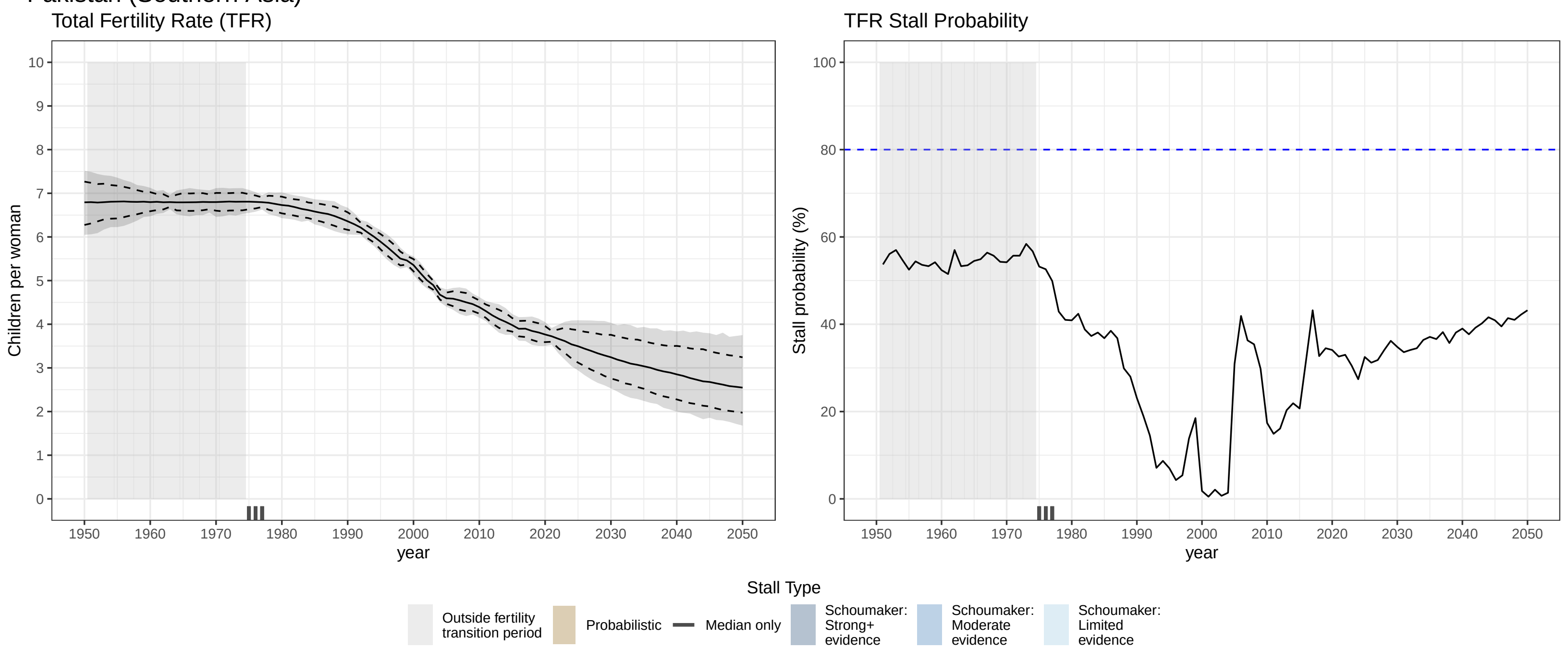
Maldives (Southern Asia)



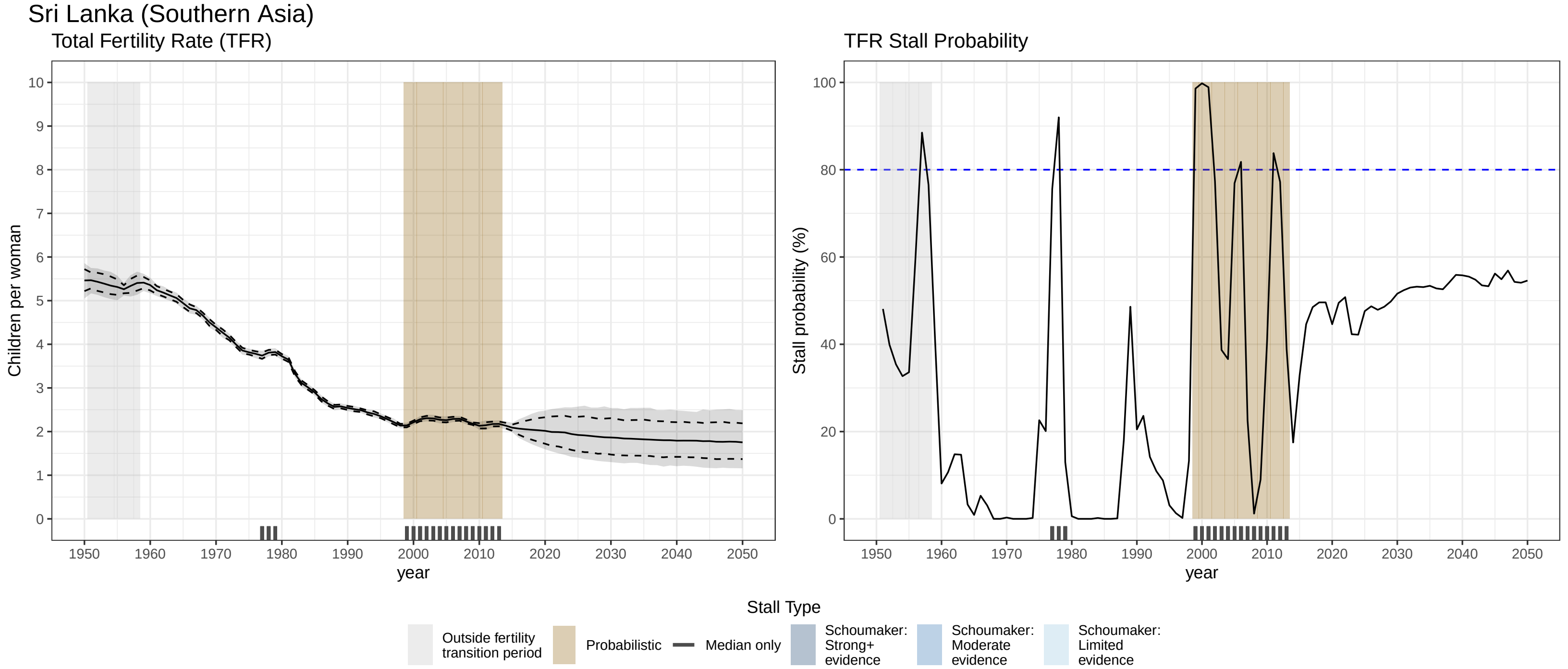
Nepal (Southern Asia)



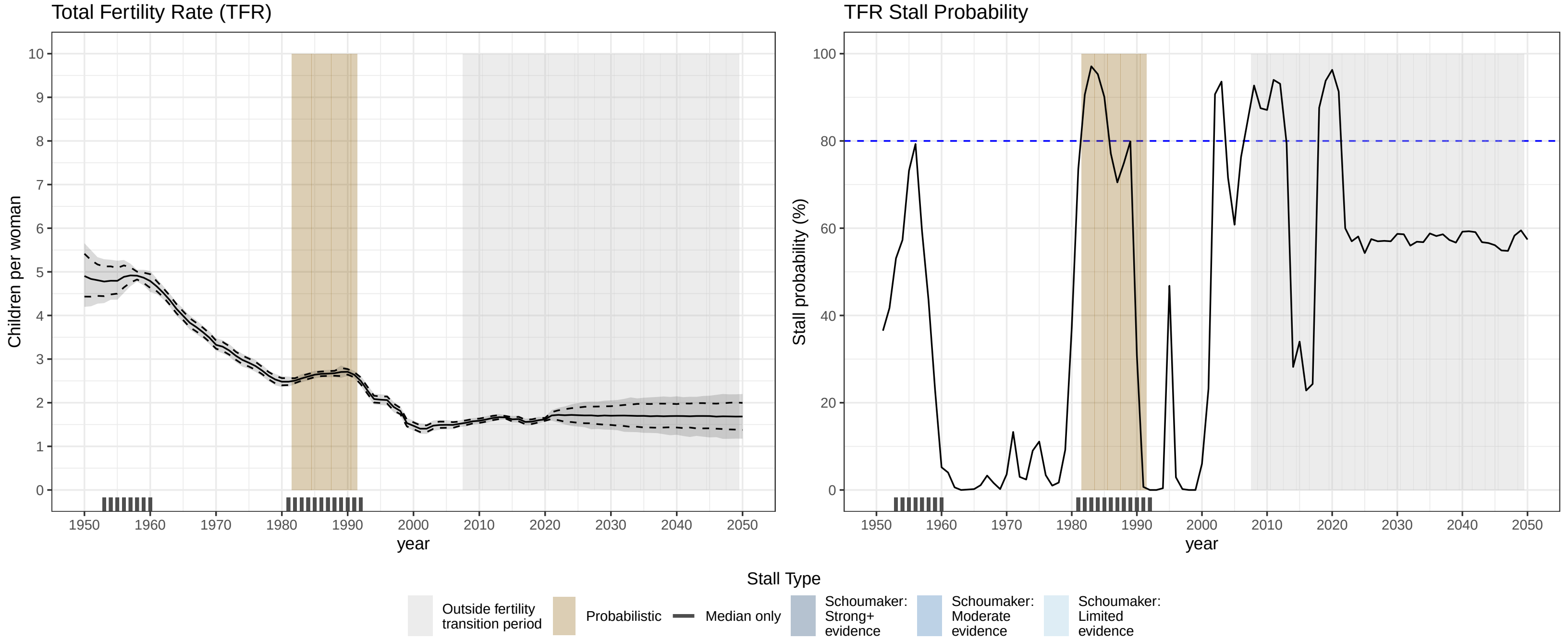
Pakistan (Southern Asia)



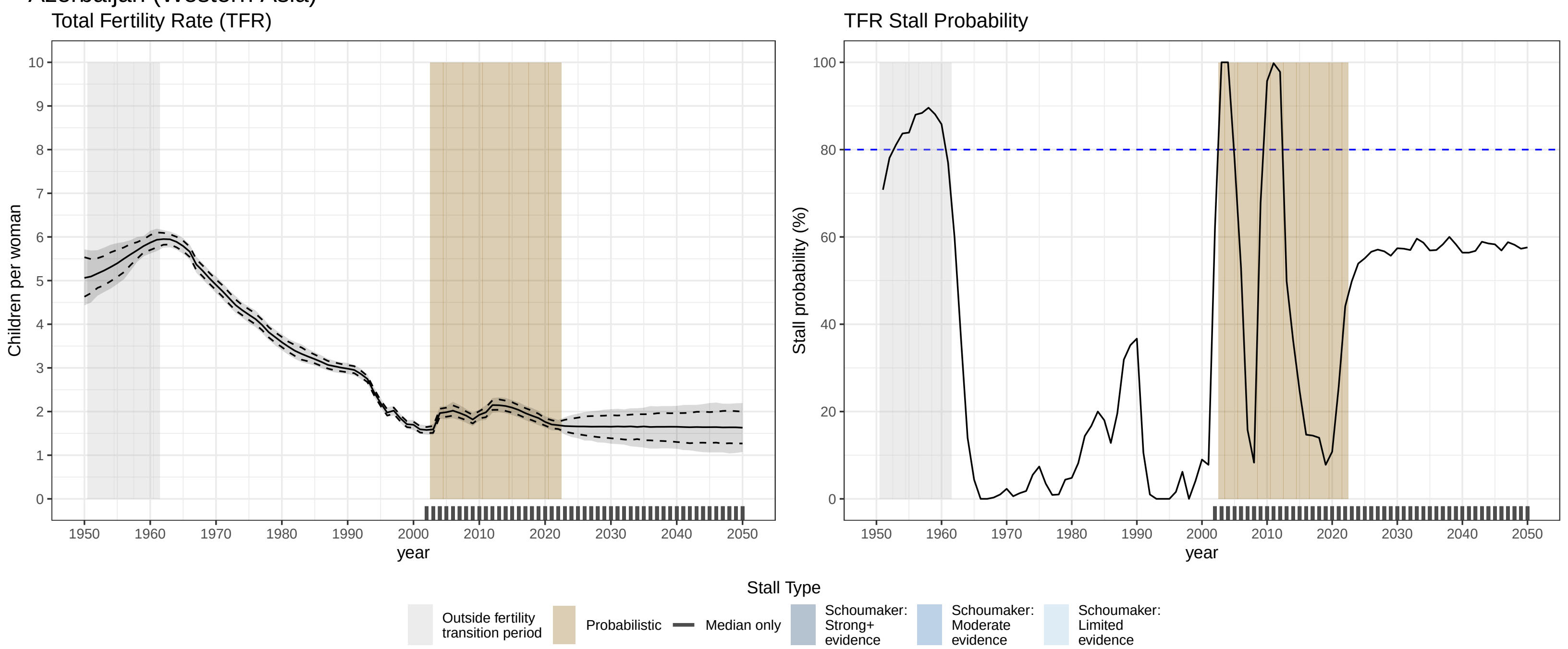
Sri Lanka (Southern Asia)



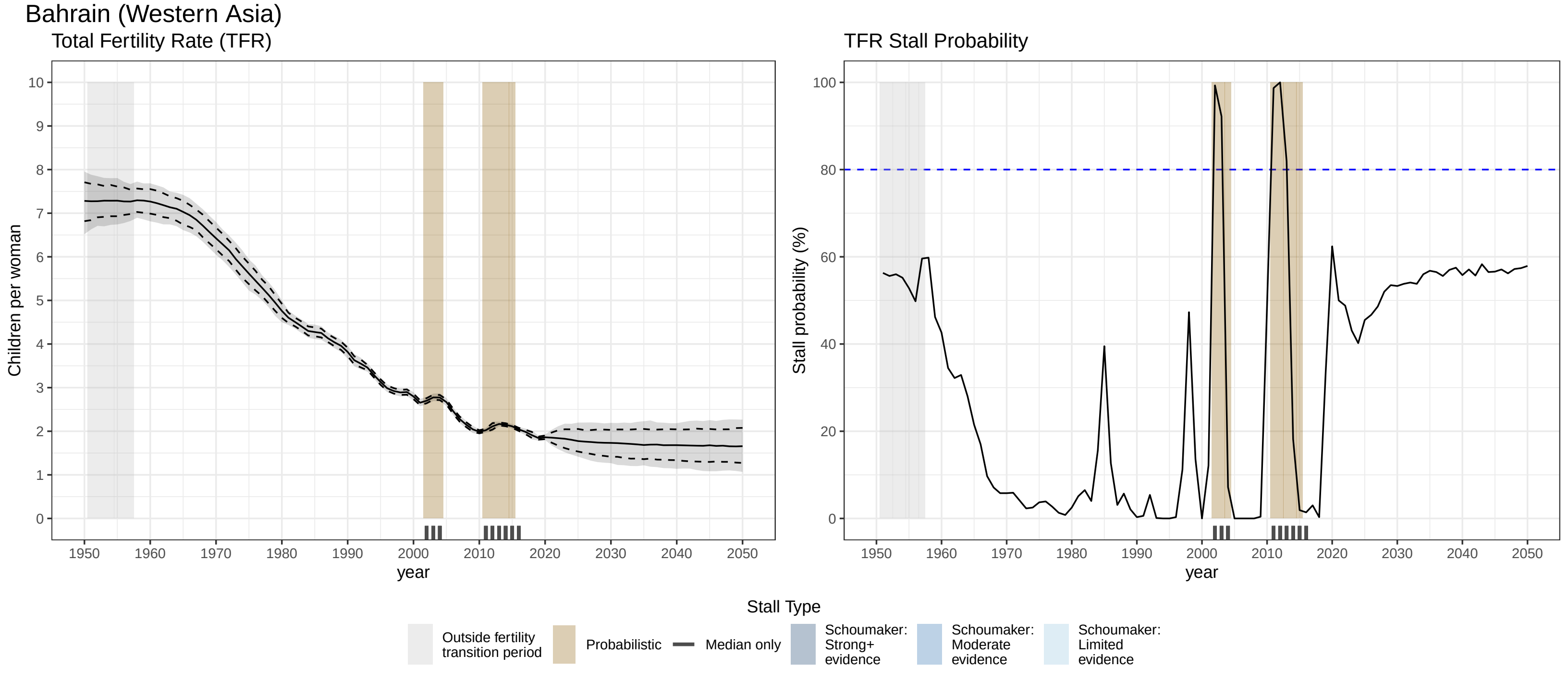
Armenia (Western Asia)



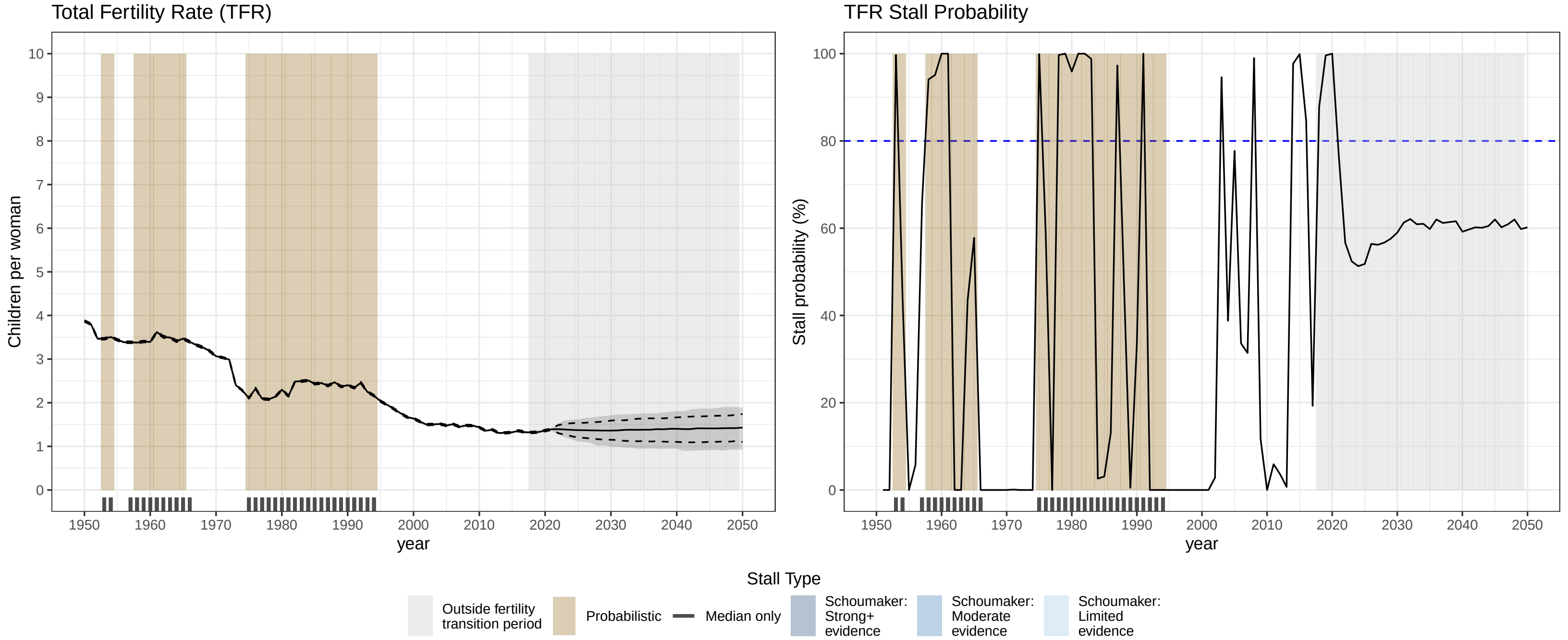
Azerbaijan (Western Asia)



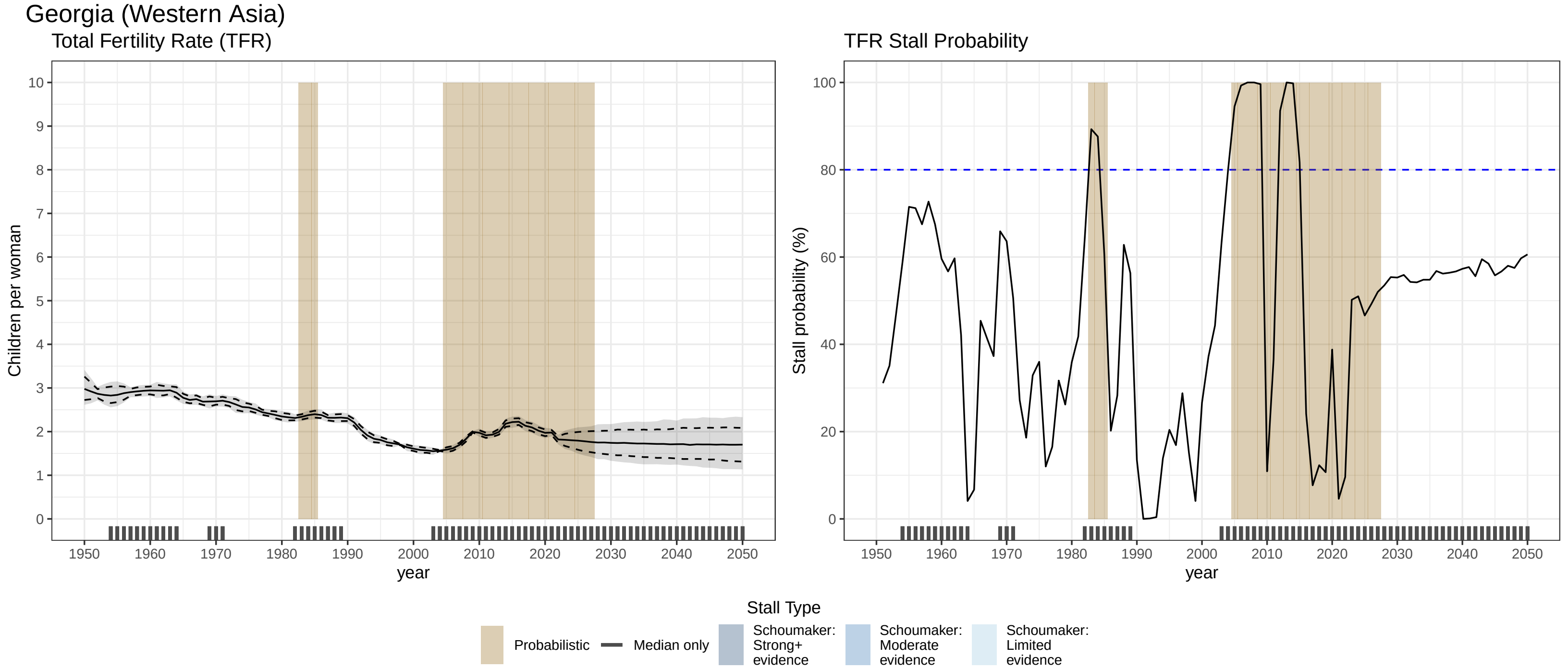
Bahrain (Western Asia)



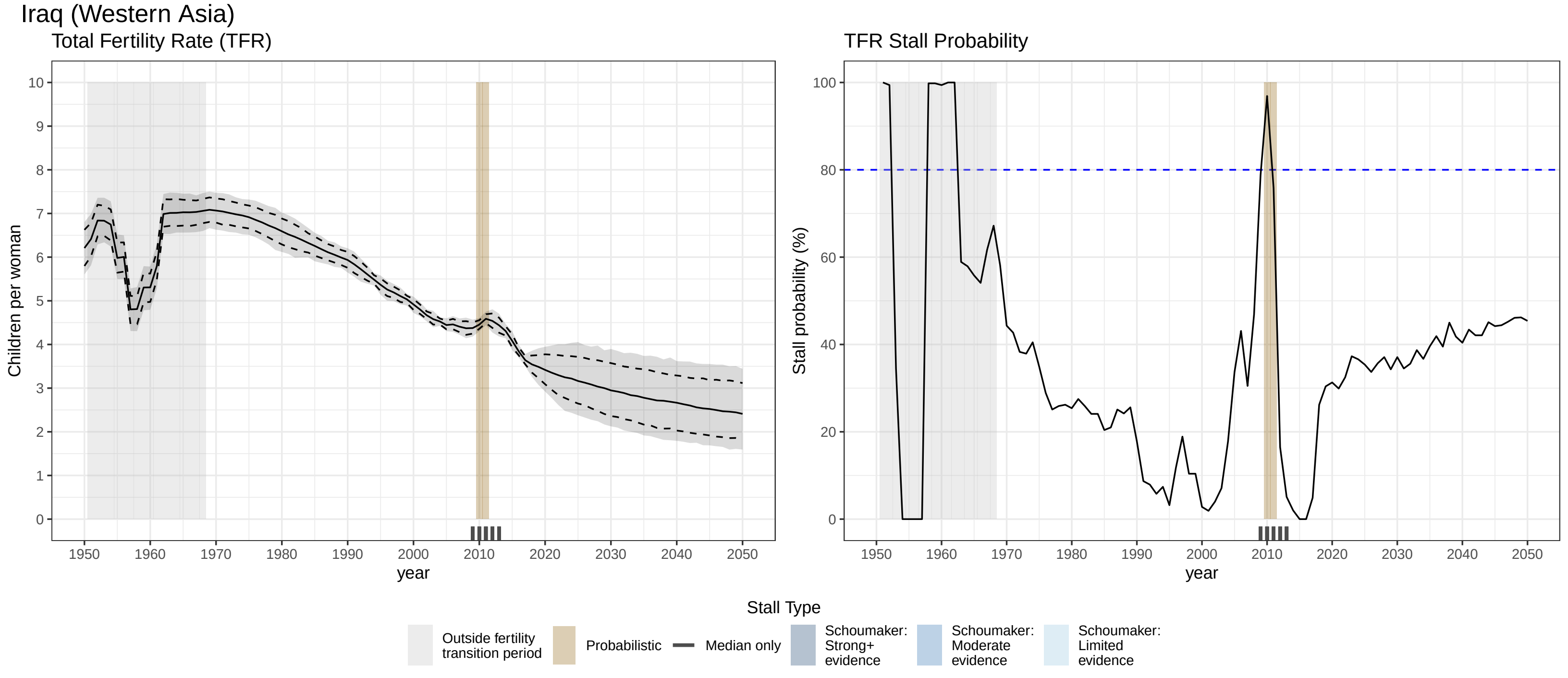
Cyprus (Western Asia)



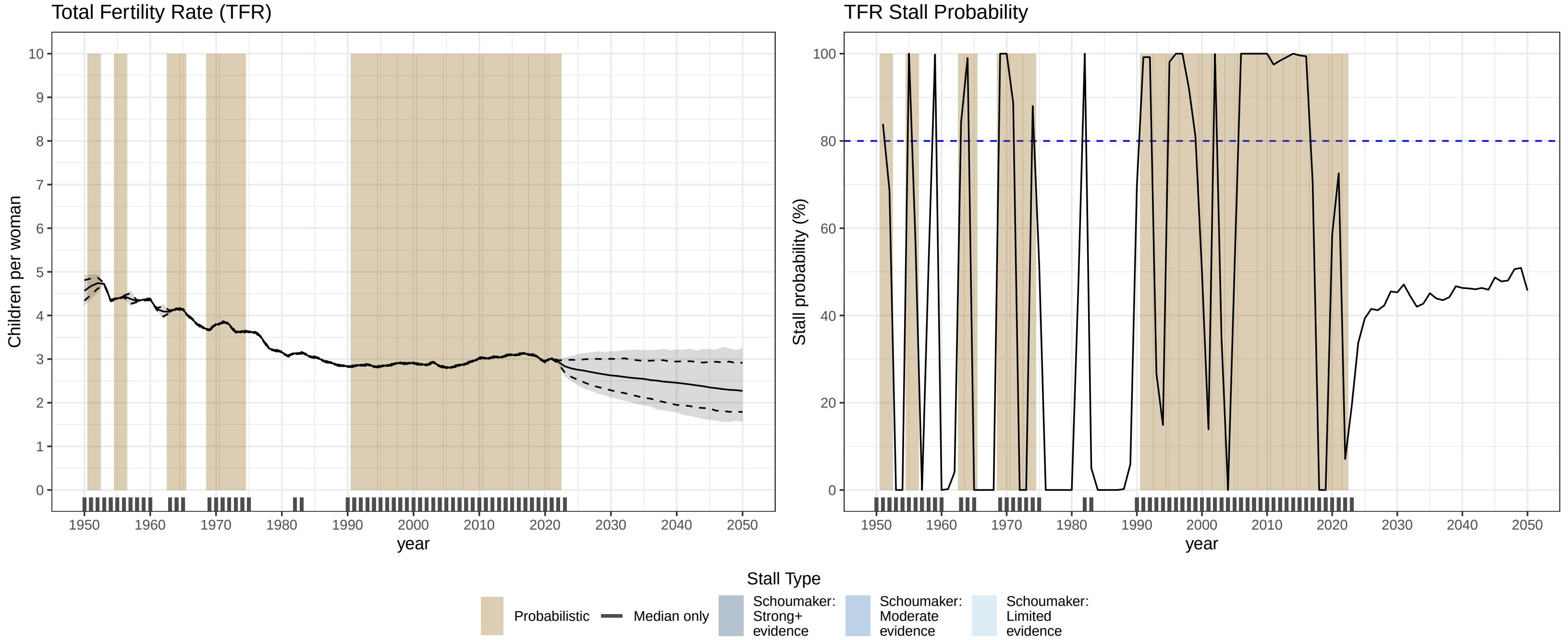
Georgia (Western Asia)



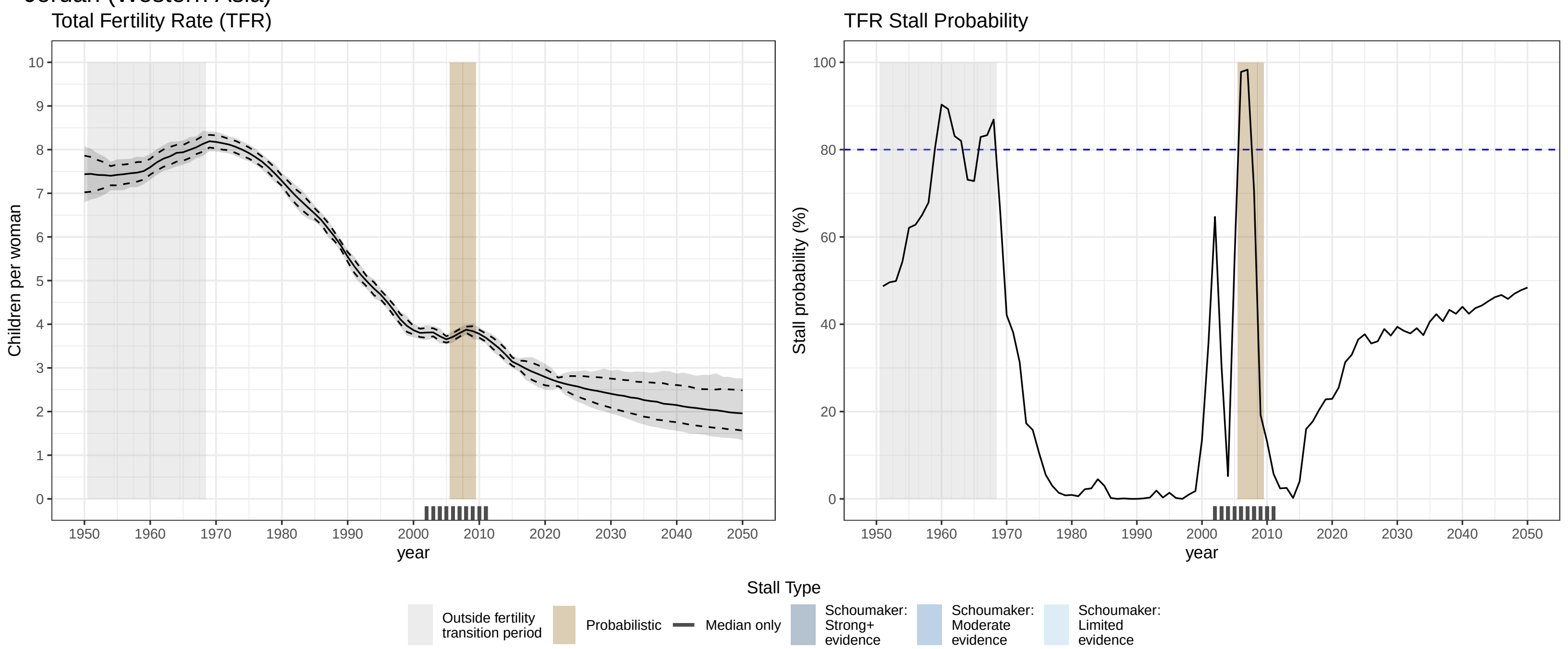
Iraq (Western Asia)



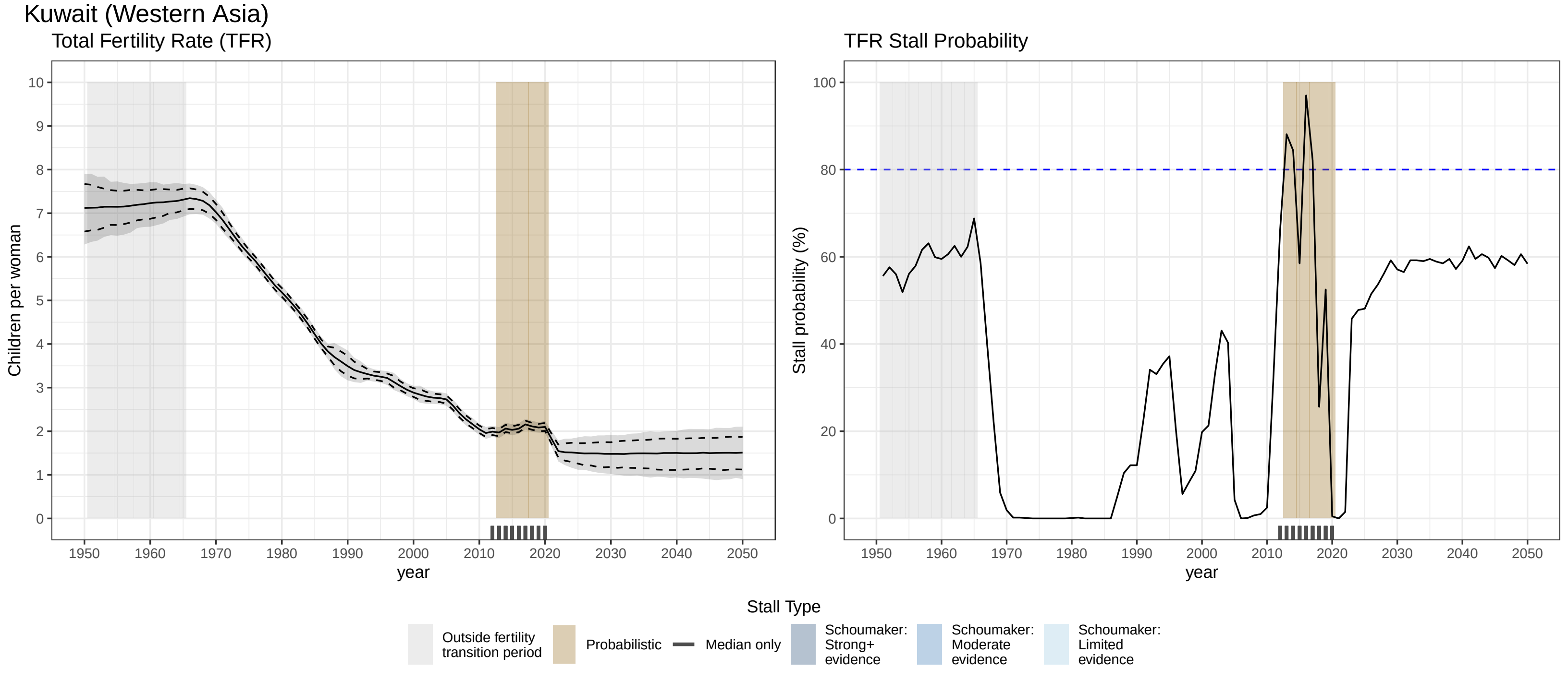
Israel (Western Asia)



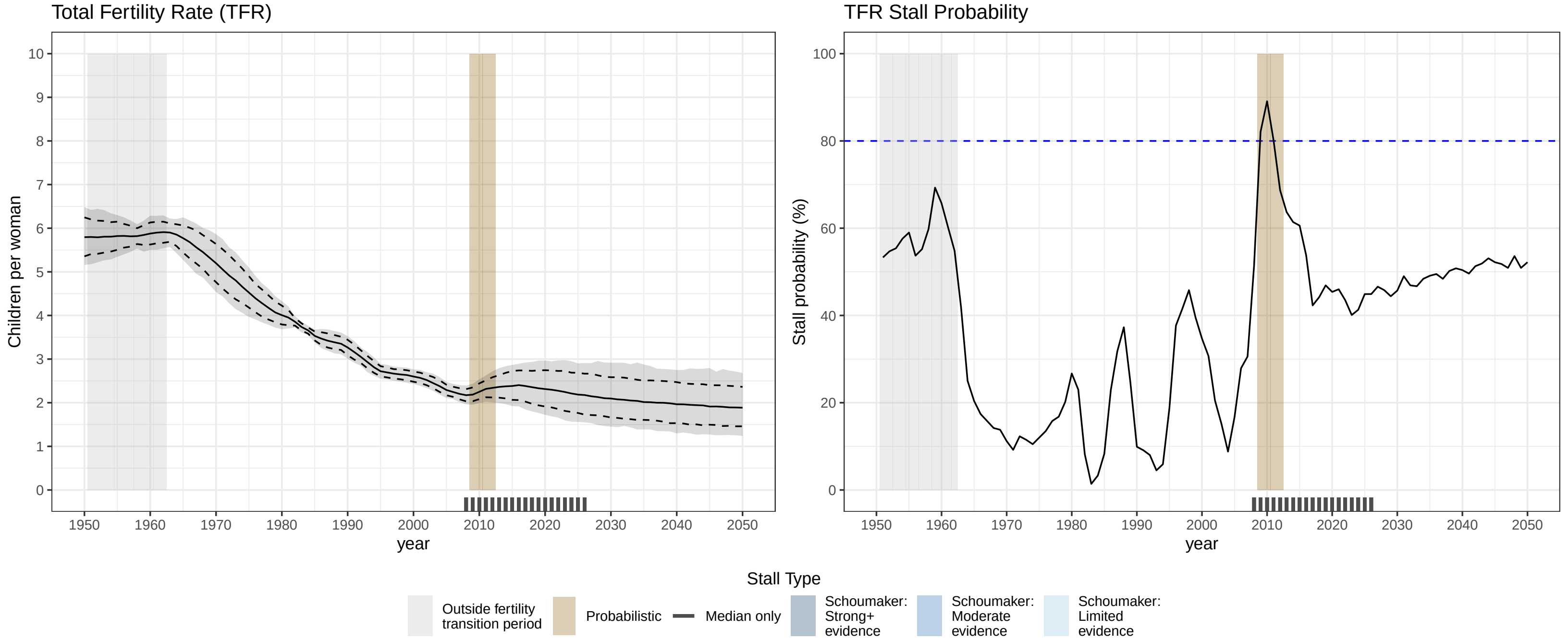
Jordan (Western Asia)



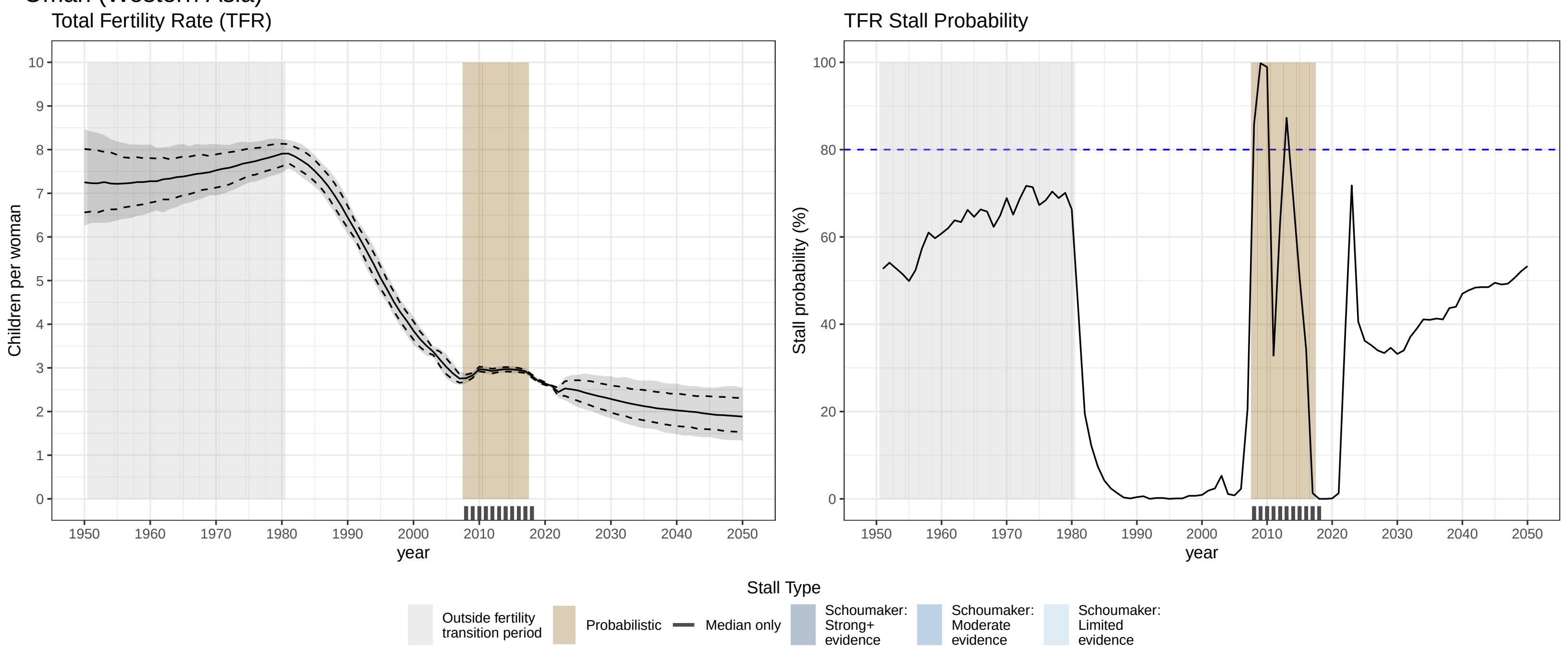
Kuwait (Western Asia)



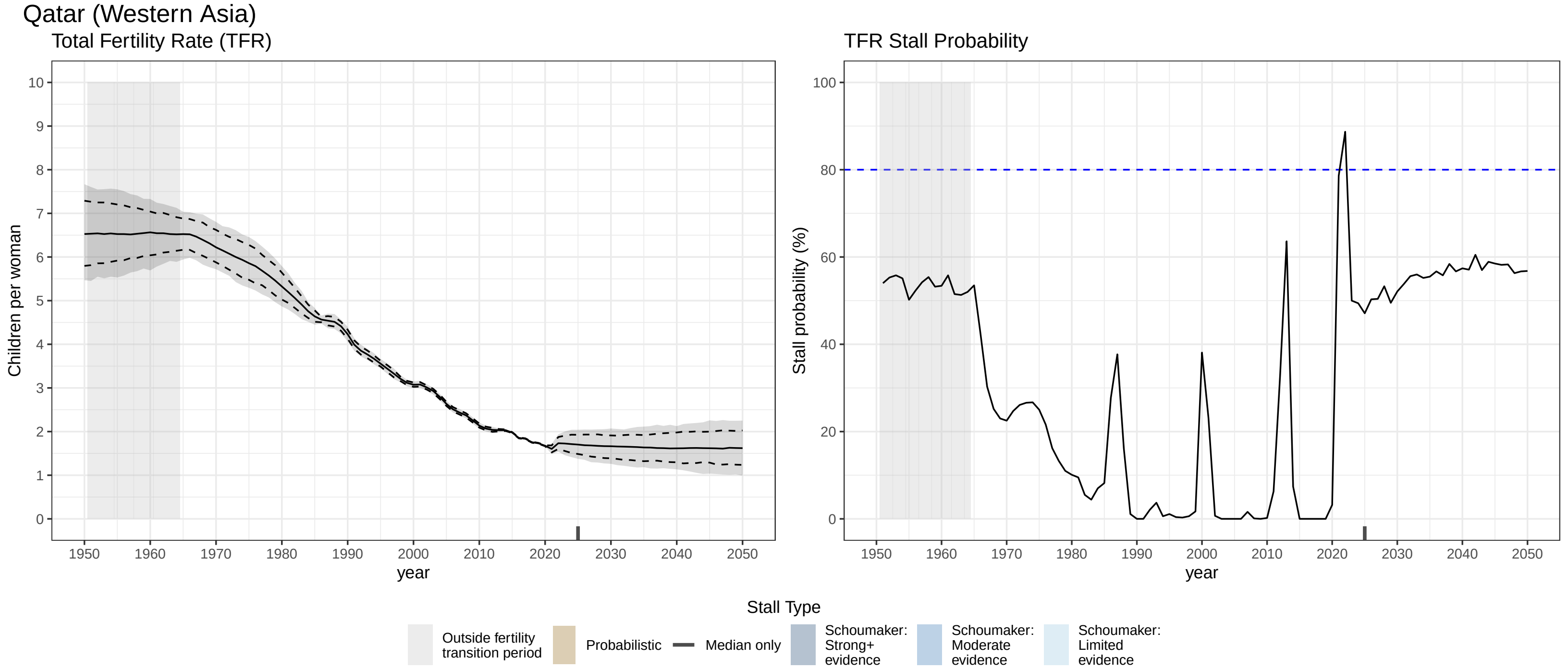
Lebanon (Western Asia)



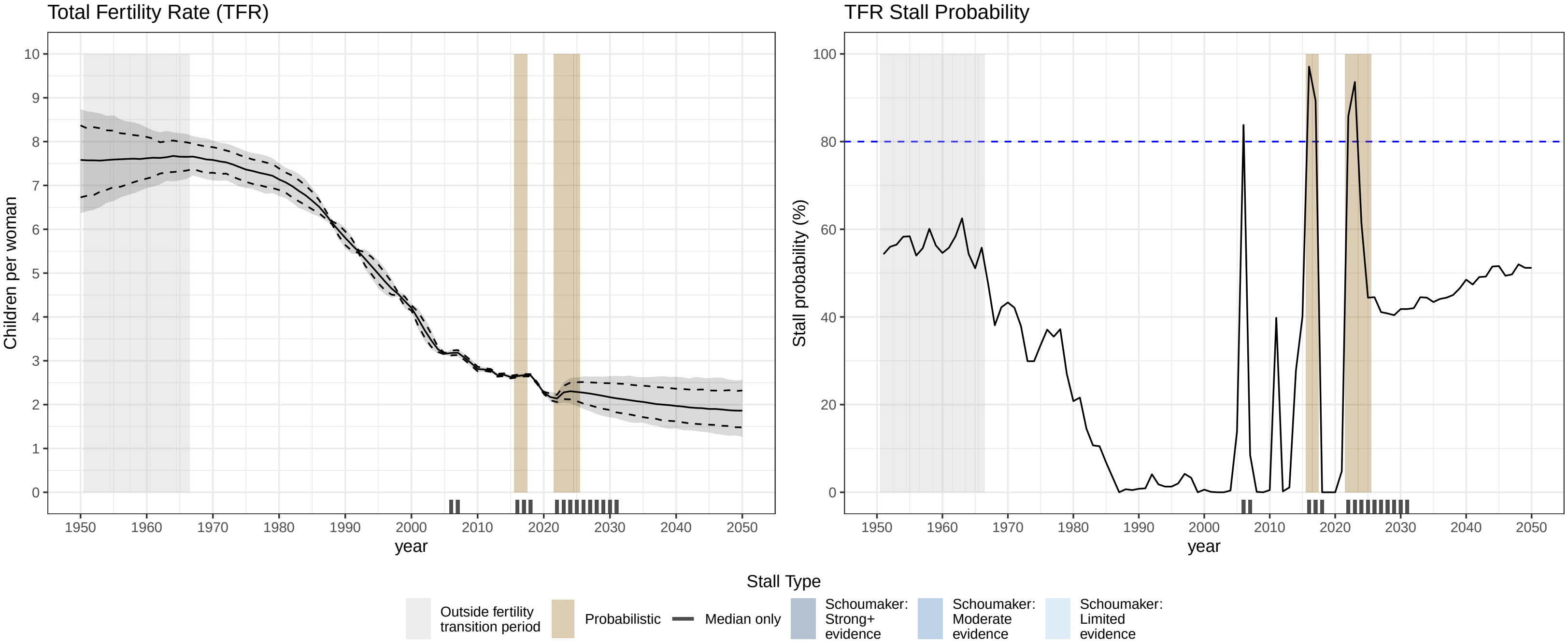
Oman (Western Asia)



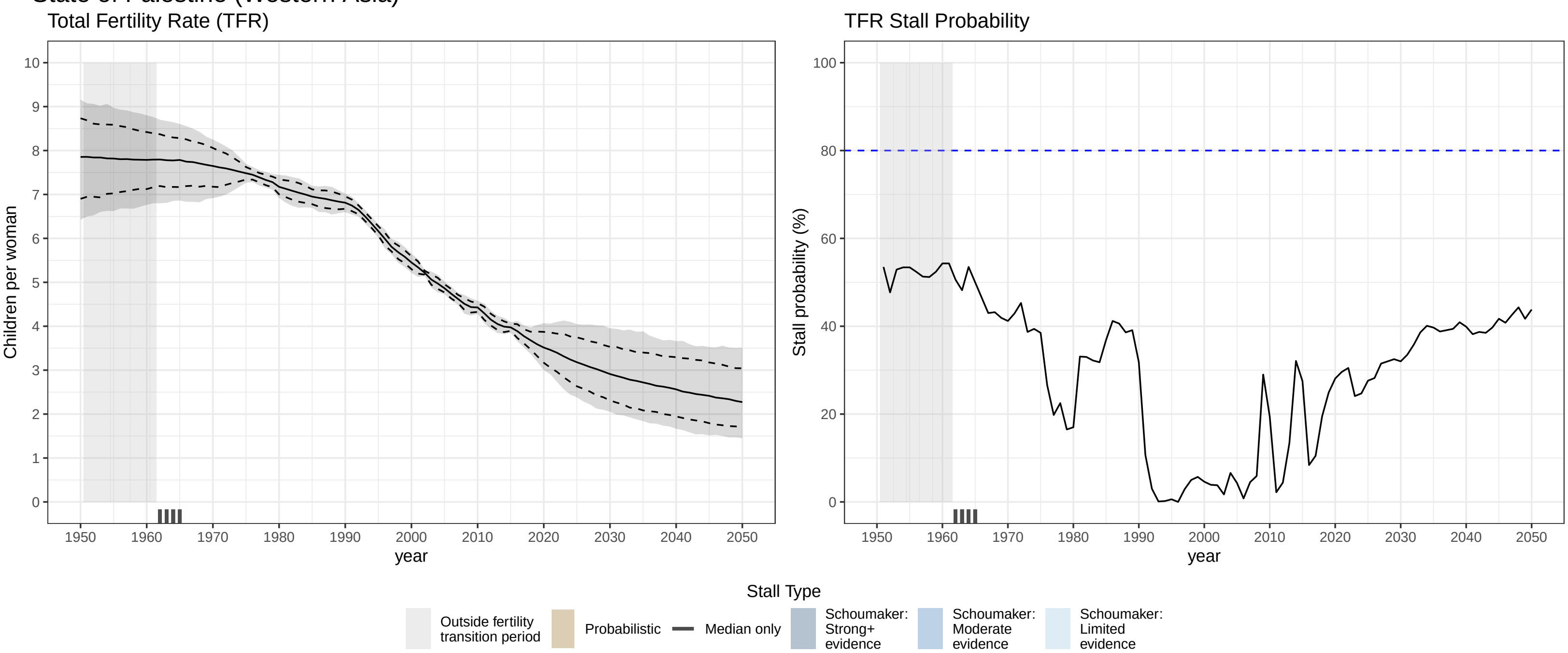
Qatar (Western Asia)



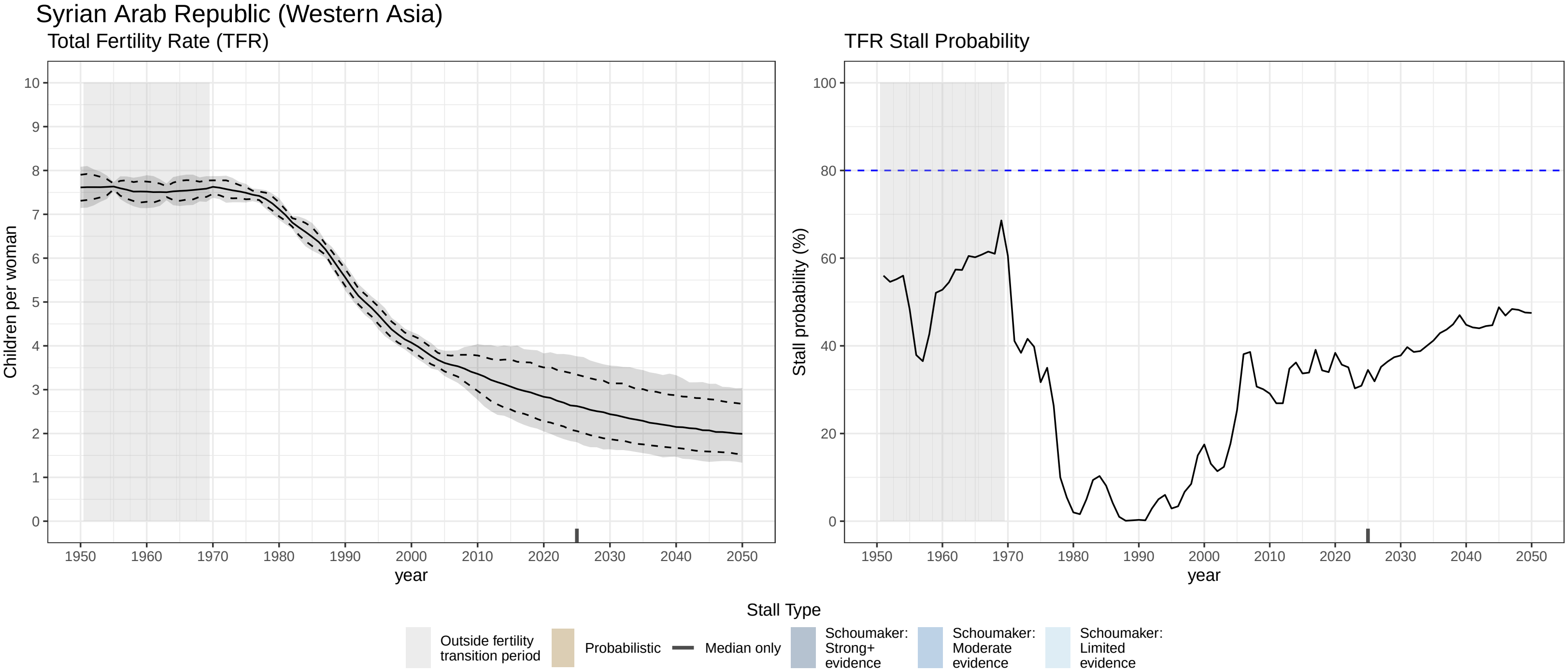
Saudi Arabia (Western Asia)



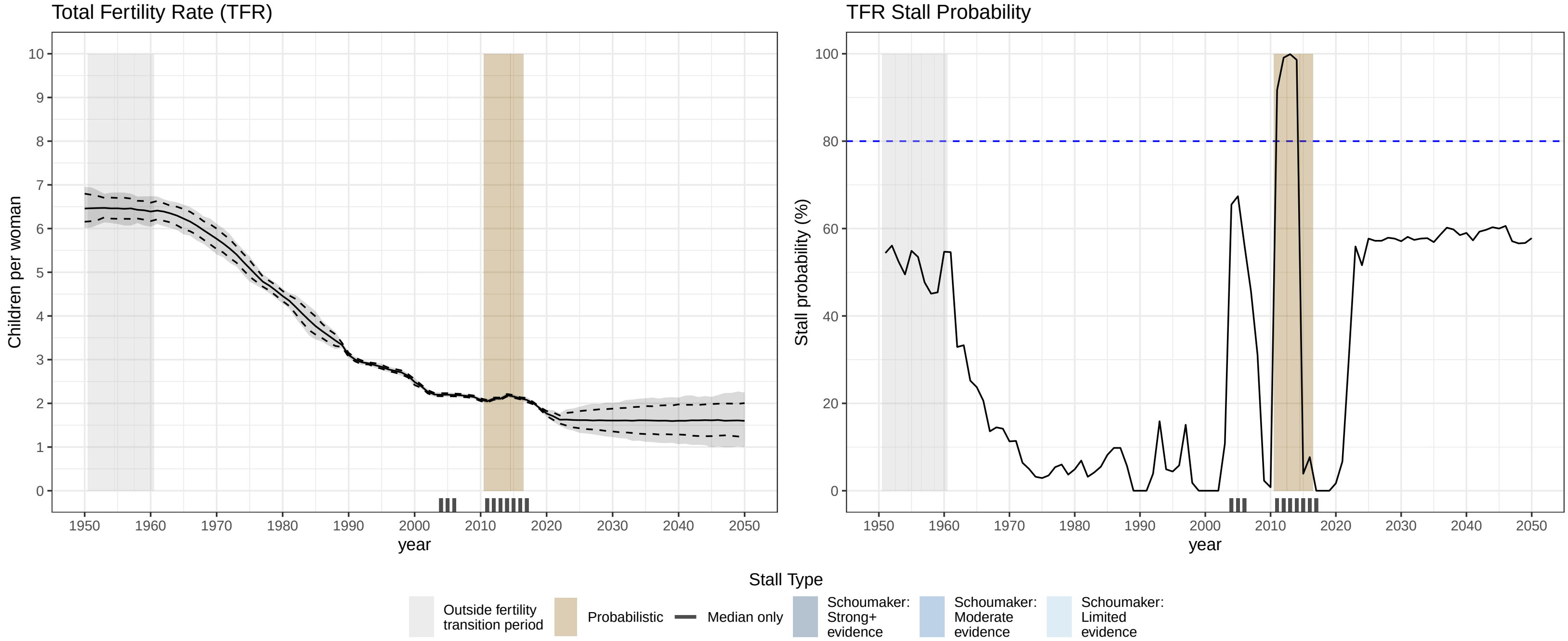
State of Palestine (Western Asia)



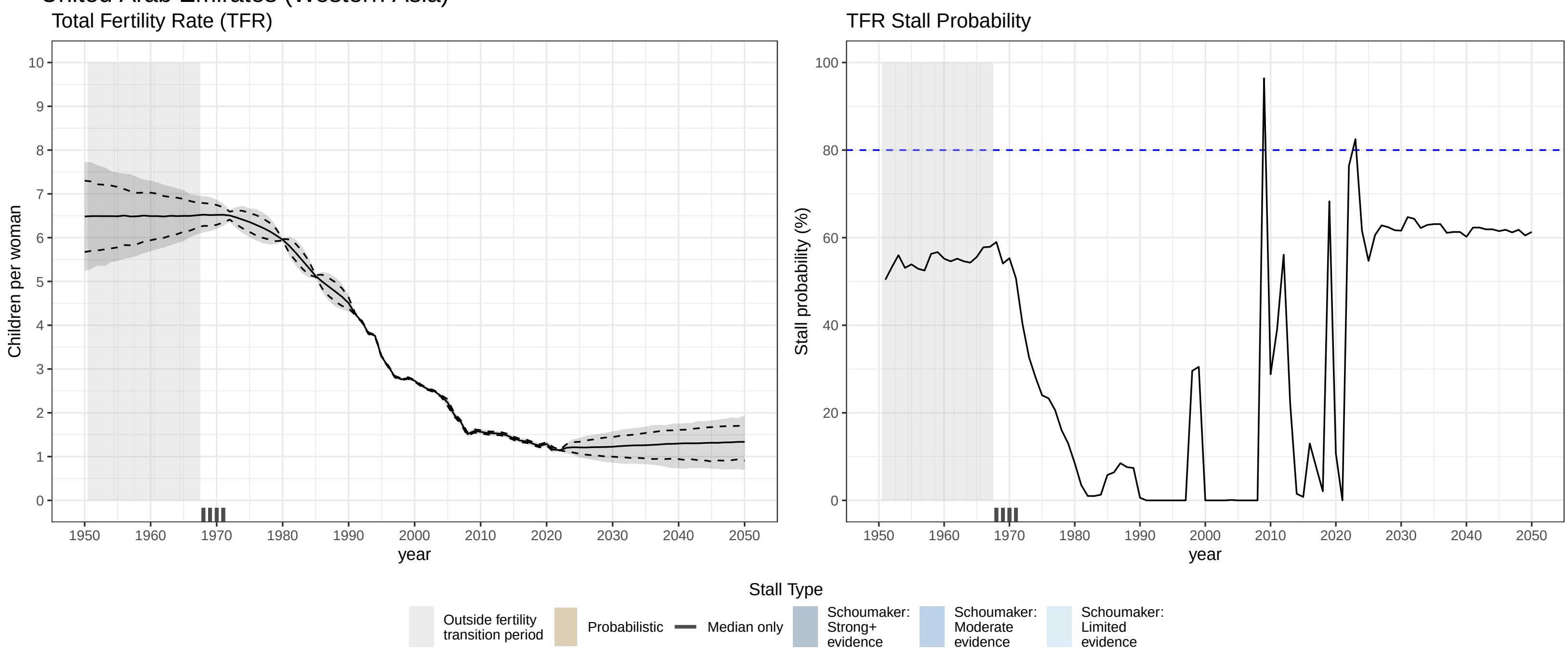
Syrian Arab Republic (Western Asia)



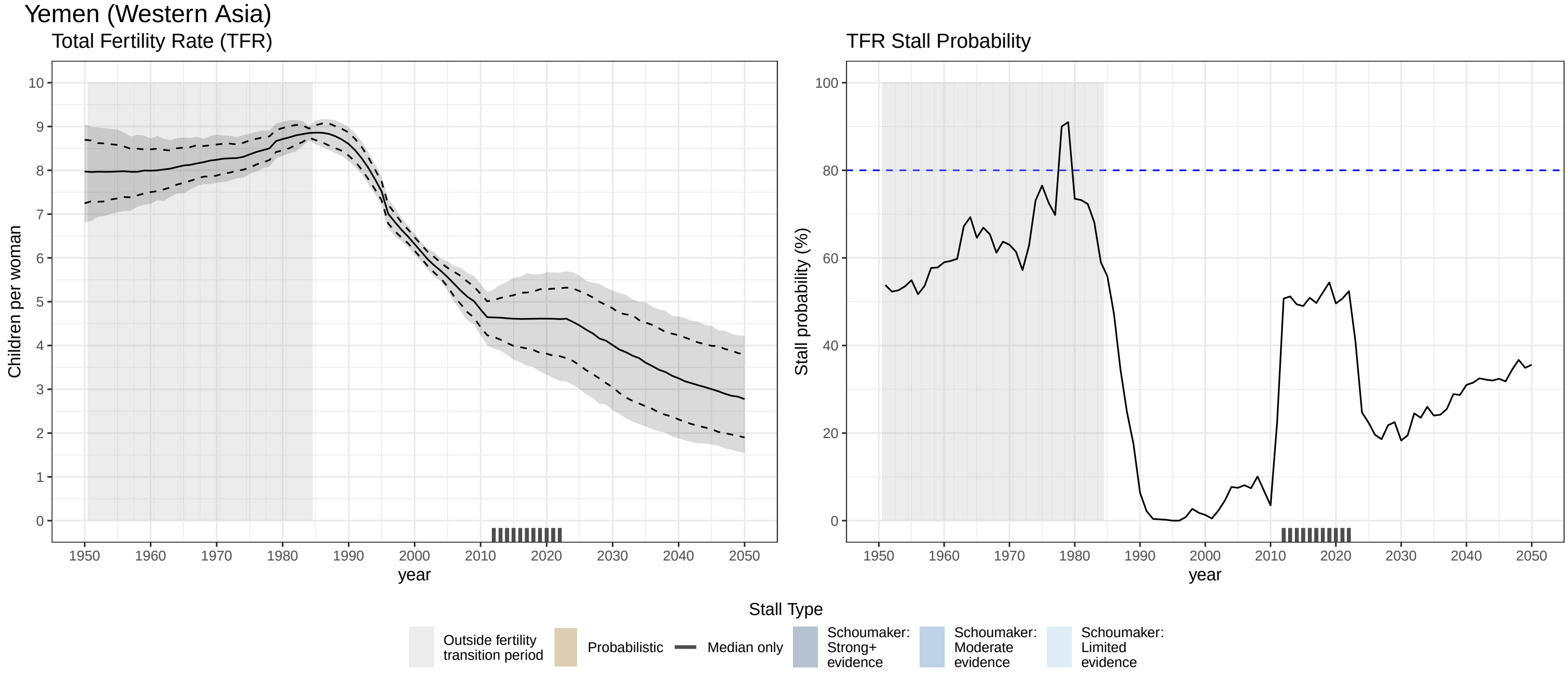
Turkiye (Western Asia)

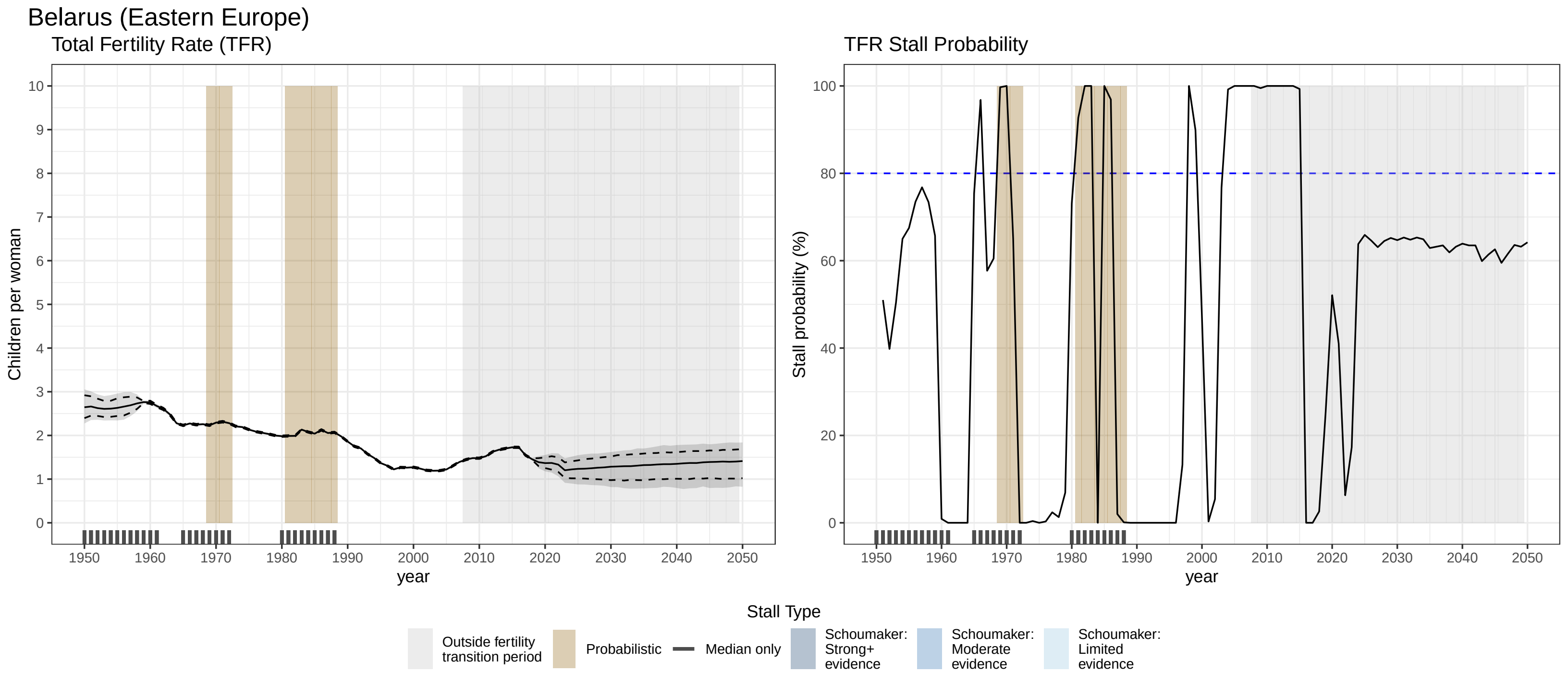


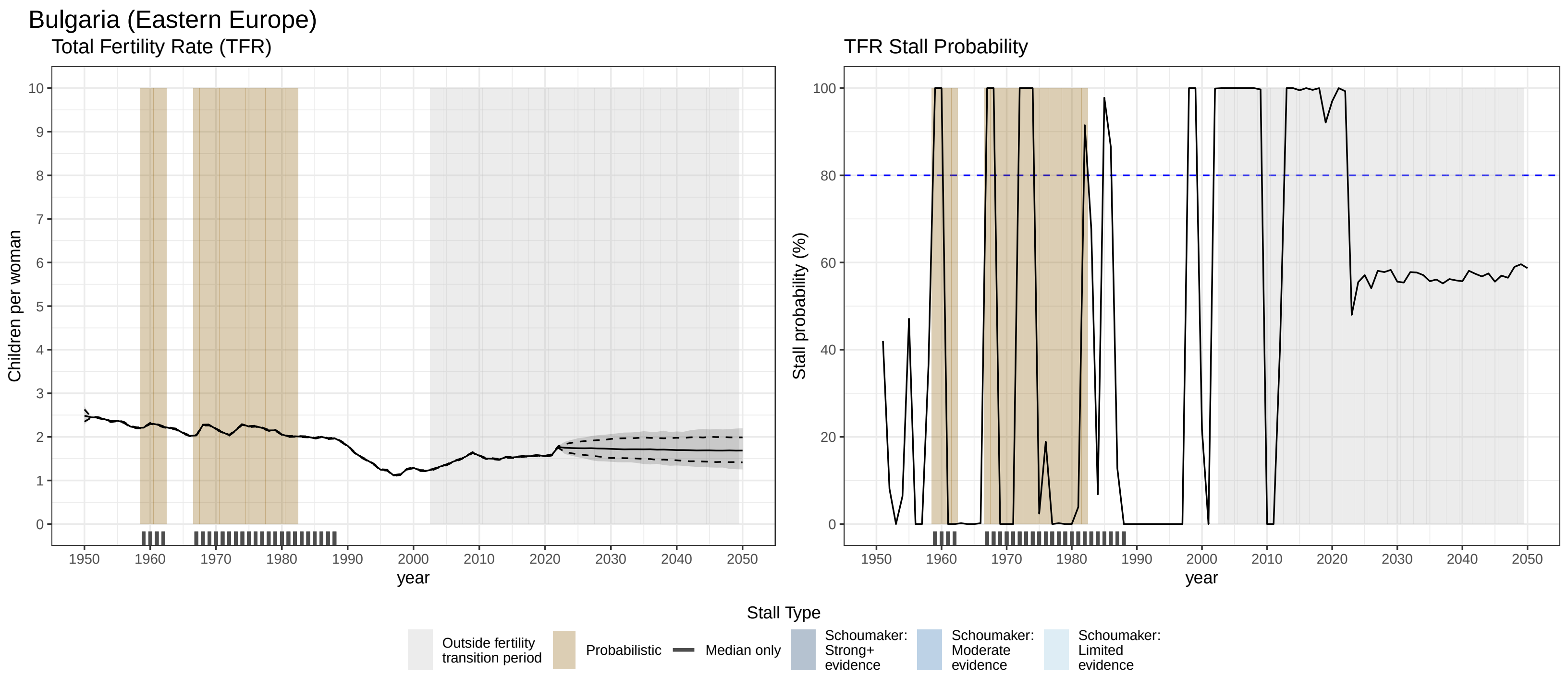
United Arab Emirates (Western Asia)

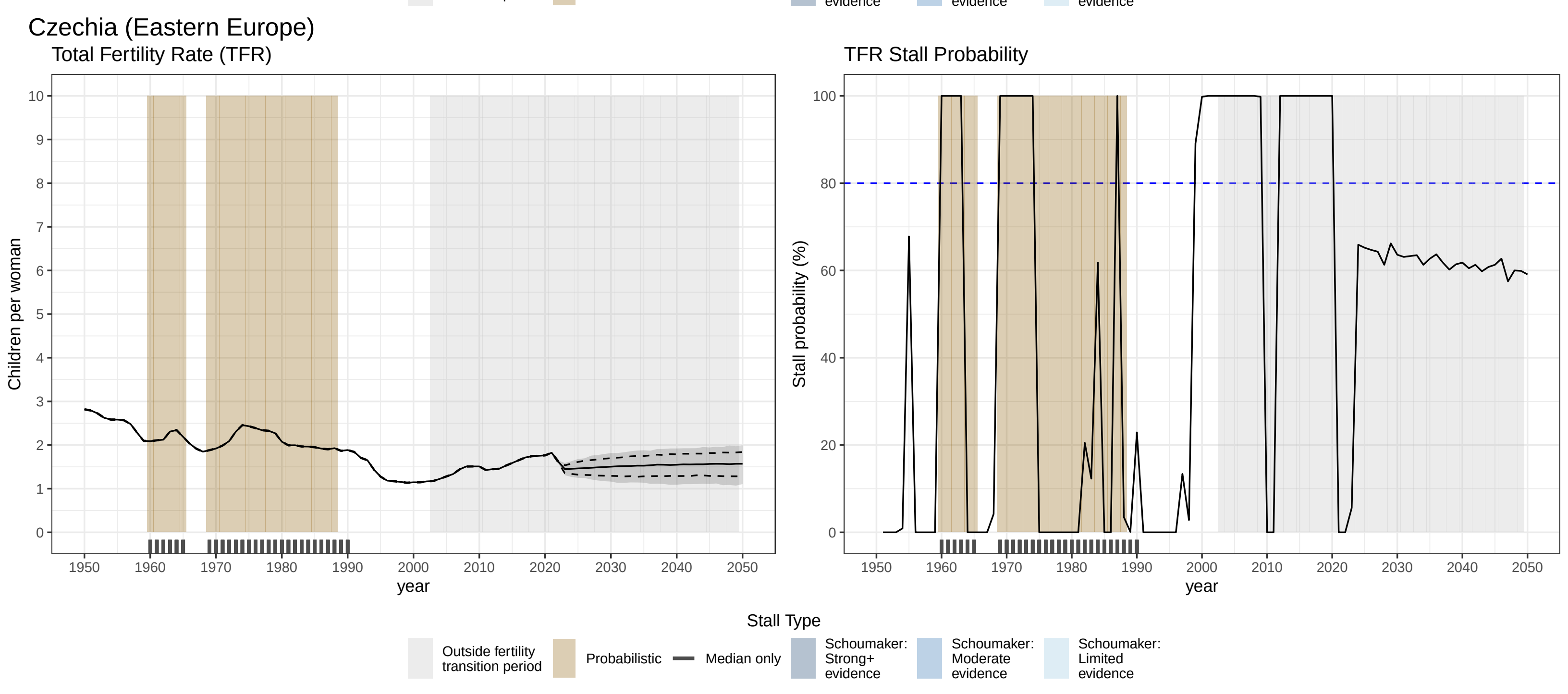


Yemen (Western Asia)

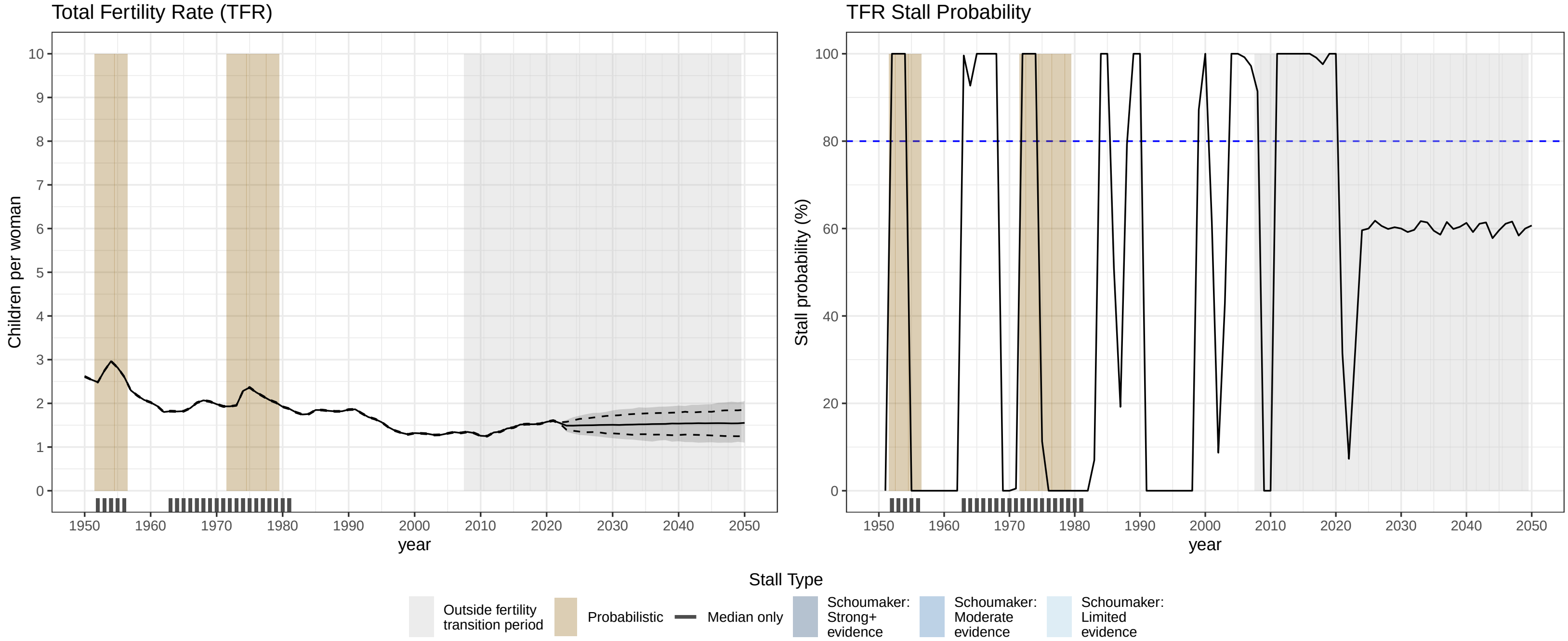



Belarus (Eastern Europe)
Total Fertility Rate (TFR)
Children per woman
year
TFR Stall Probability
Stall probability (%)
year
Stall Type
Outside fertility transition period
Probabilistic
Median only
Schoumaker: Strong+ evidence
Schoumaker: Moderate evidence
Schoumaker: Limited evidence

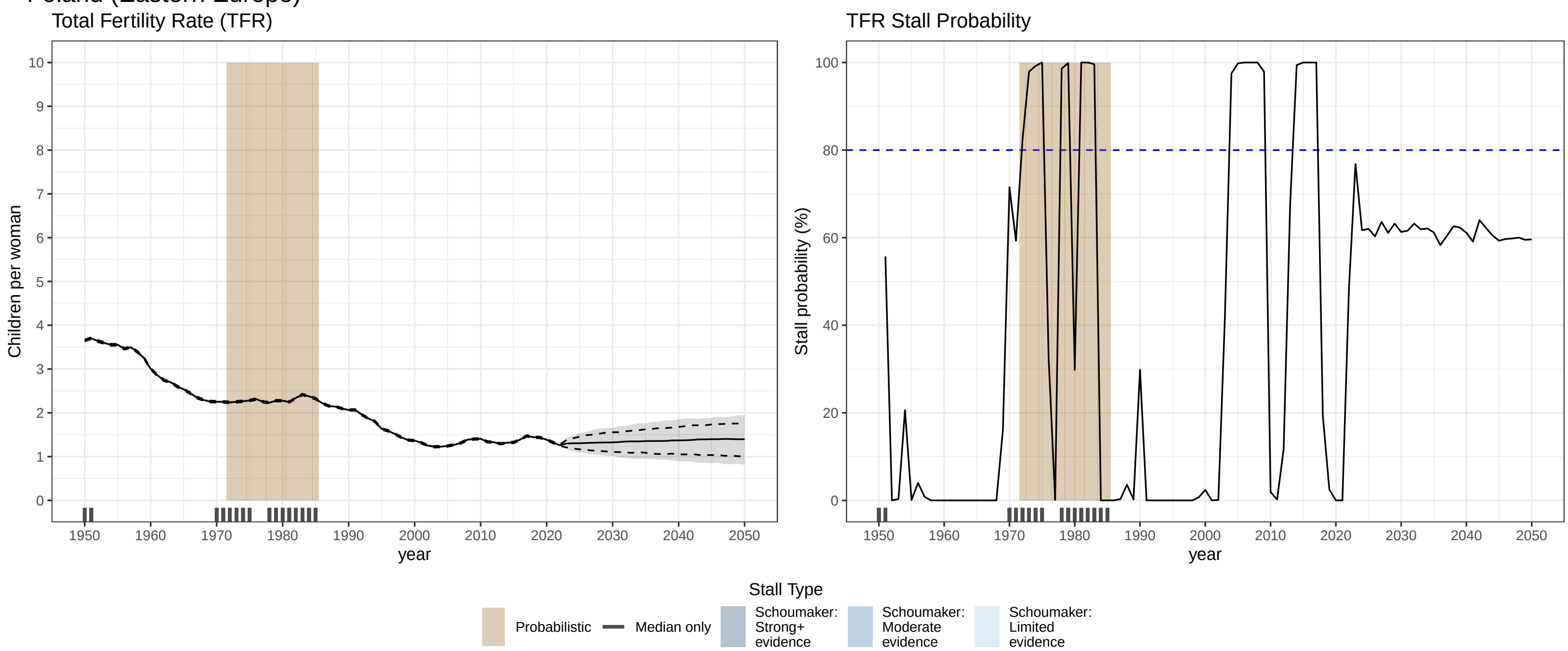

Bulgaria (Eastern Europe)
Total Fertility Rate (TFR)
Children per woman
year
TFR Stall Probability
Stall probability (%)
year
Stall Type
Outside fertility transition period
Probabilistic
Median only
Schoumaker: Strong+ evidence
Schoumaker: Moderate evidence
Schoumaker: Limited evidence


Czechia (Eastern Europe)
Total Fertility Rate (TFR)
Children per woman
year
TFR Stall Probability
Stall probability (%)
year
Stall Type
Outside fertility transition period
Probabilistic
Median only
Schoumaker: Strong+ evidence
Schoumaker: Moderate evidence
Schoumaker: Limited evidence

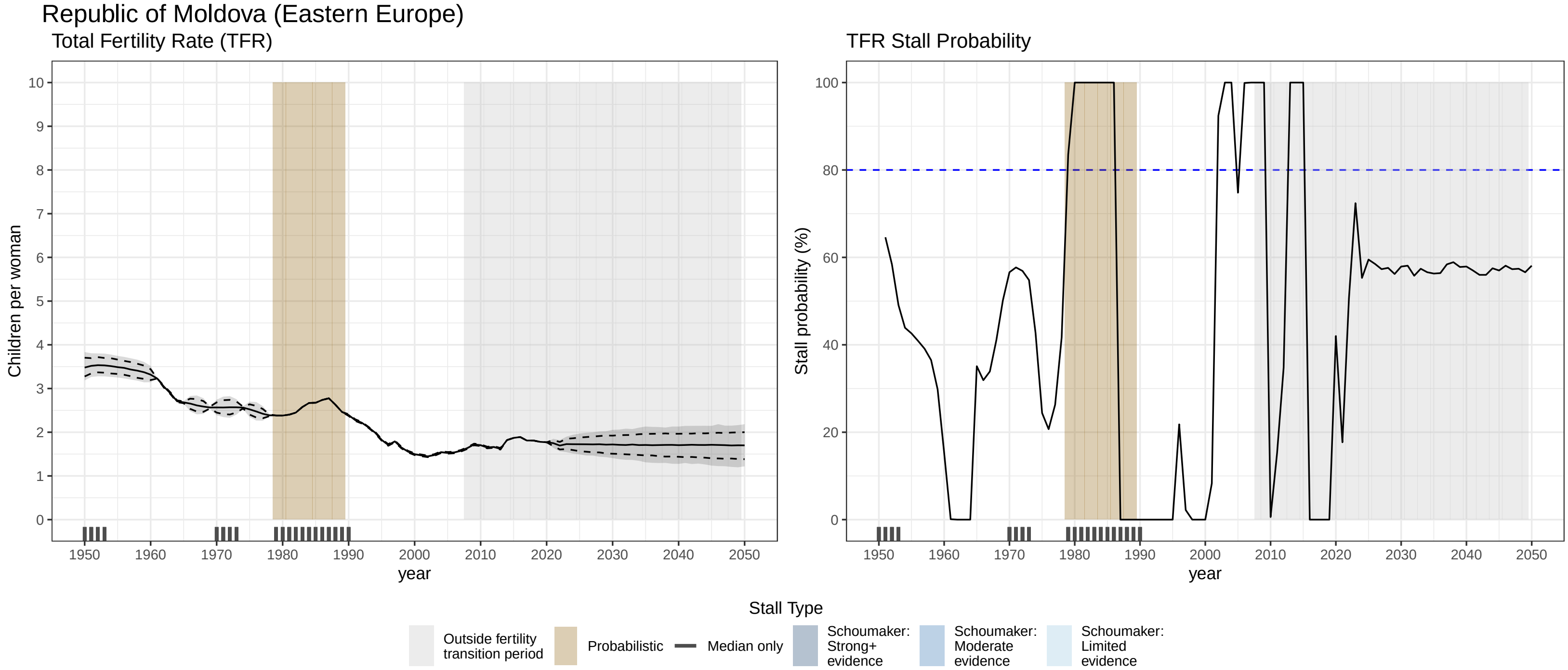
Hungary (Eastern Europe)



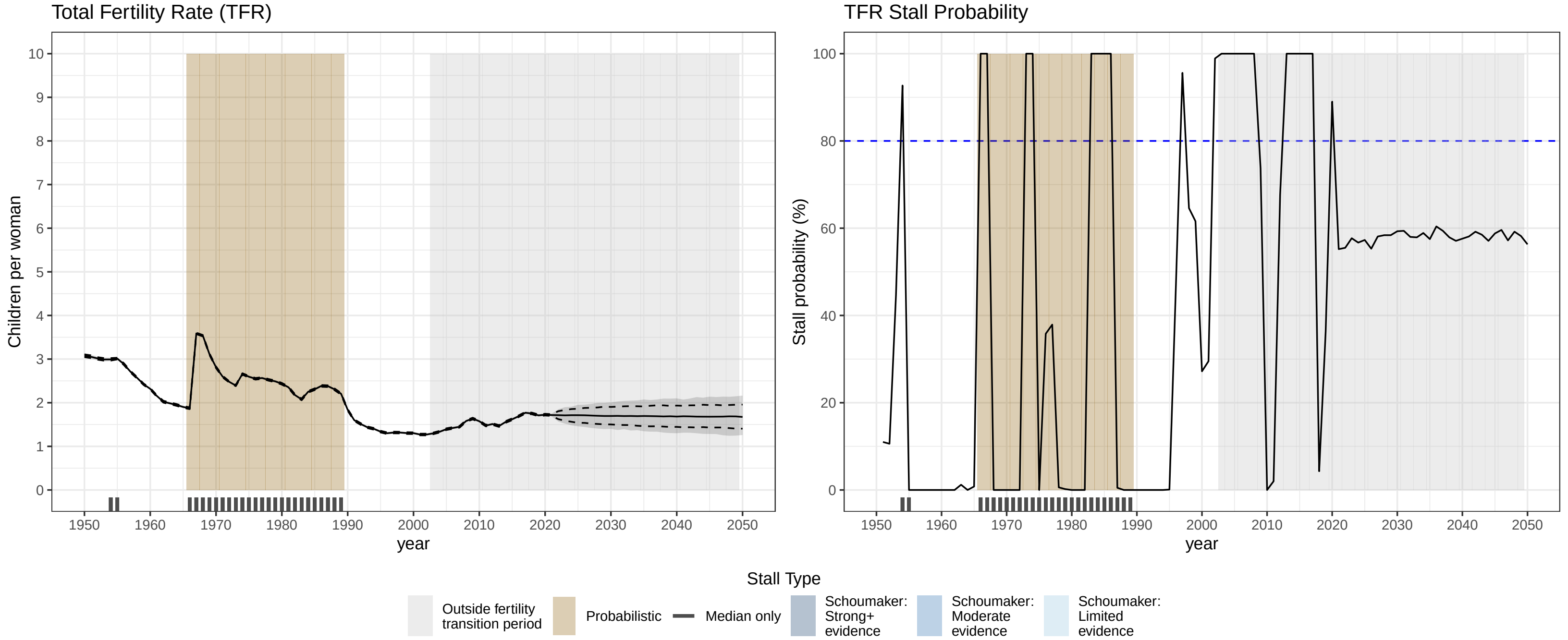
Poland (Eastern Europe)



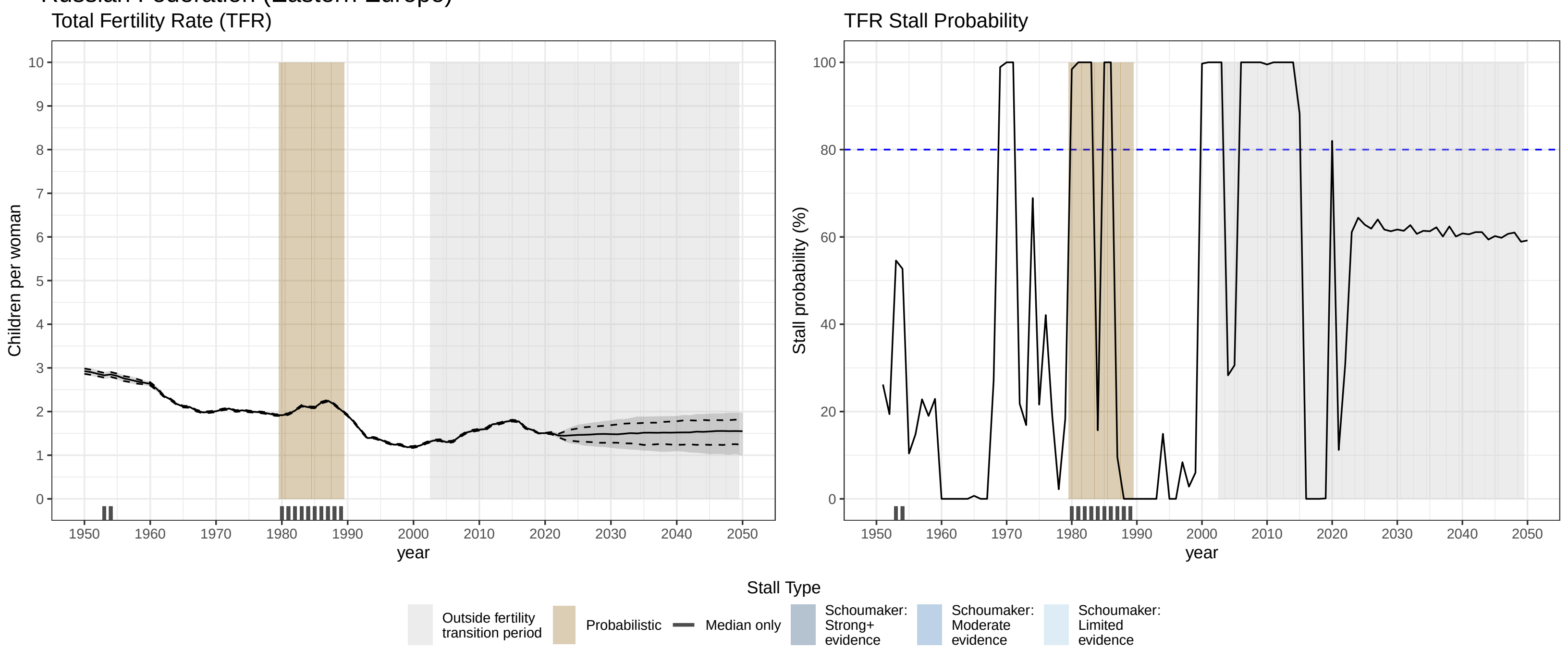
Republic of Moldova (Eastern Europe)



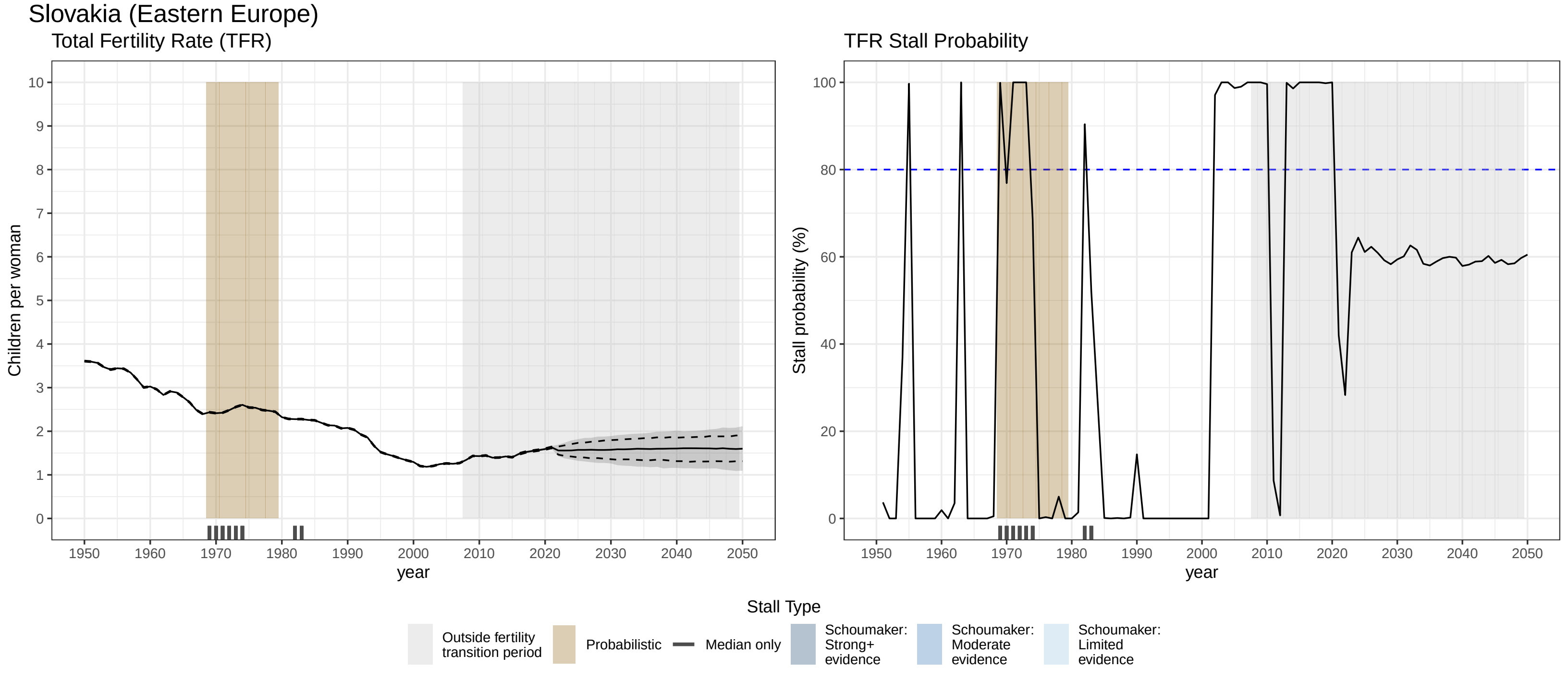
Romania (Eastern Europe)



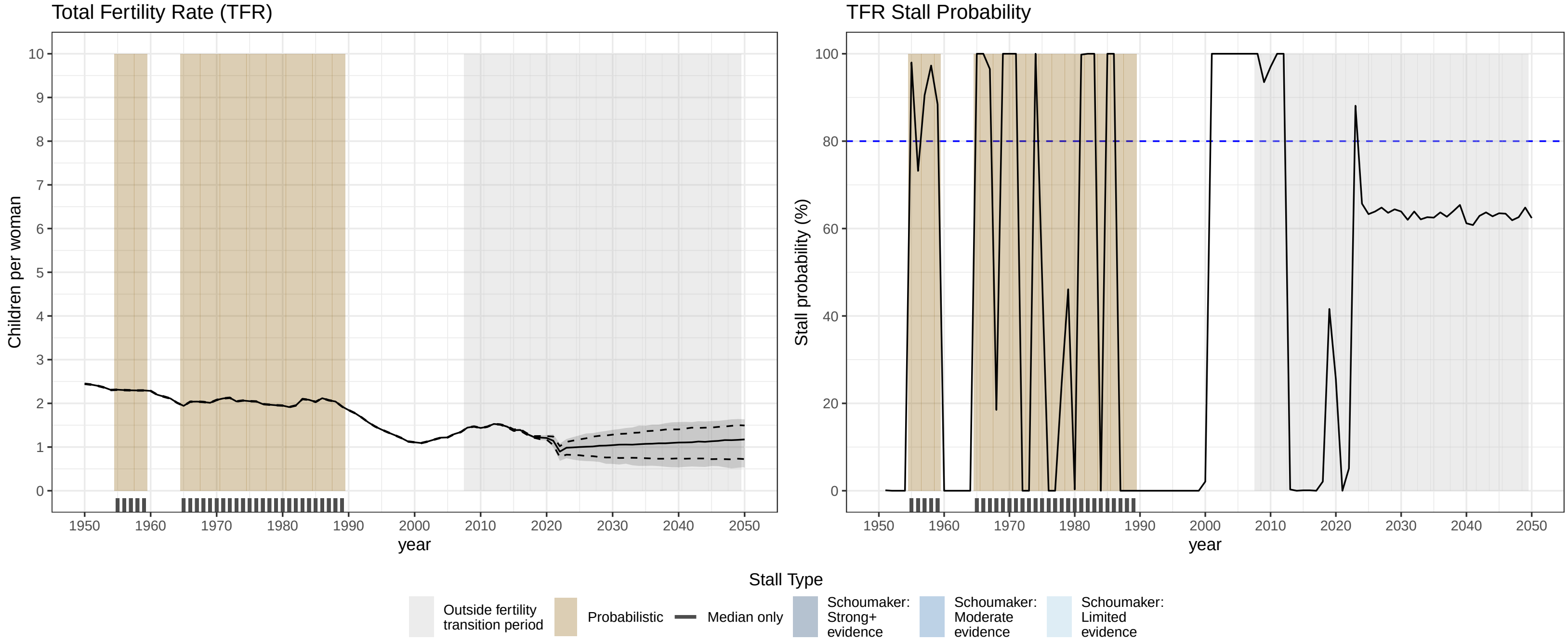
Russian Federation (Eastern Europe)



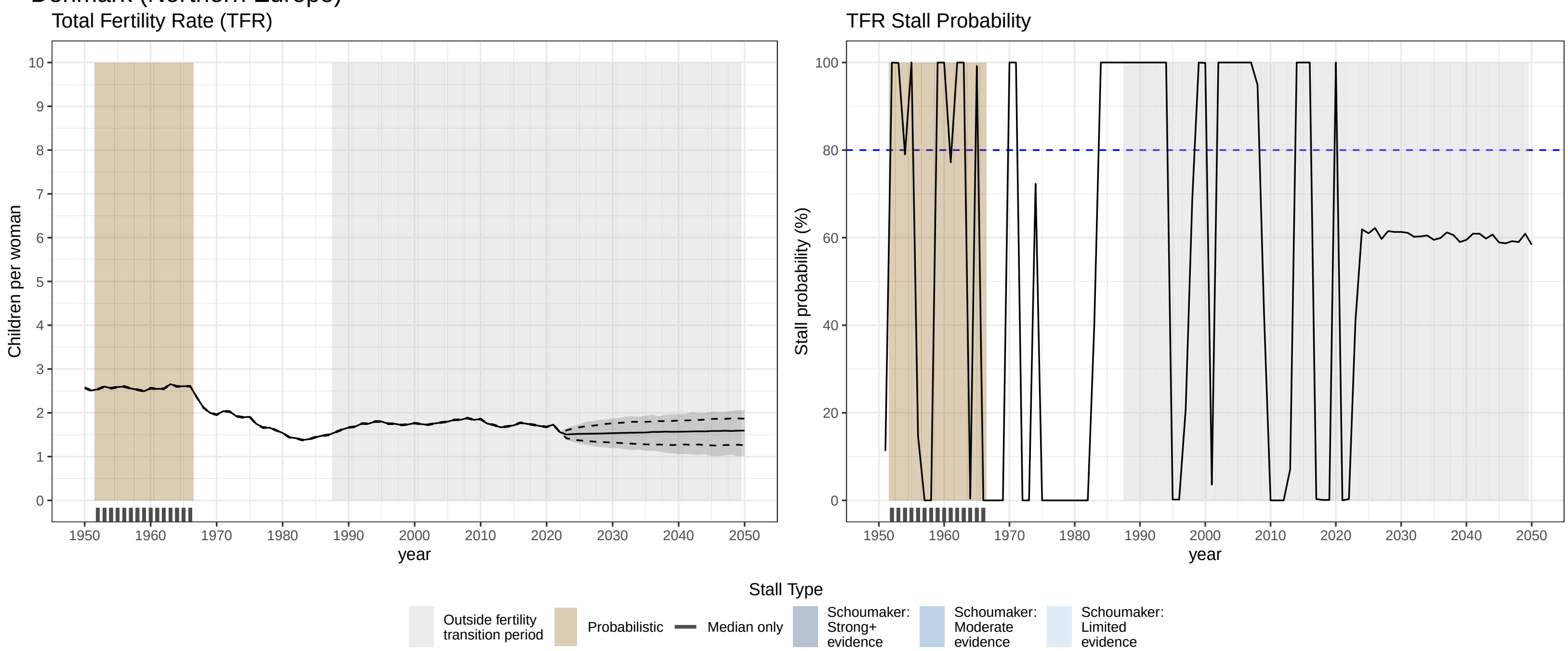
Slovakia (Eastern Europe)



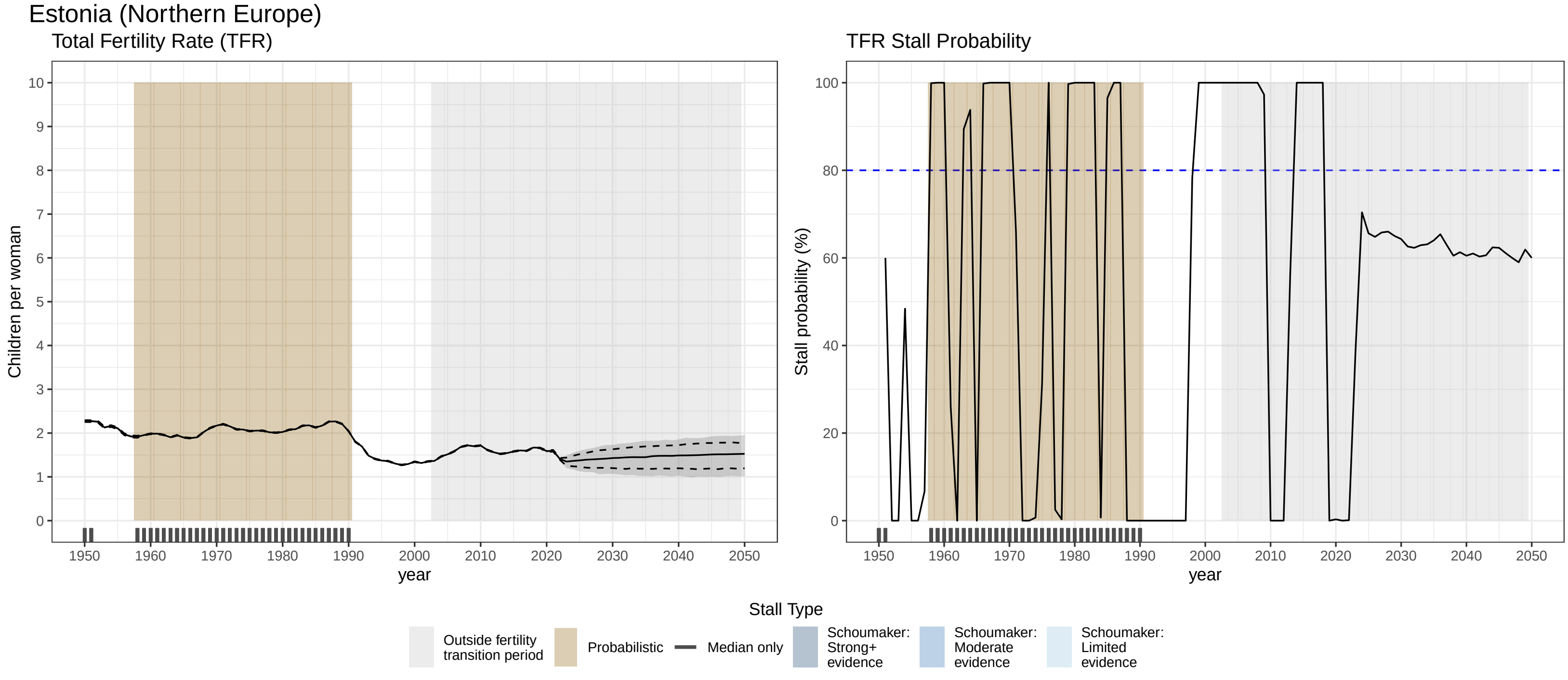
Ukraine (Eastern Europe)



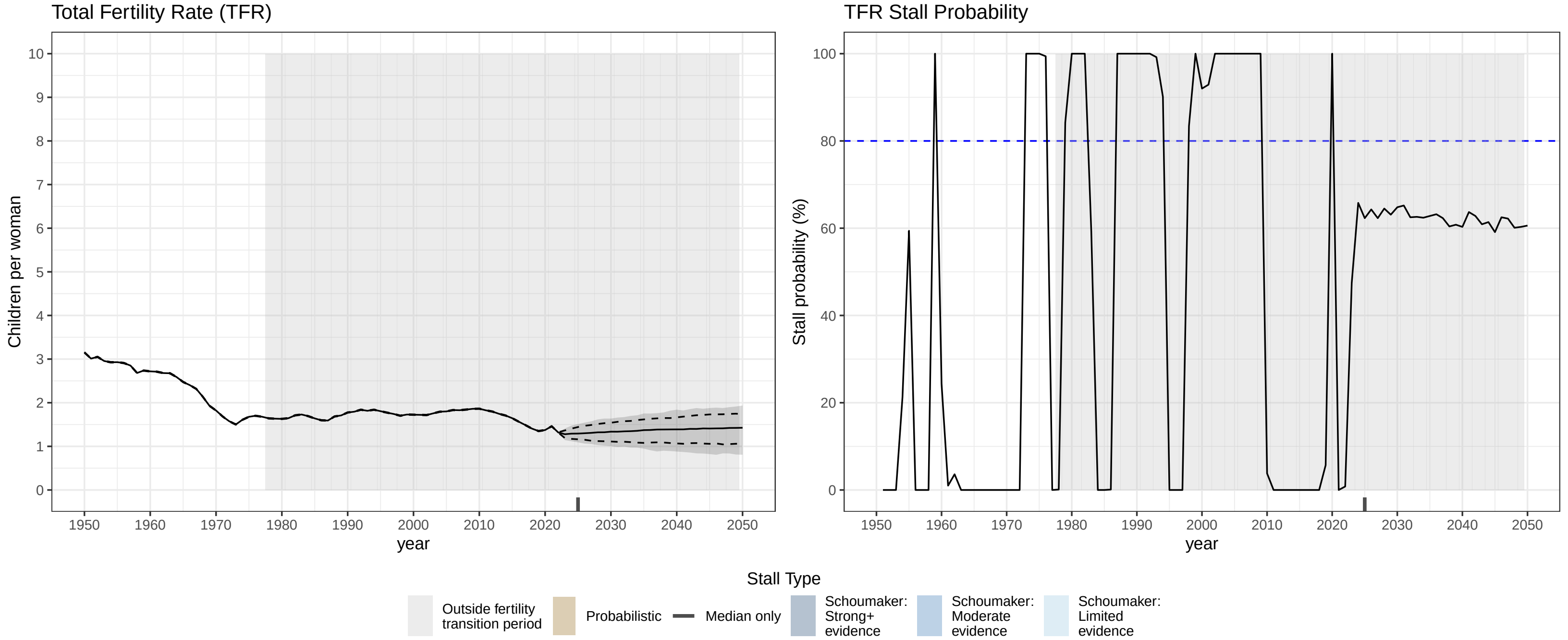
Denmark (Northern Europe)



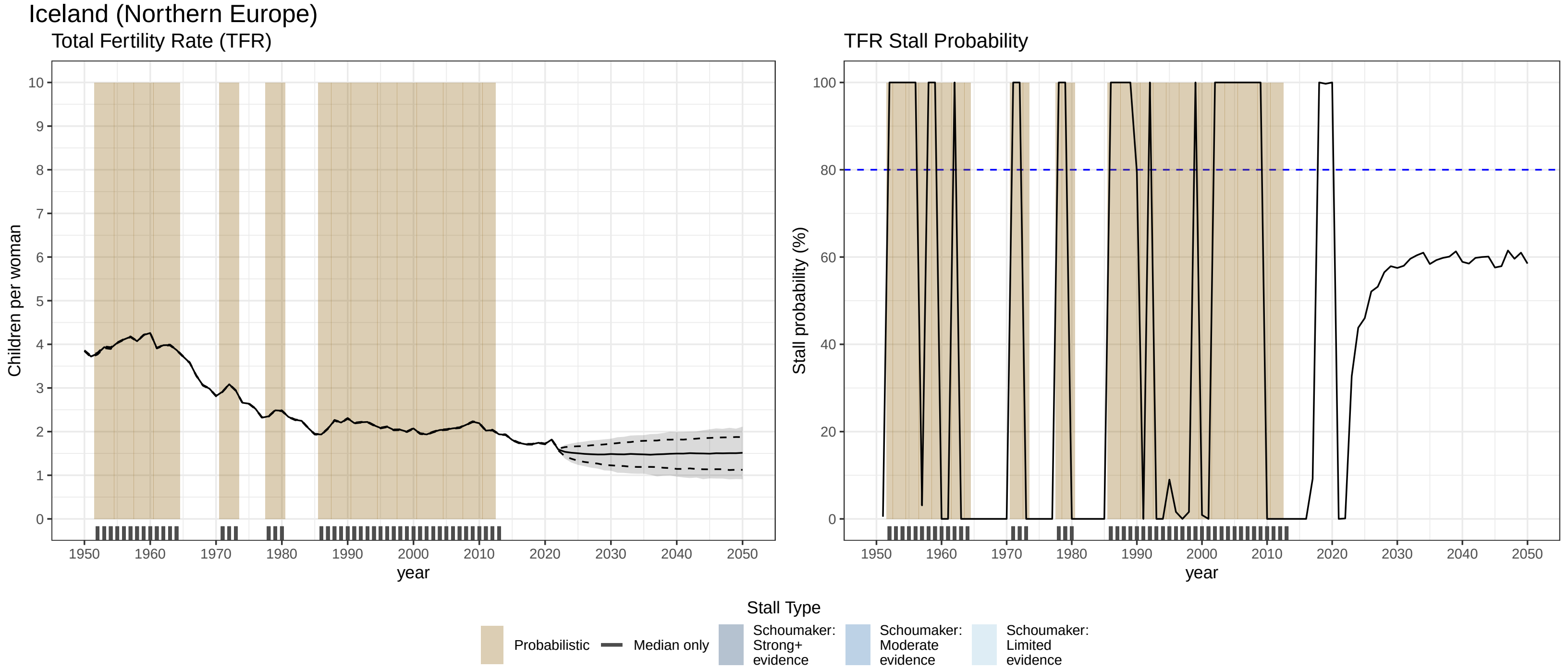
Estonia (Northern Europe)



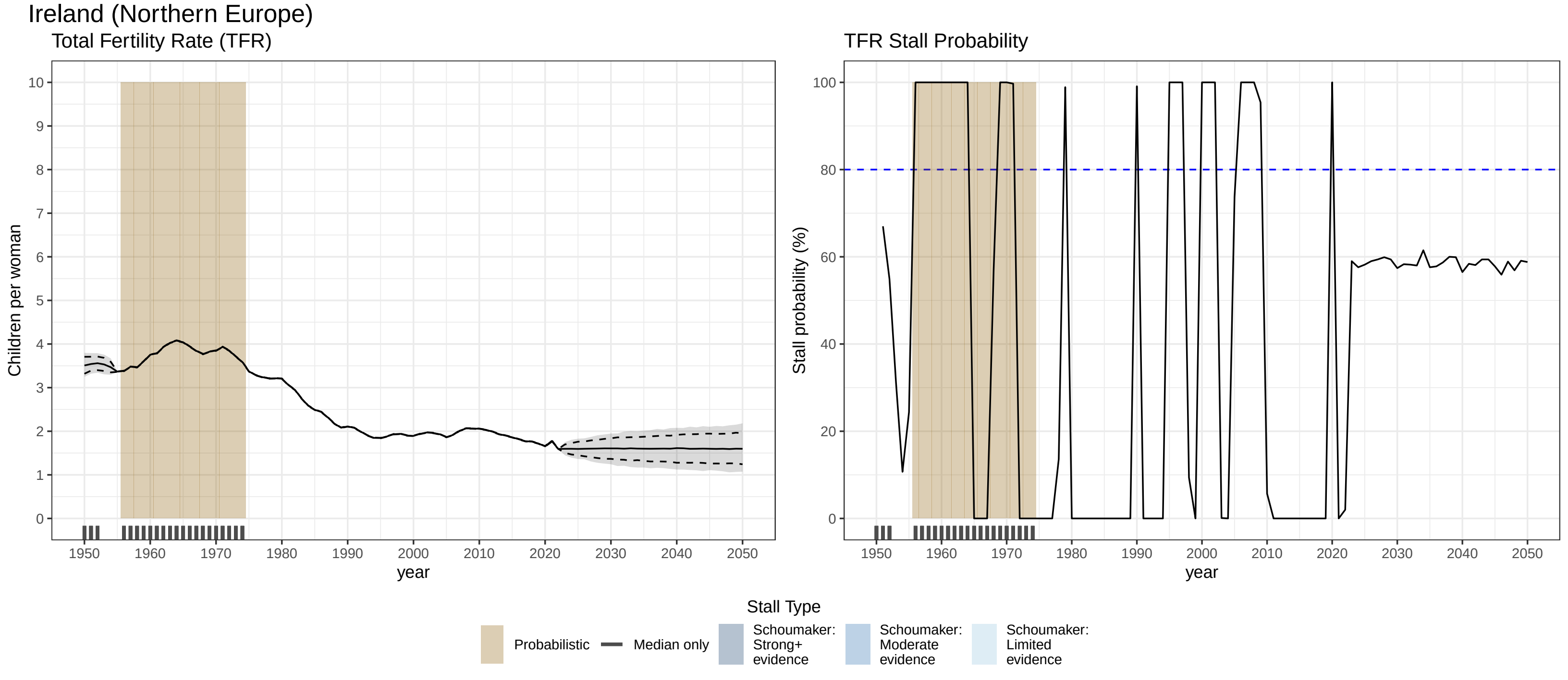
Finland (Northern Europe)



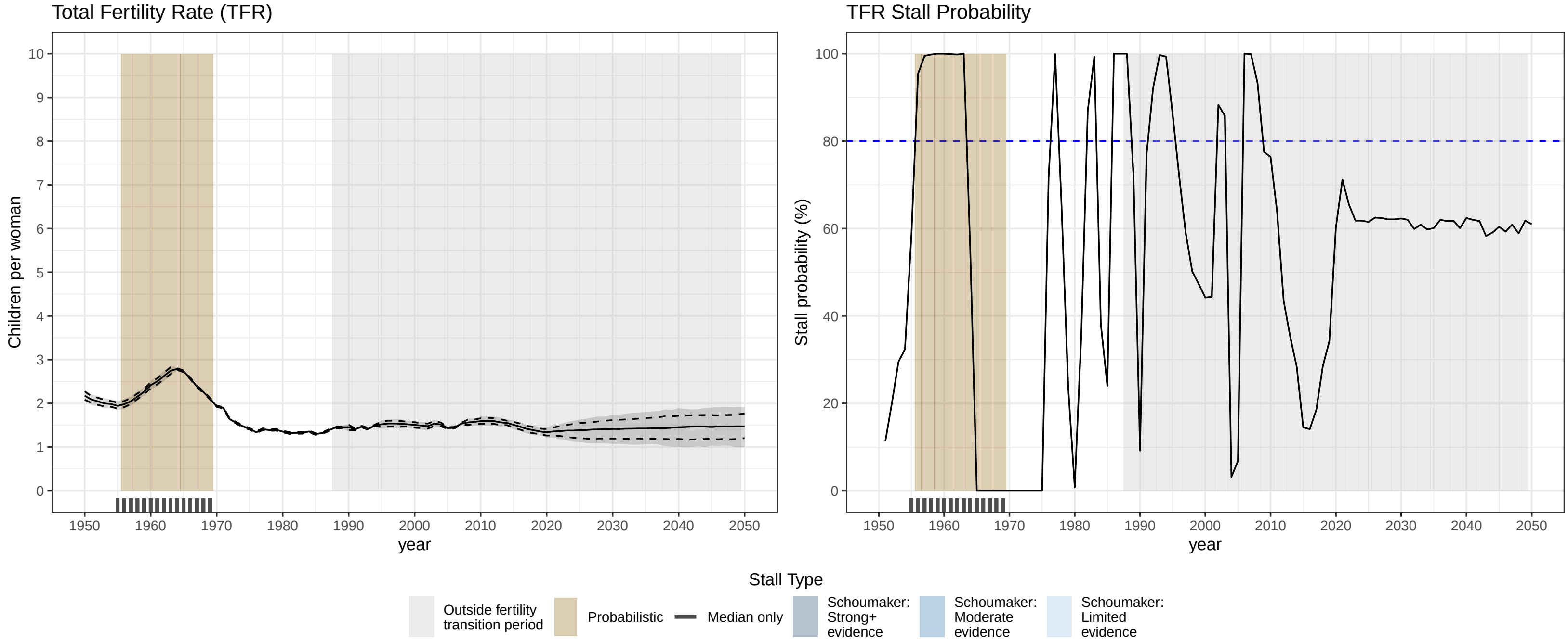
Iceland (Northern Europe)



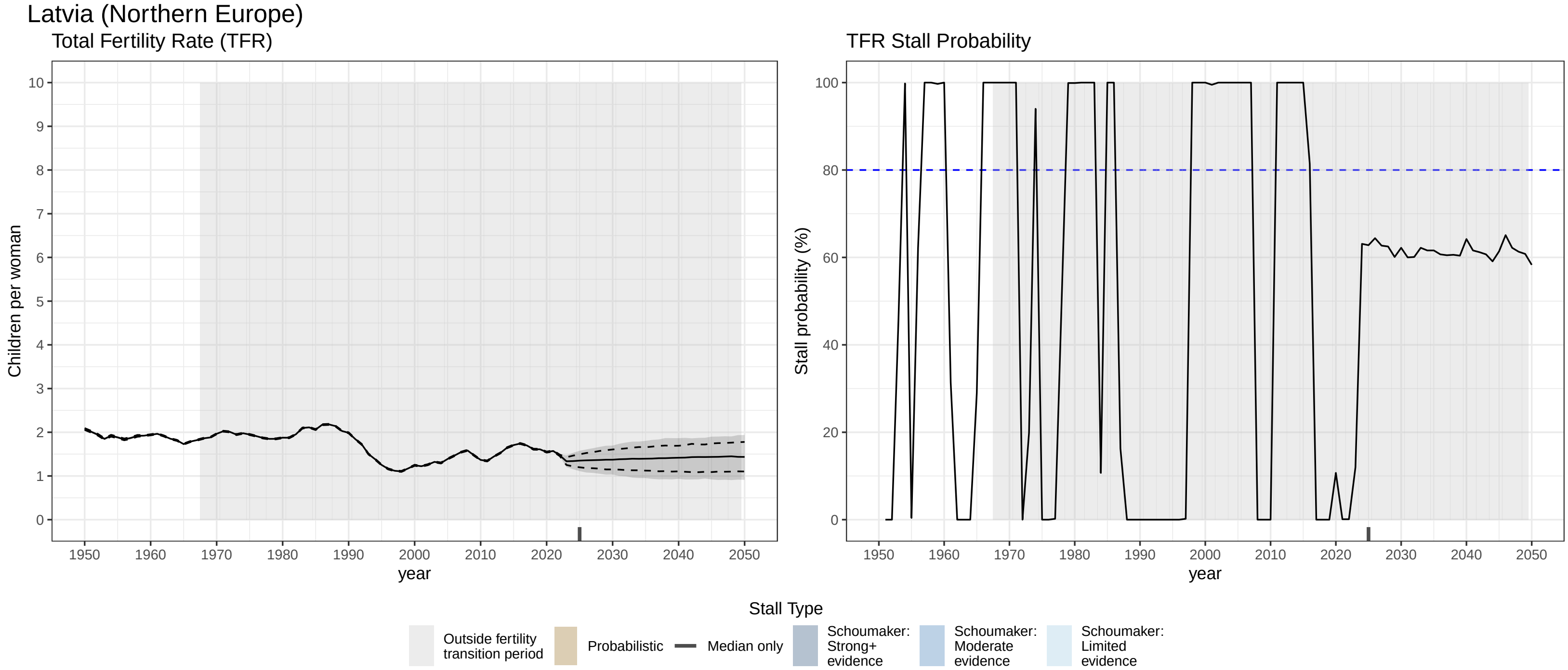
Ireland (Northern Europe)



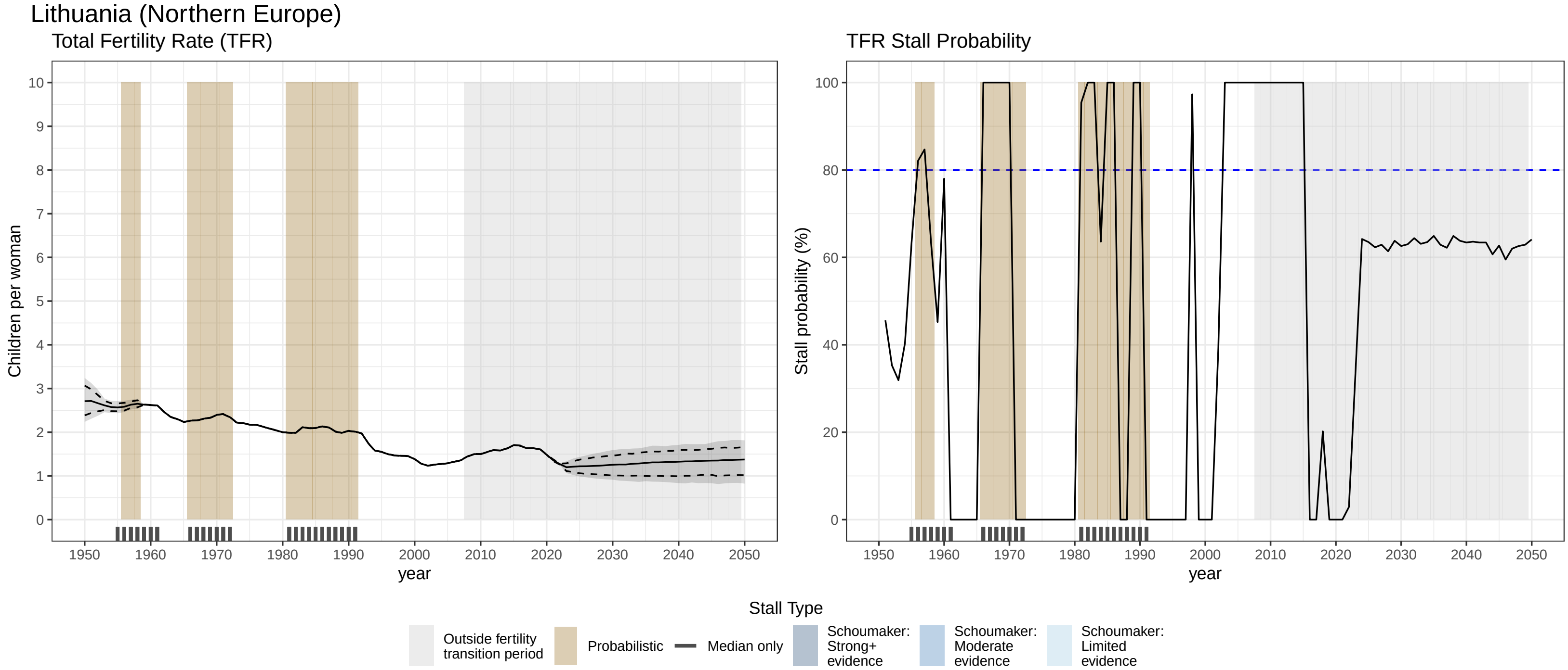
Jersey (Northern Europe)



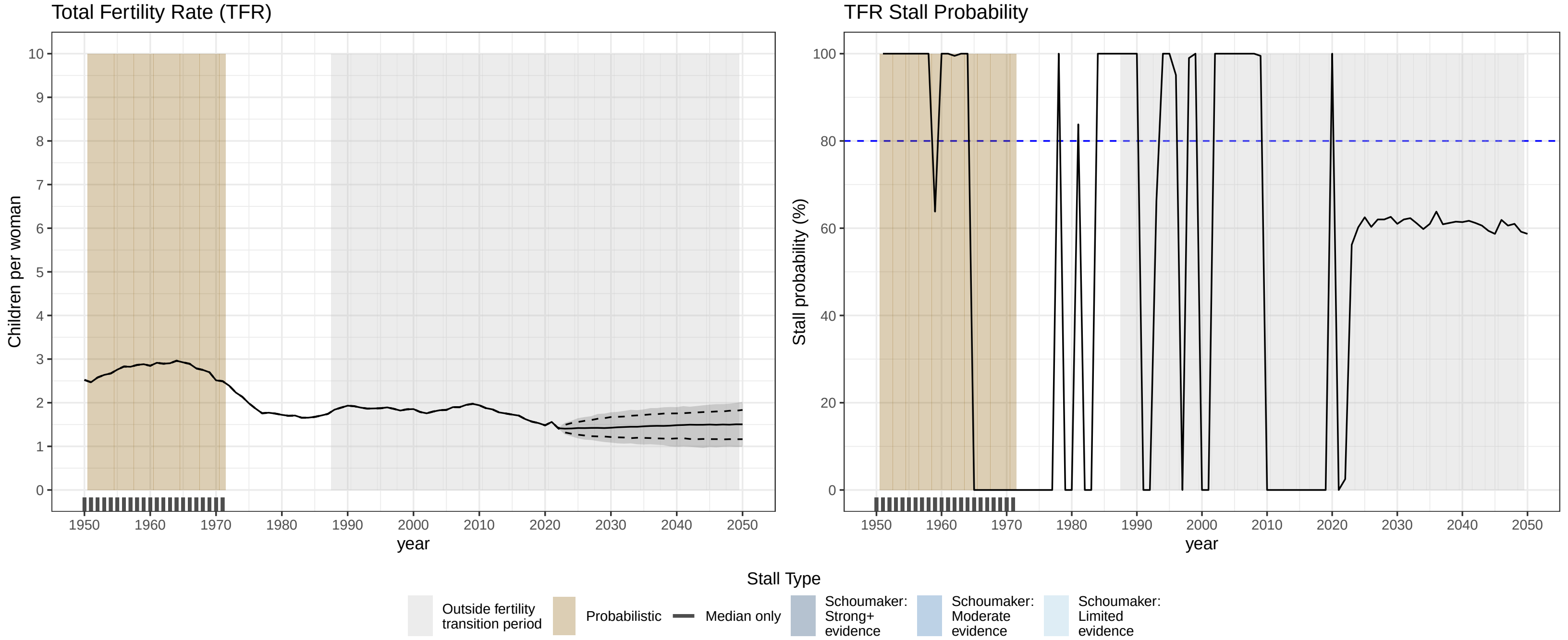
Latvia (Northern Europe)



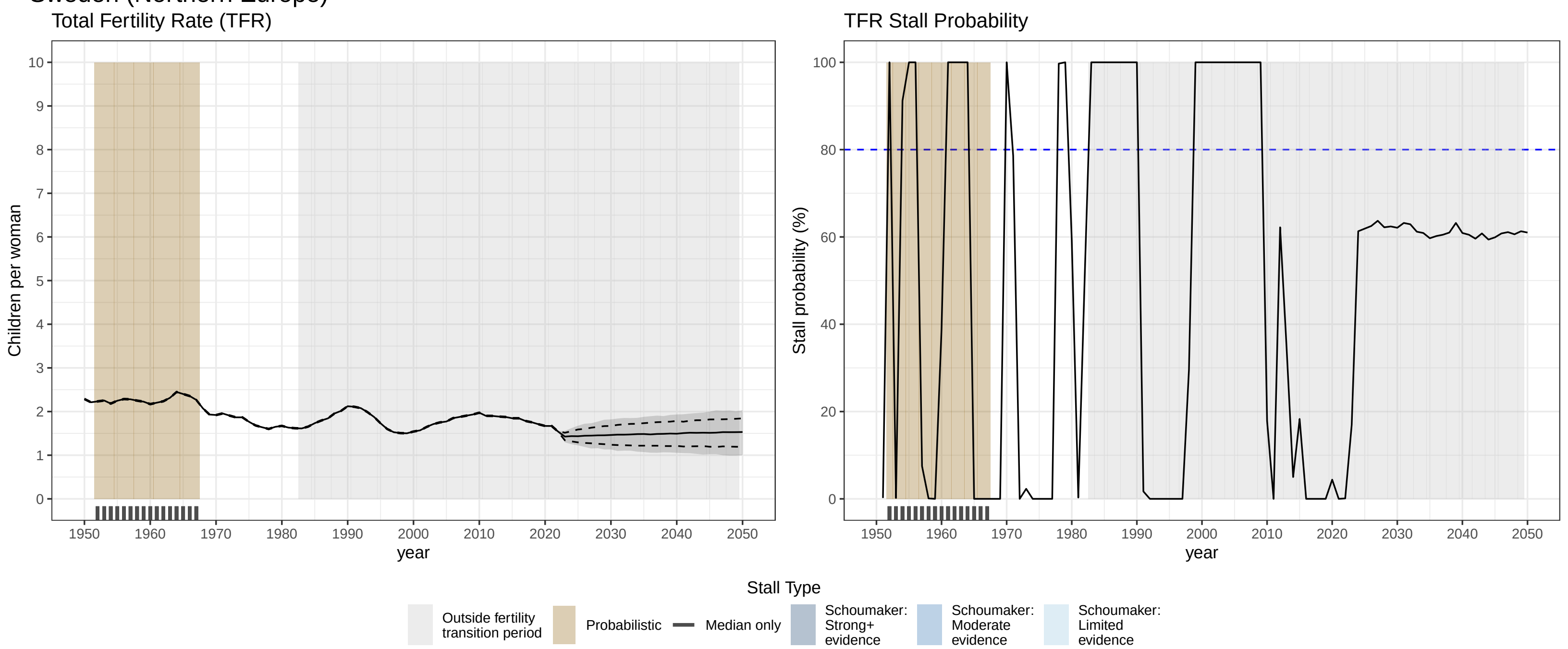
Lithuania (Northern Europe)



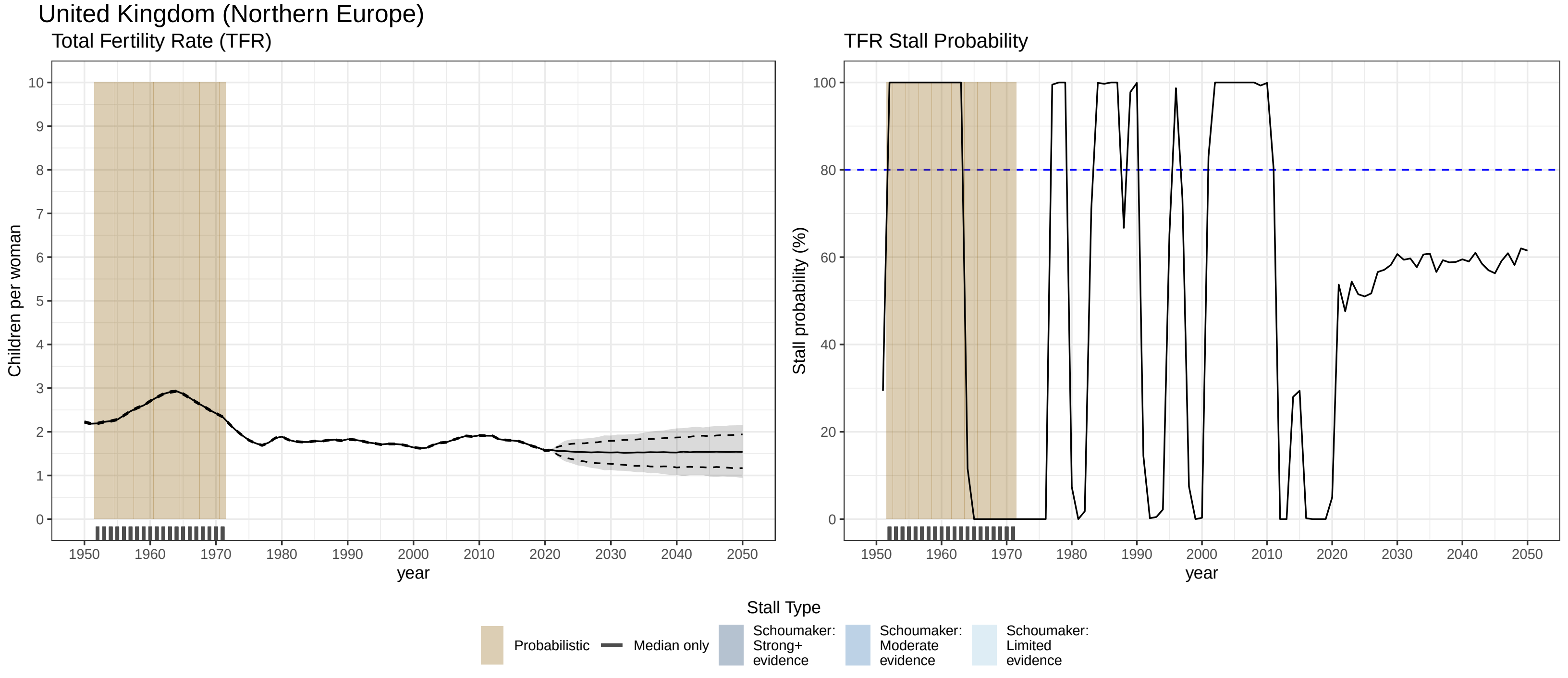
Norway (Northern Europe)



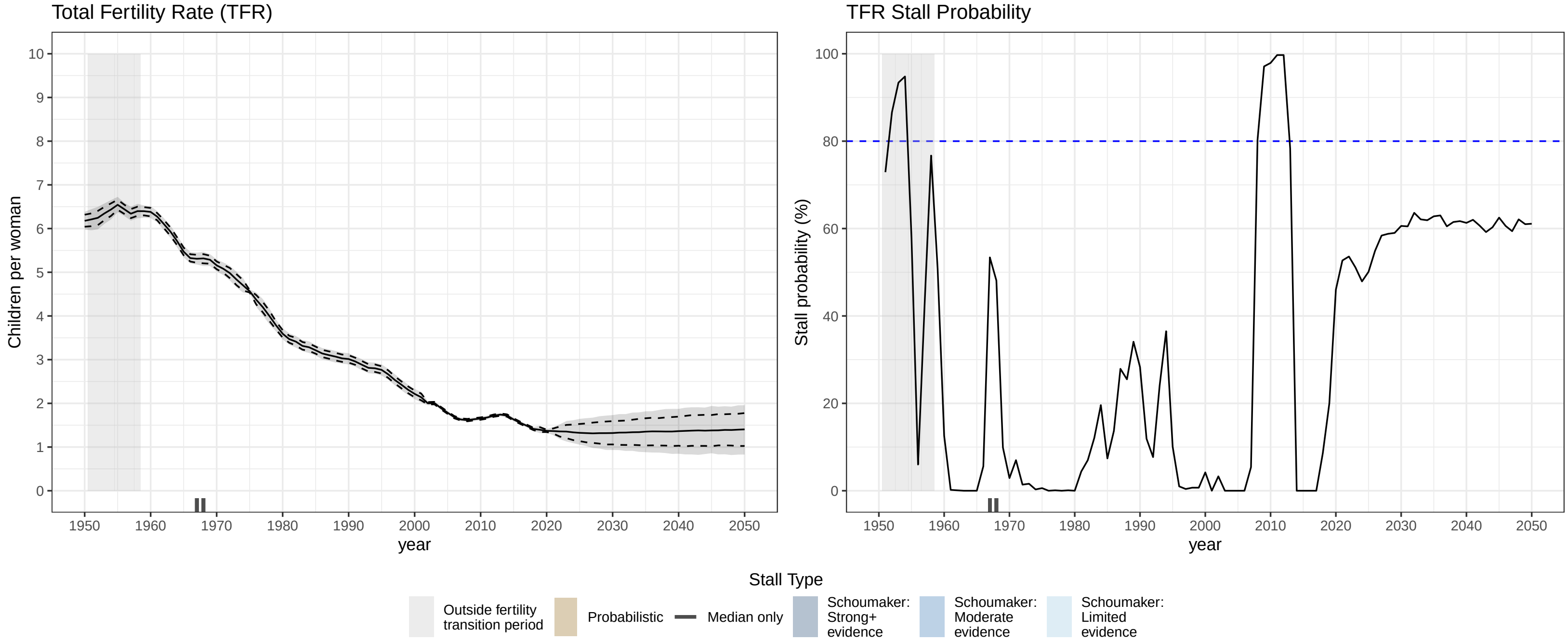
Sweden (Northern Europe)



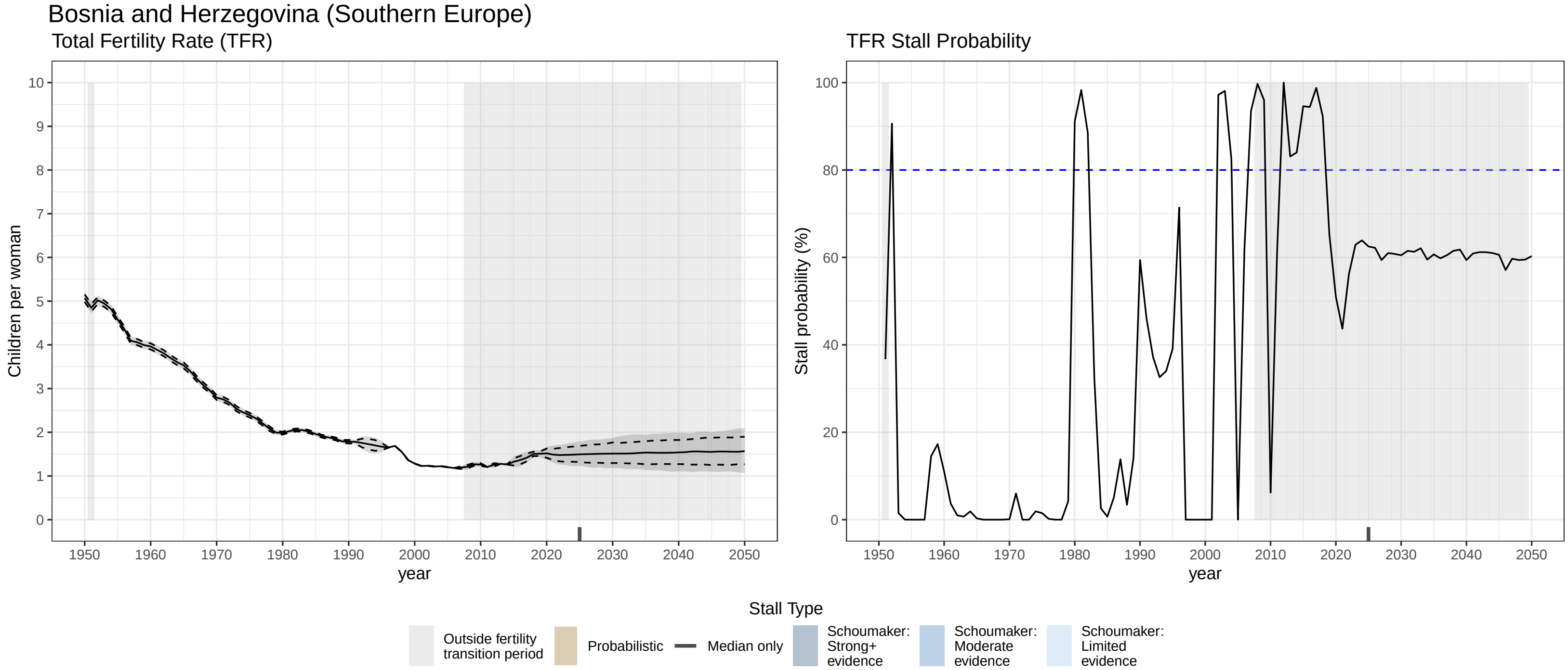
United Kingdom (Northern Europe)



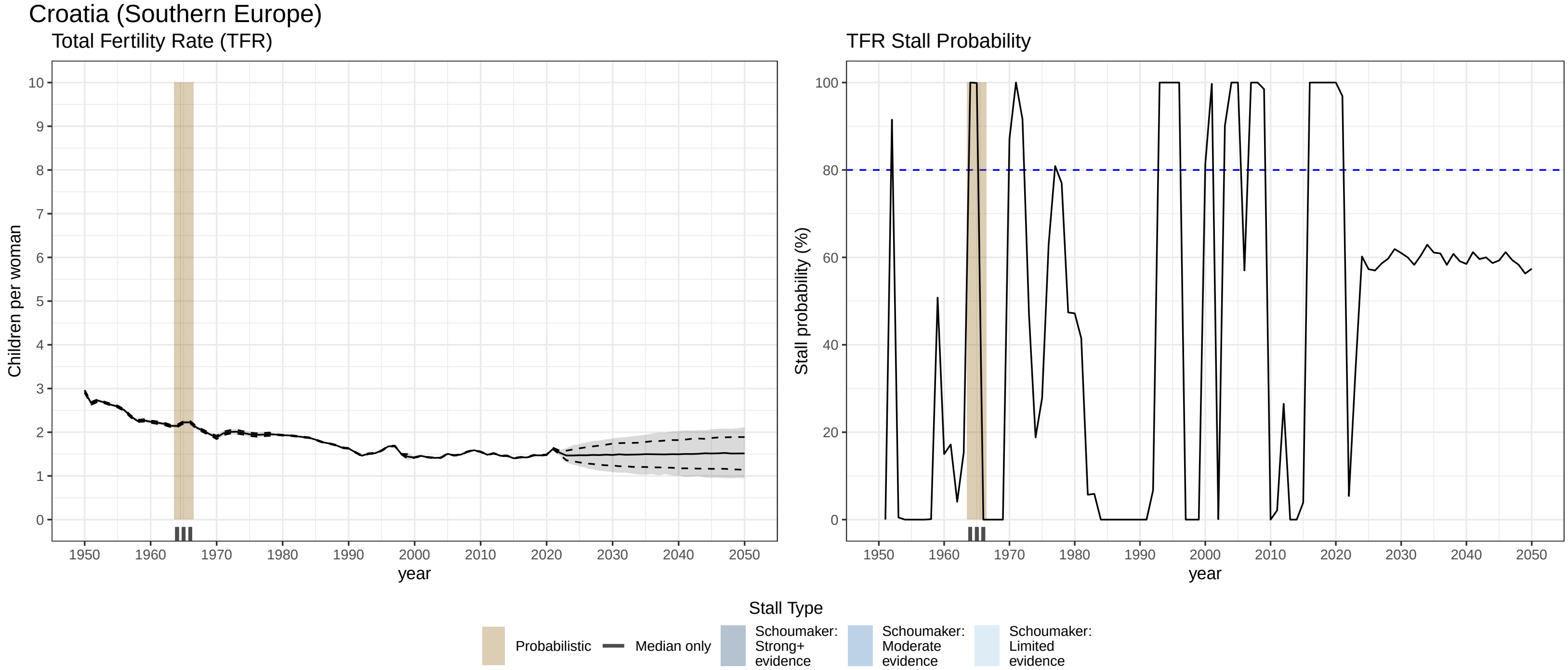
Albania (Southern Europe)

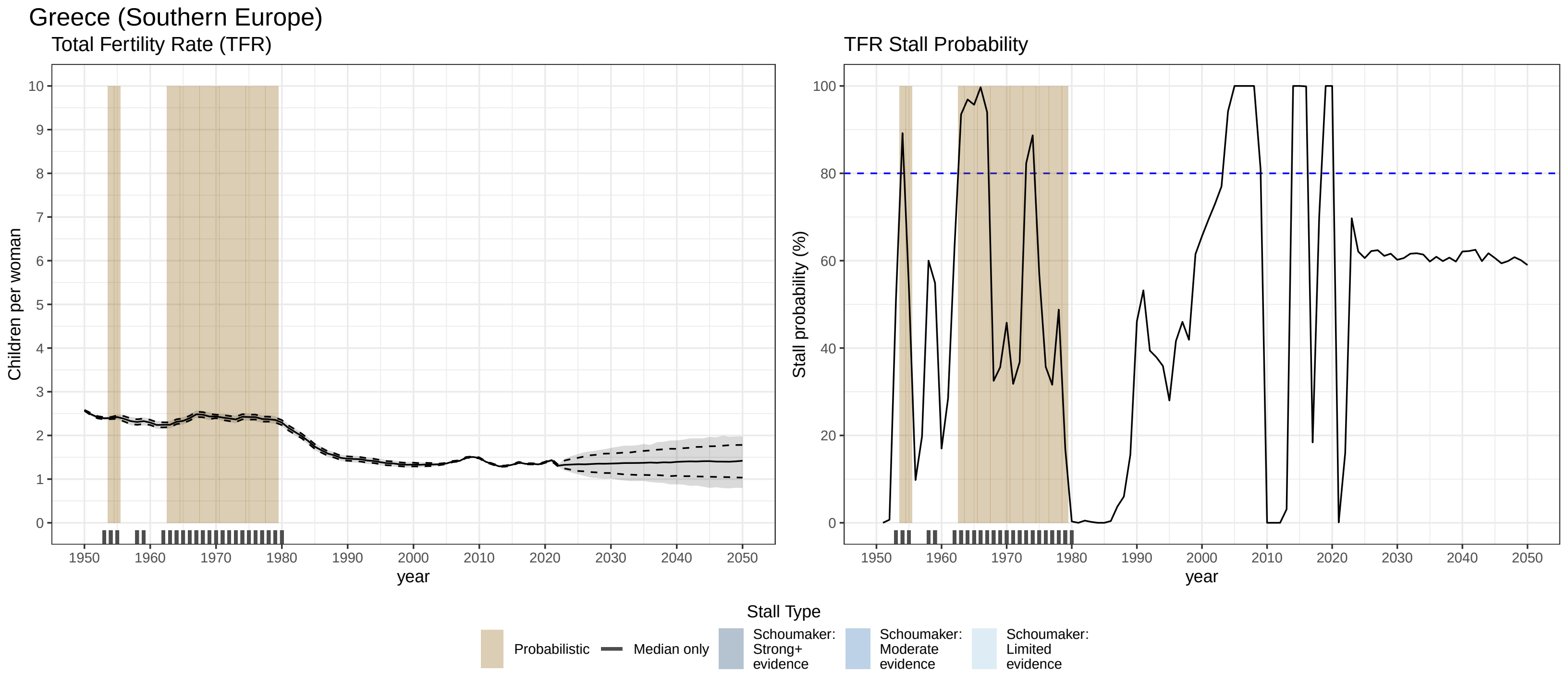


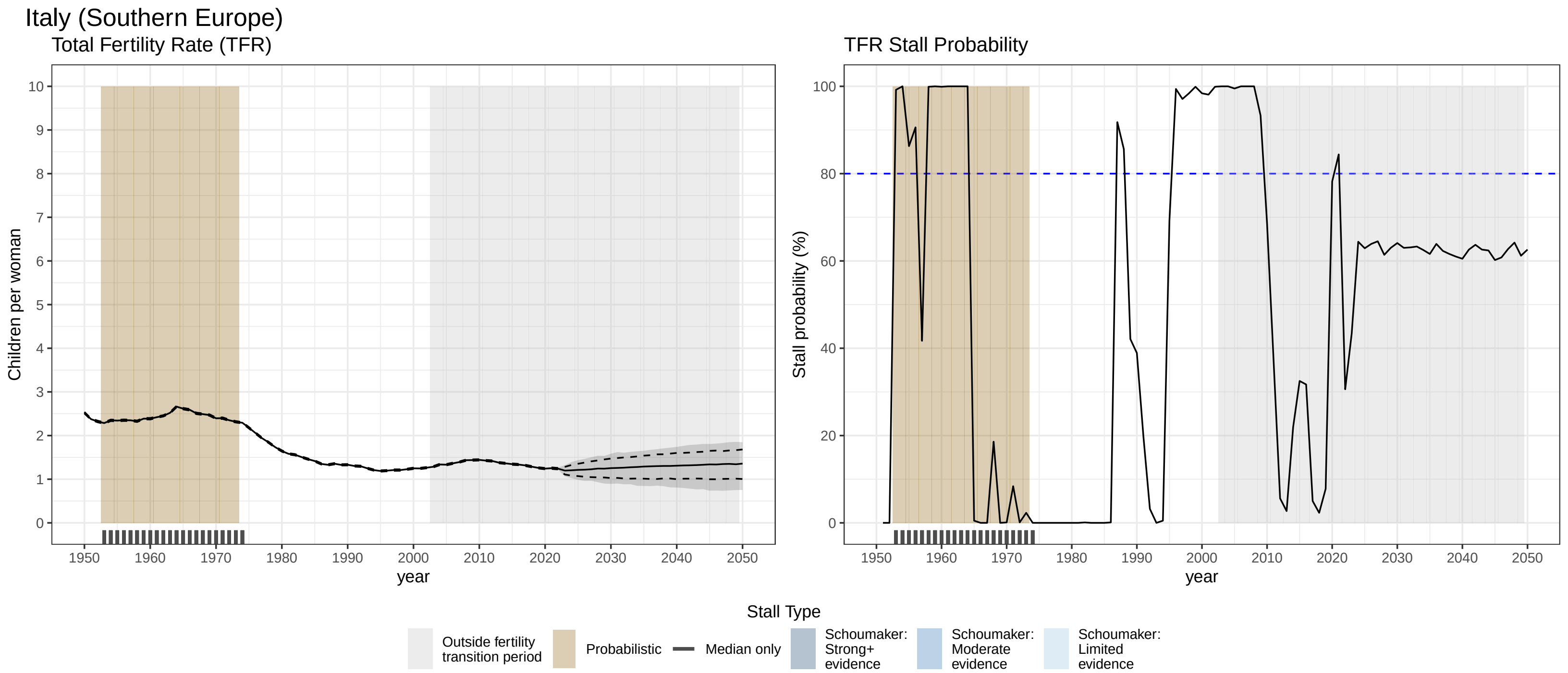
Bosnia and Herzegovina (Southern Europe)

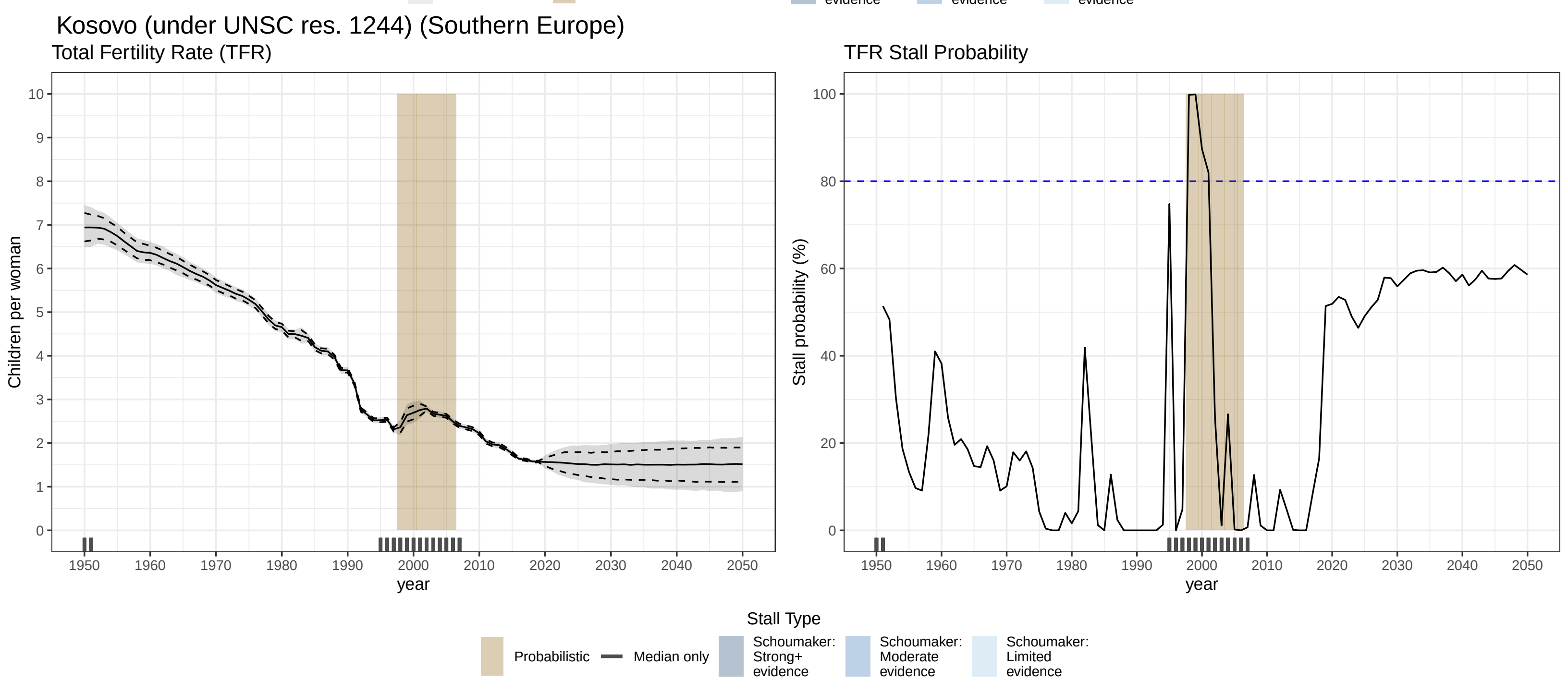


Croatia (Southern Europe)

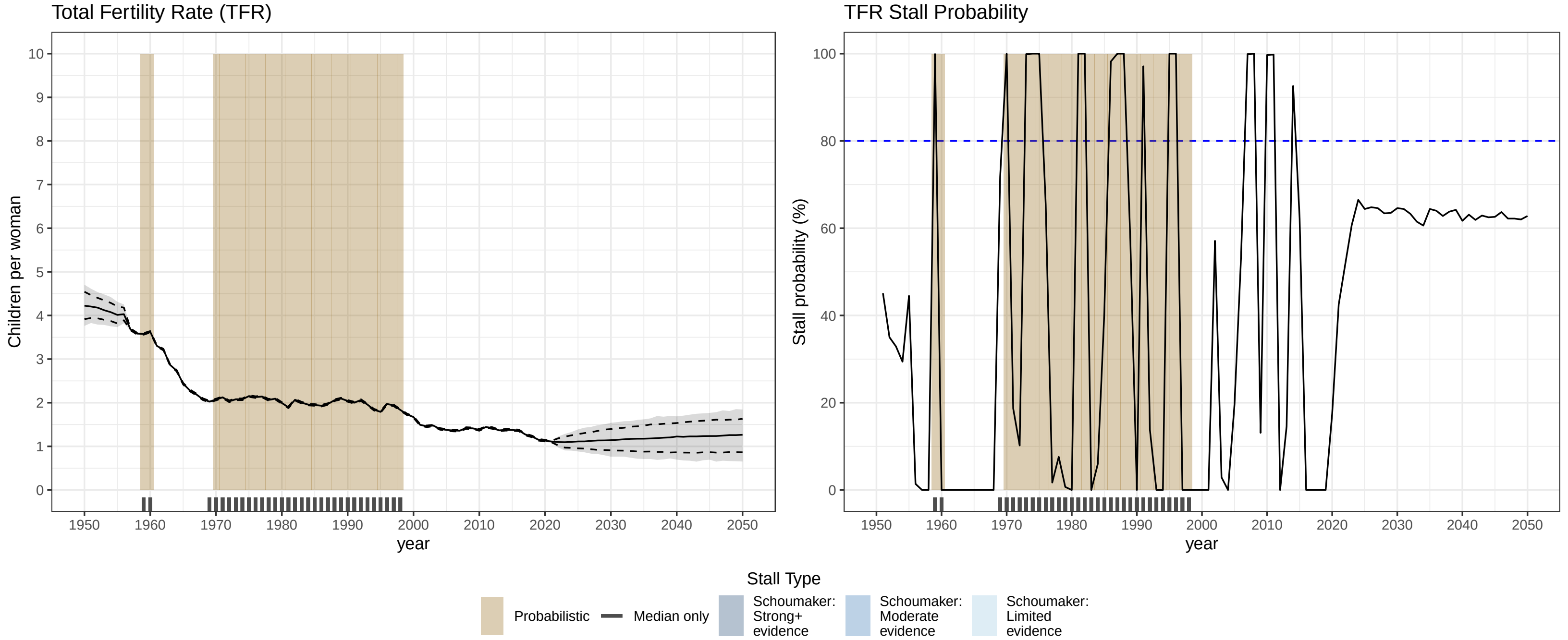



Greece (Southern Europe)
Total Fertility Rate (TFR)
TFR Stall Probability
Children per woman
Stall probability (%)
year
Stall Type
Probabilistic
Median only
Schoumaker: Strong+ evidence
Schoumaker: Moderate evidence
Schoumaker: Limited evidence

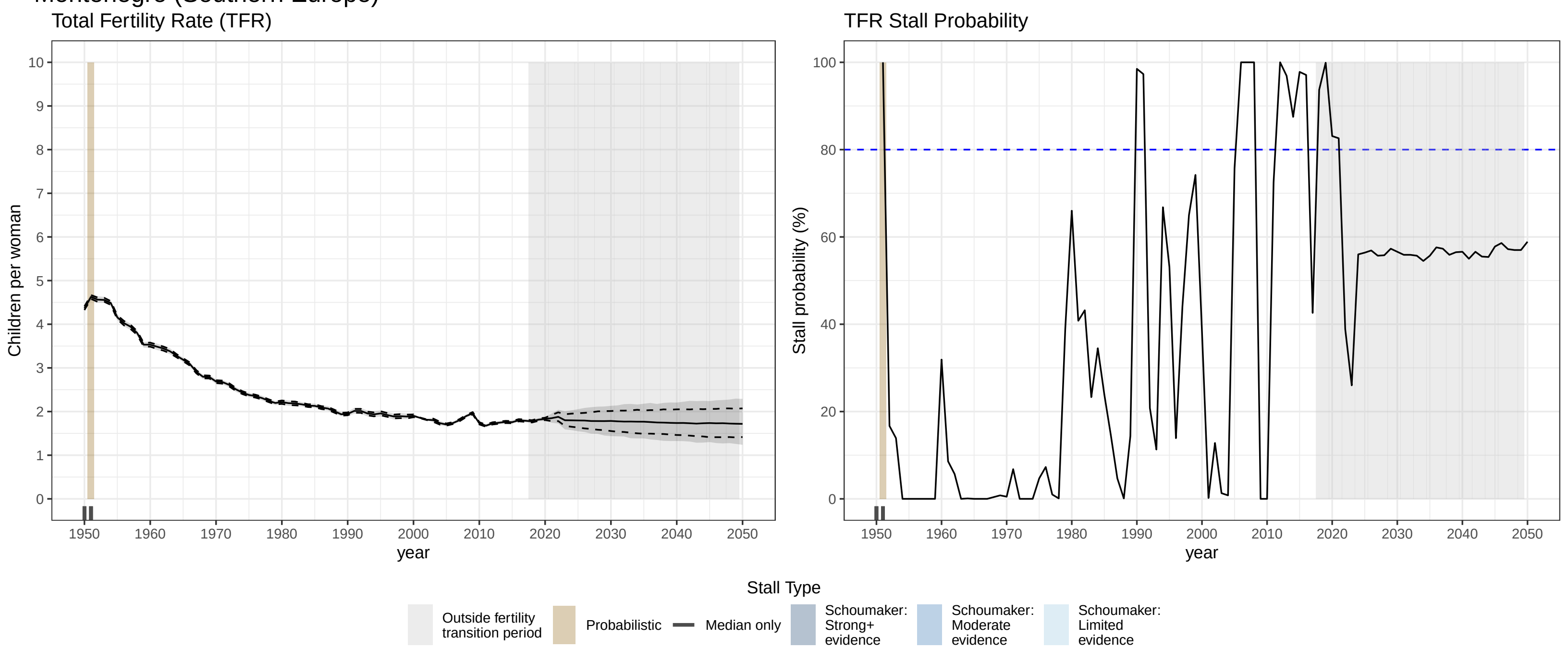

Italy (Southern Europe)
Total Fertility Rate (TFR)
TFR Stall Probability
Children per woman
Stall probability (%)
year
Stall Type
Outside fertility transition period
Probabilistic
Median only
Schoumaker: Strong+ evidence
Schoumaker: Moderate evidence
Schoumaker: Limited evidence


Kosovo (under UNSC res. 1244) (Southern Europe)
Total Fertility Rate (TFR)
TFR Stall Probability
Children per woman
Stall probability (%)
year
Stall Type
Probabilistic
Median only
Schoumaker: Strong+ evidence
Schoumaker: Moderate evidence
Schoumaker: Limited evidence

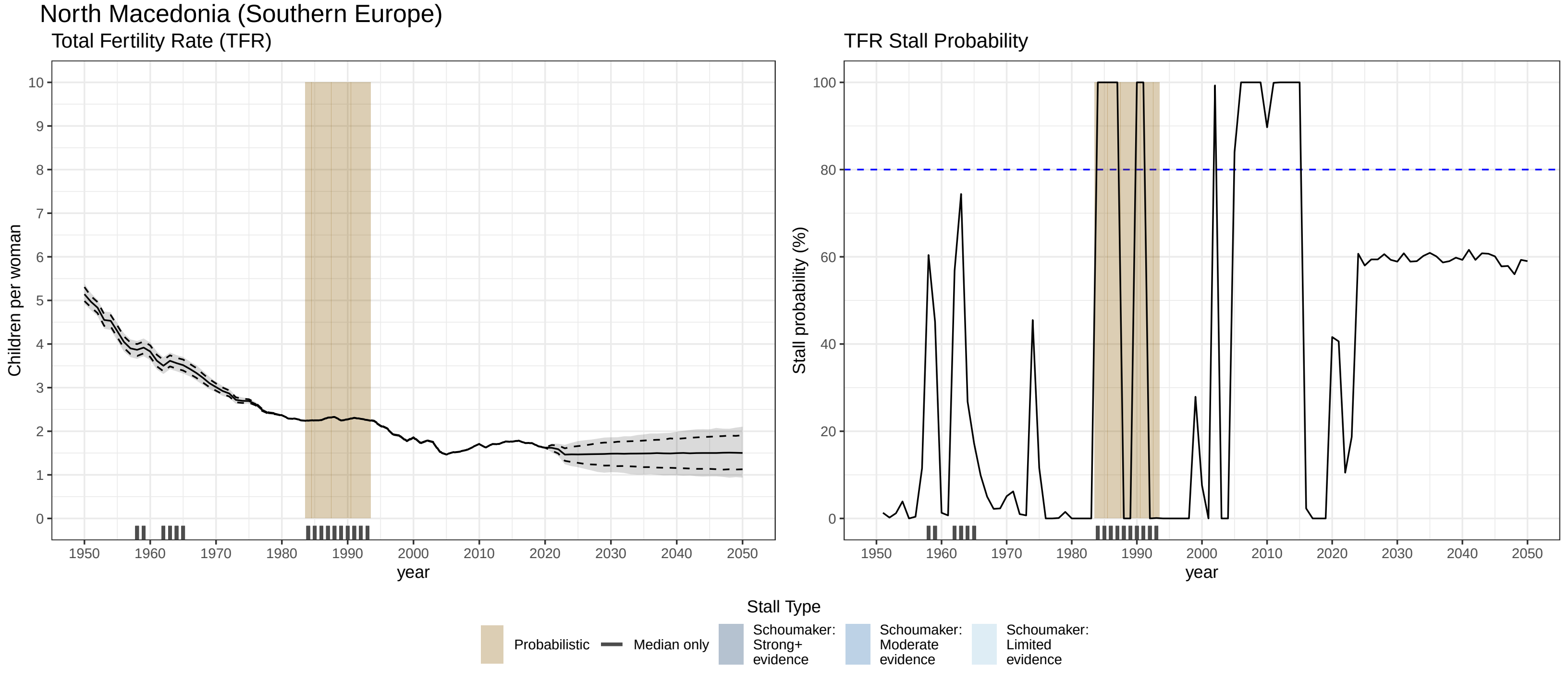
Malta (Southern Europe)



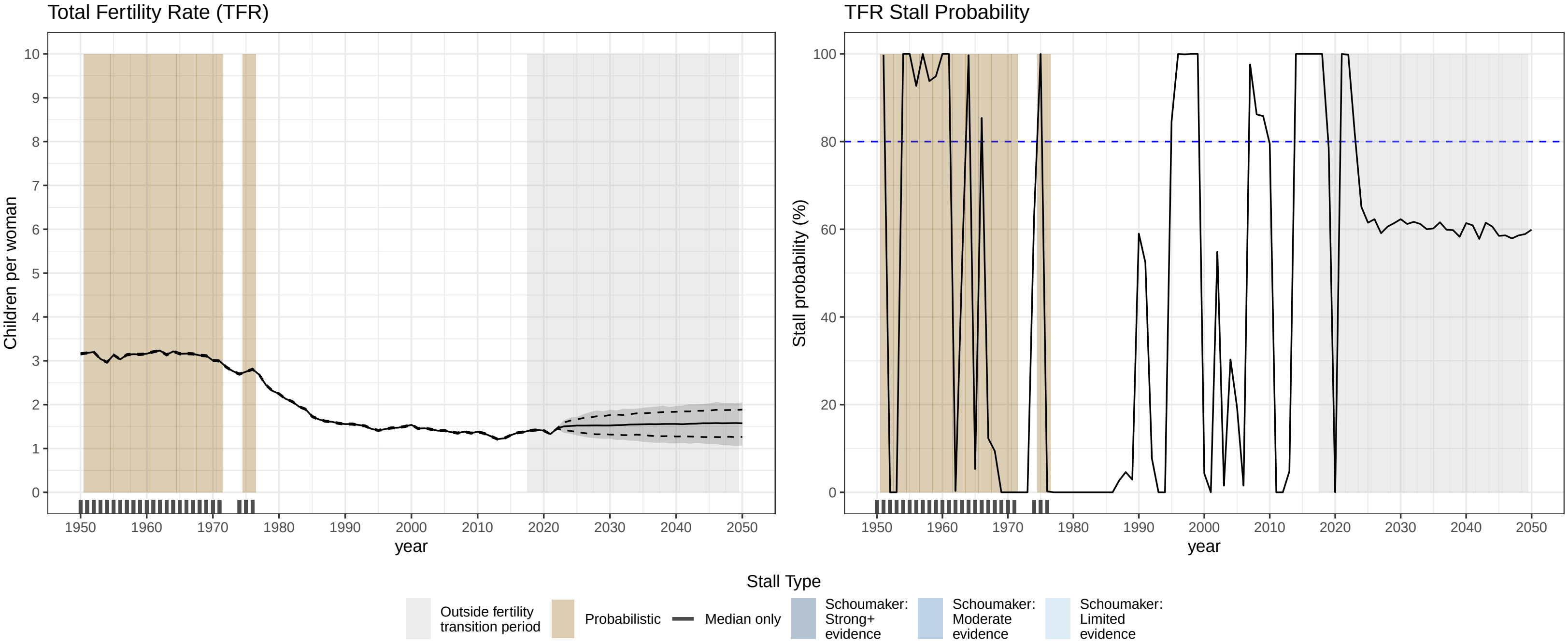
Montenegro (Southern Europe)



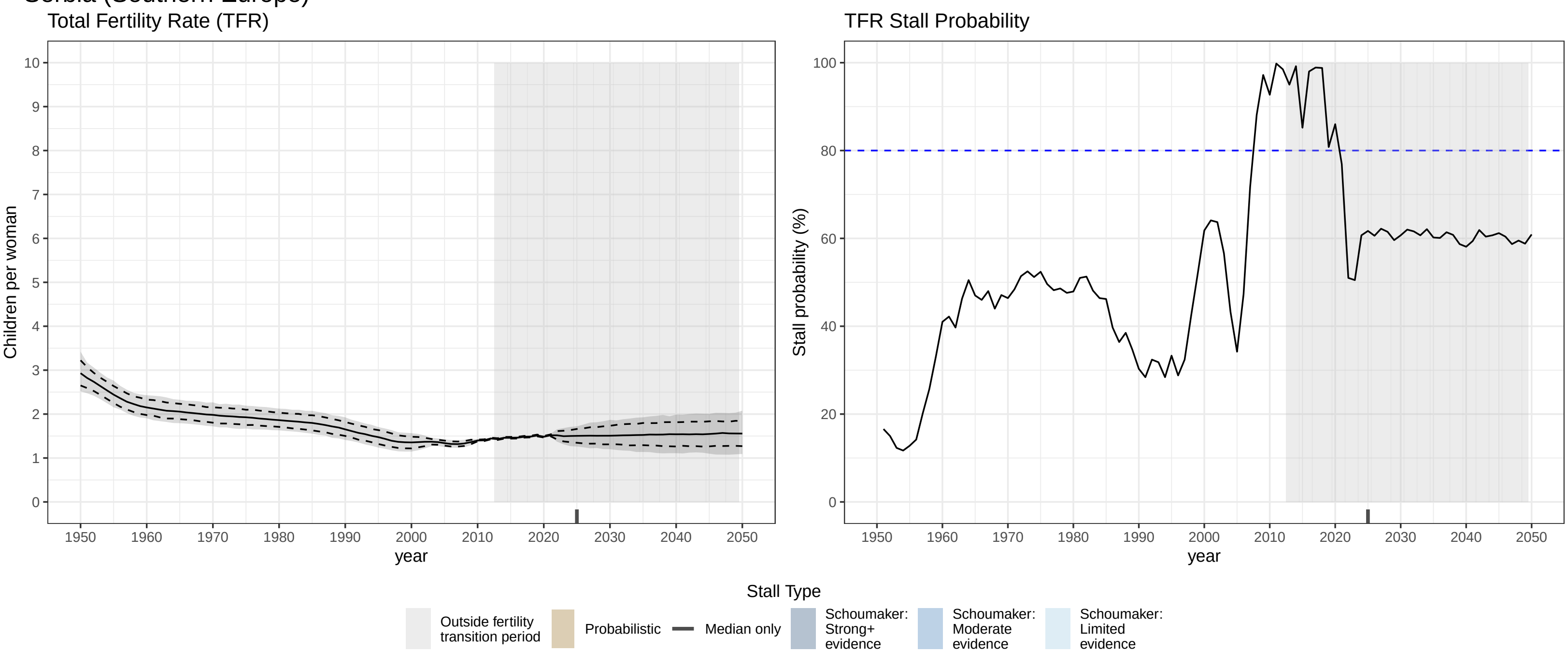
North Macedonia (Southern Europe)



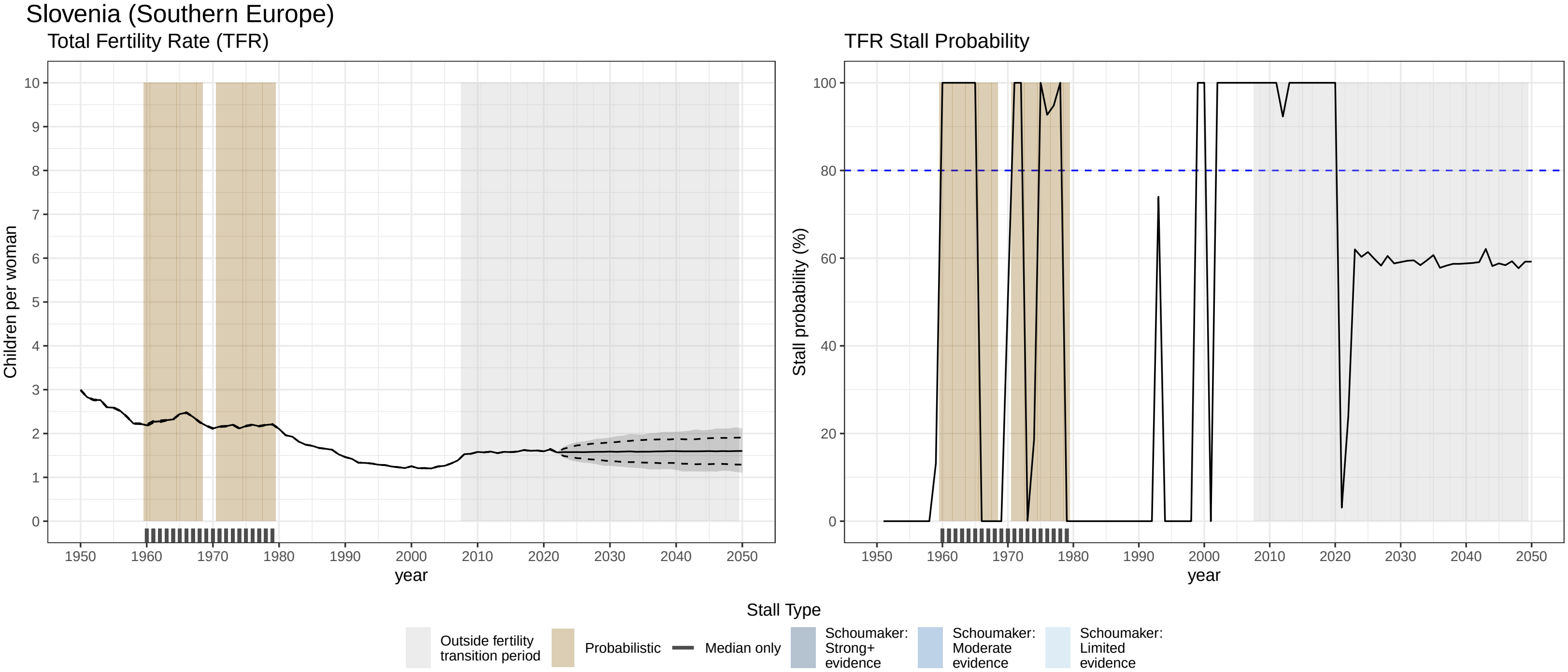
Portugal (Southern Europe)



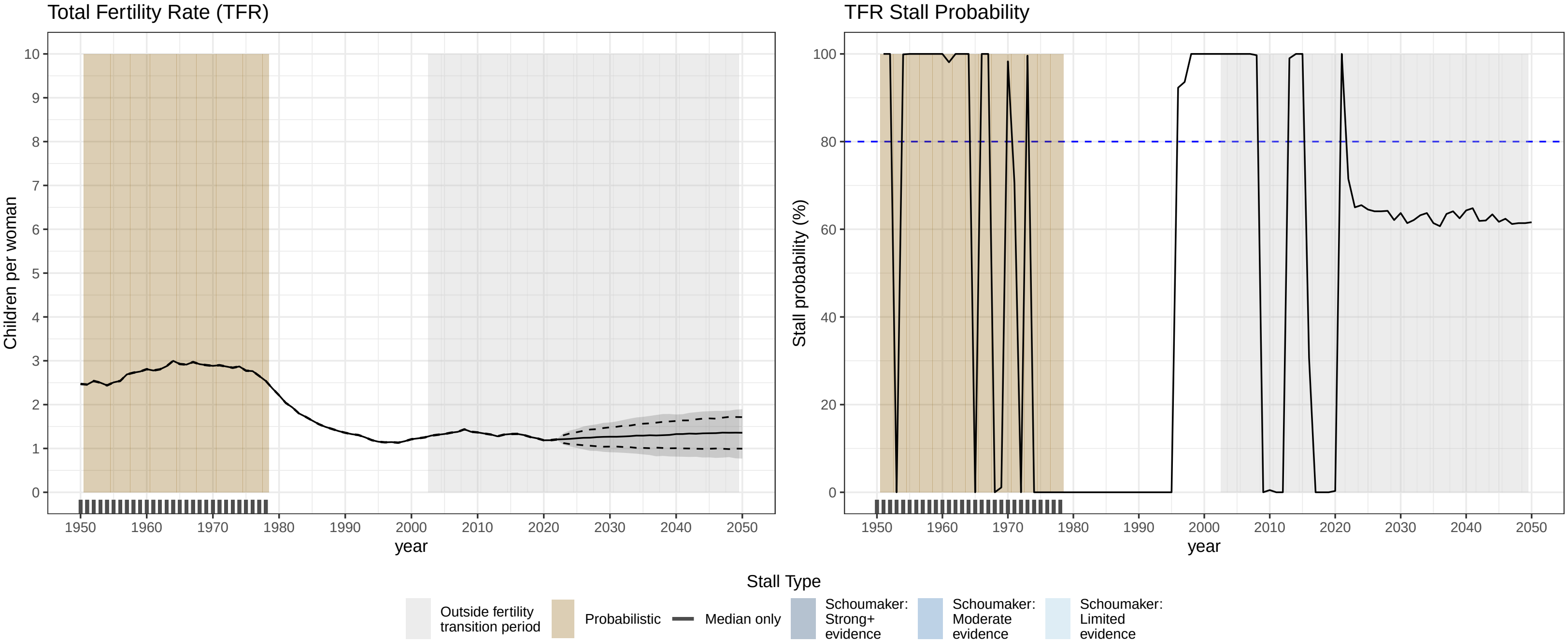
Serbia (Southern Europe)



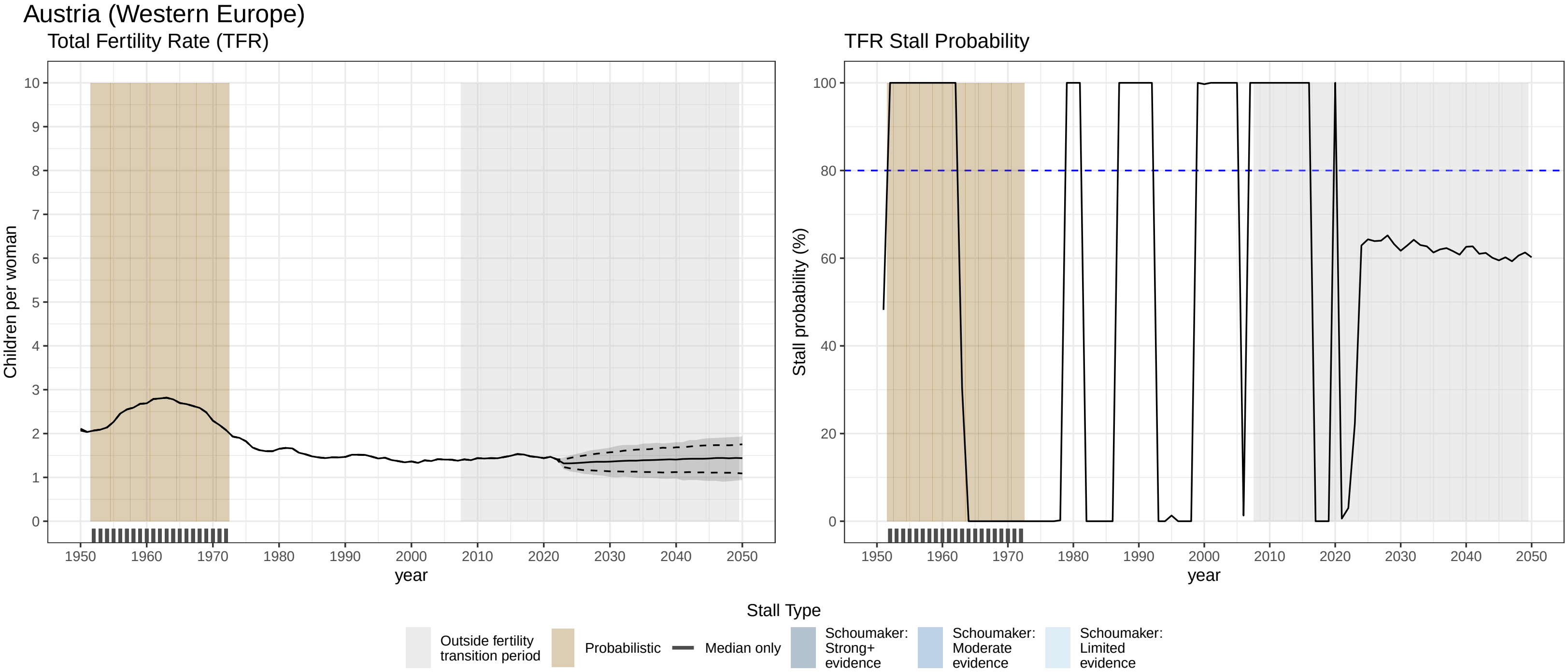
Slovenia (Southern Europe)



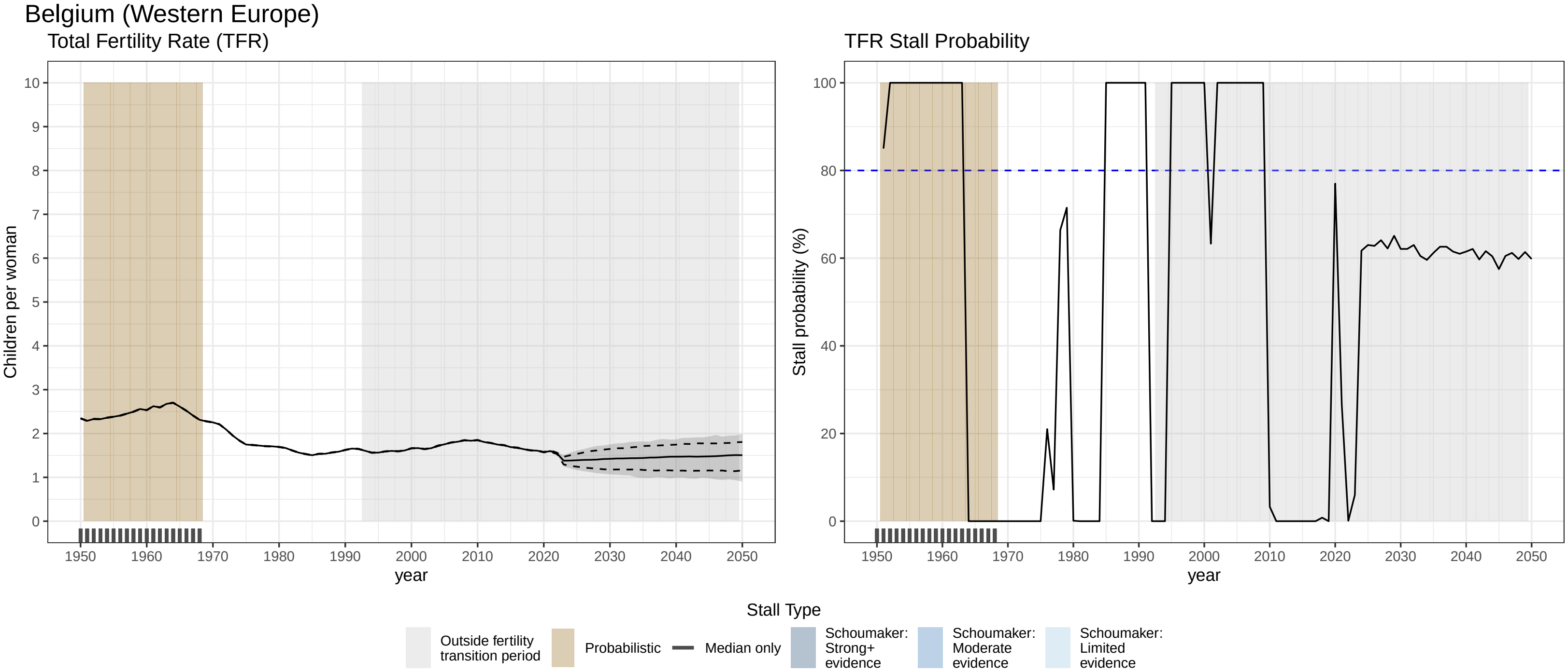
Spain (Southern Europe)



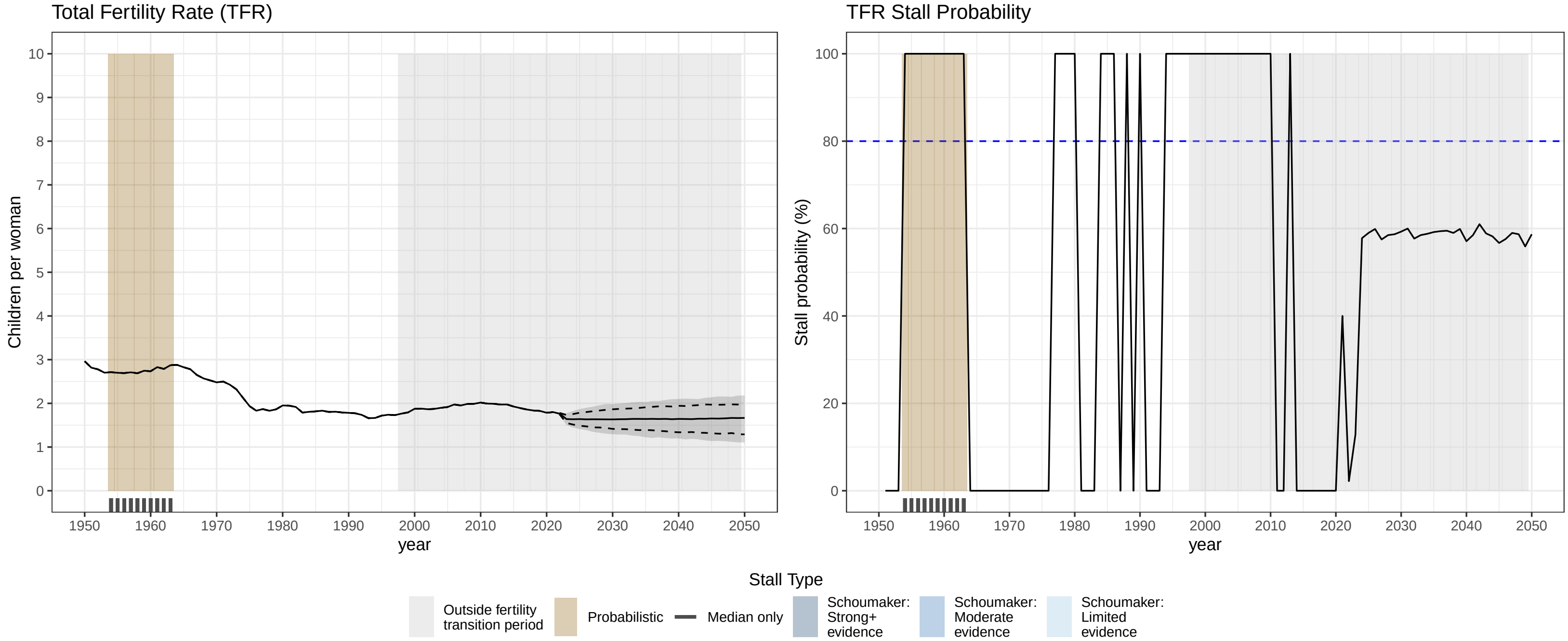
Austria (Western Europe)



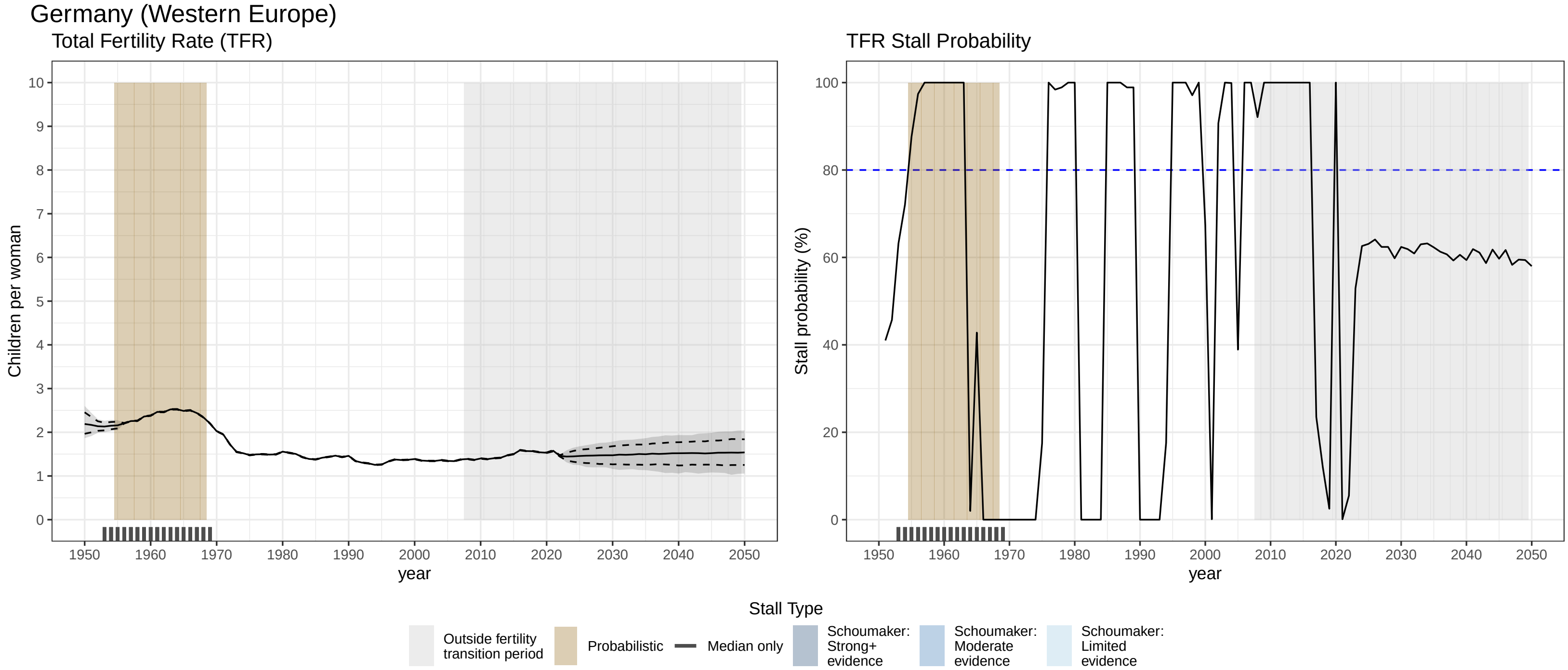
Belgium (Western Europe)



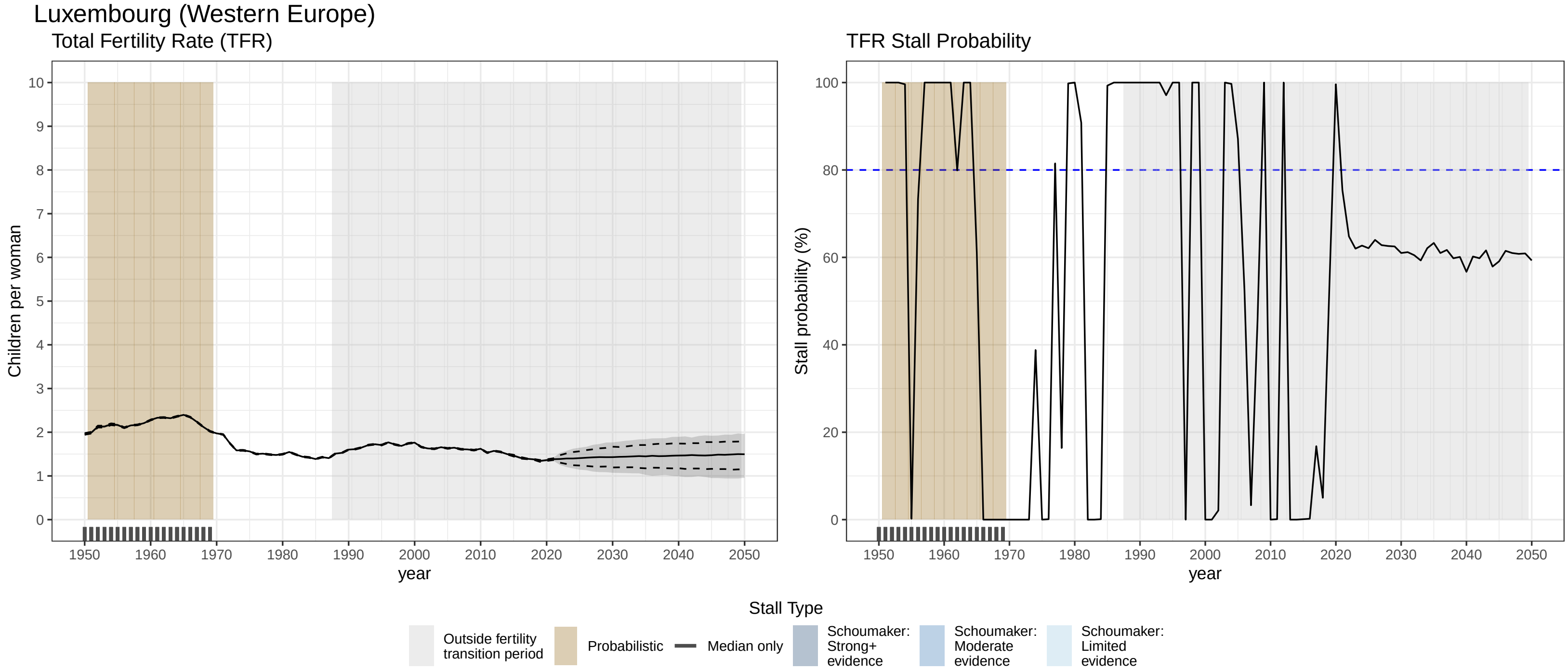
France (Western Europe)

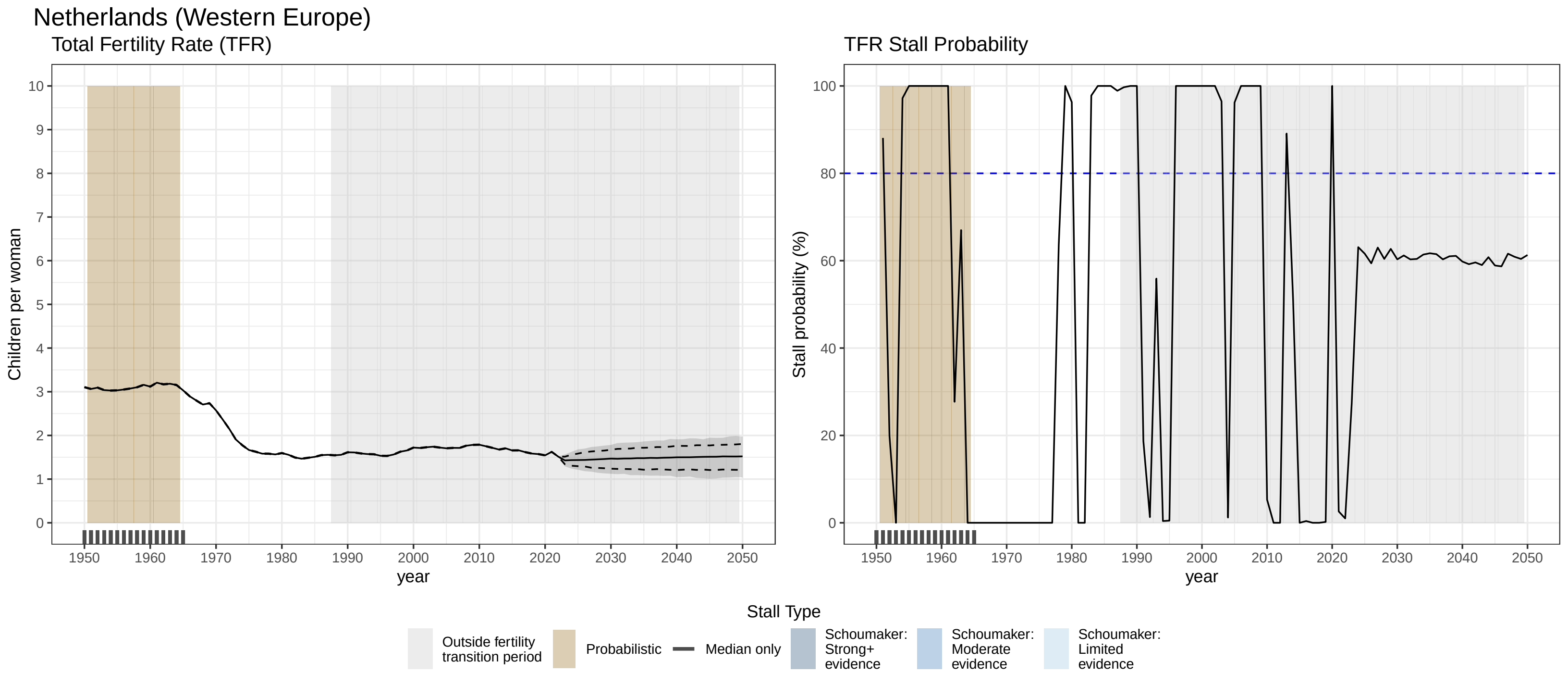


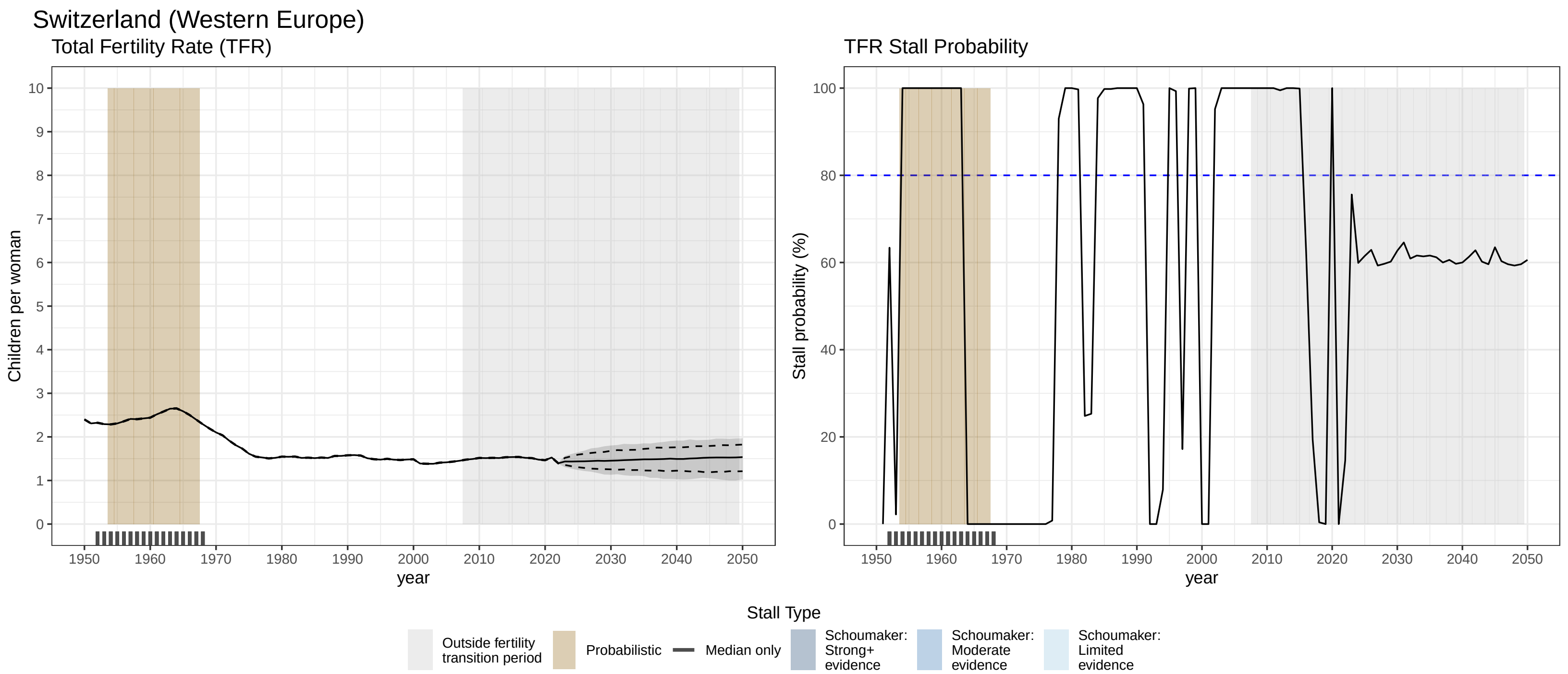
Germany (Western Europe)

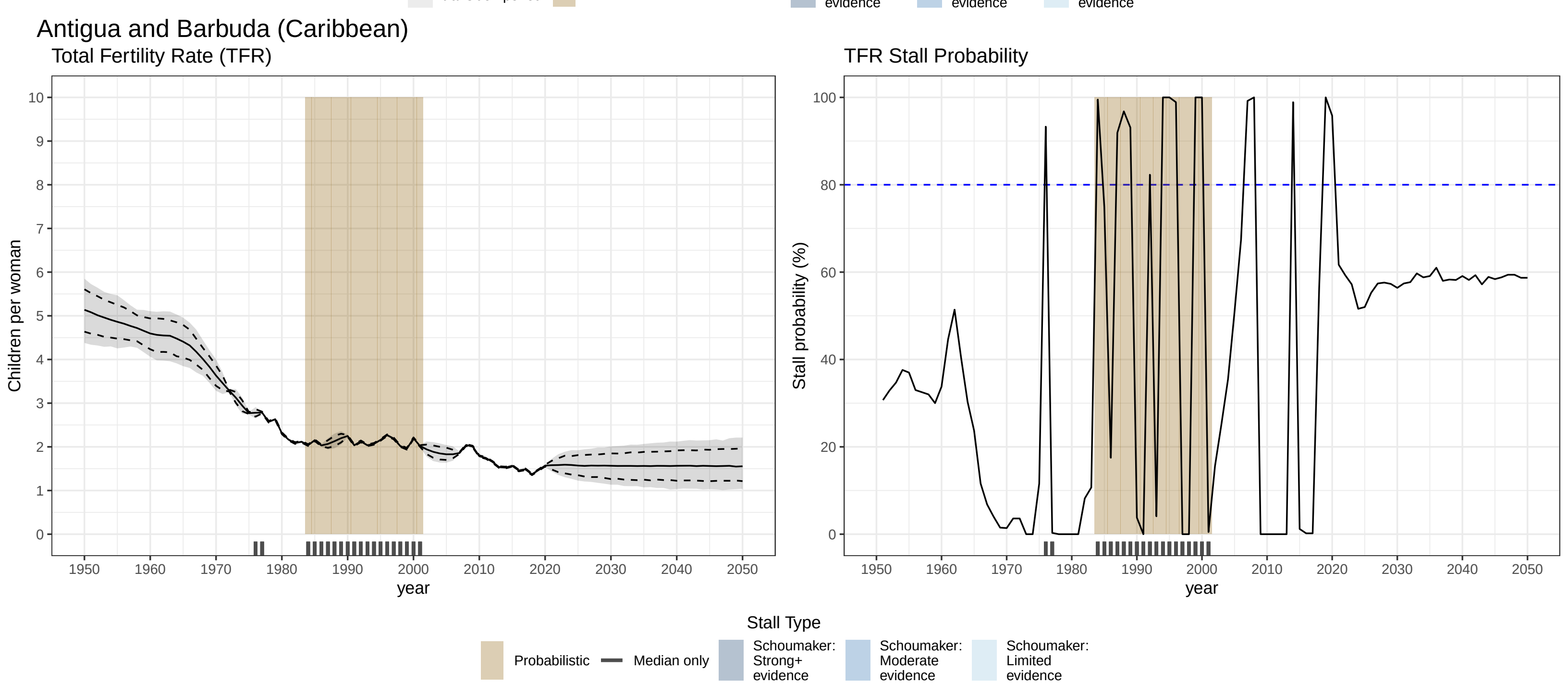


Luxembourg (Western Europe)

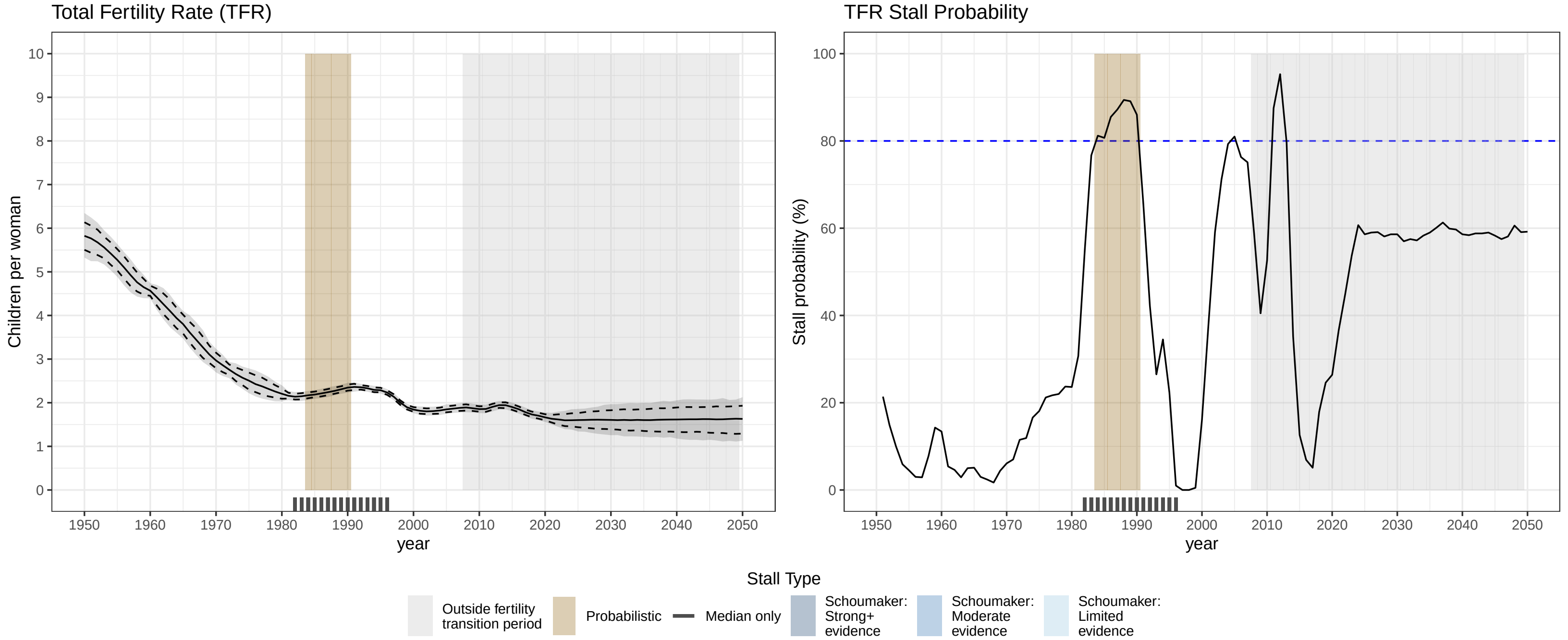



Netherlands (Western Europe)
Total Fertility Rate (TFR)
Children per woman
year
TFR Stall Probability
Stall probability (%)
year
Stall Type
Outside fertility transition period
Probabilistic
Median only
Schoumaker: Strong+ evidence
Schoumaker: Moderate evidence
Schoumaker: Limited evidence

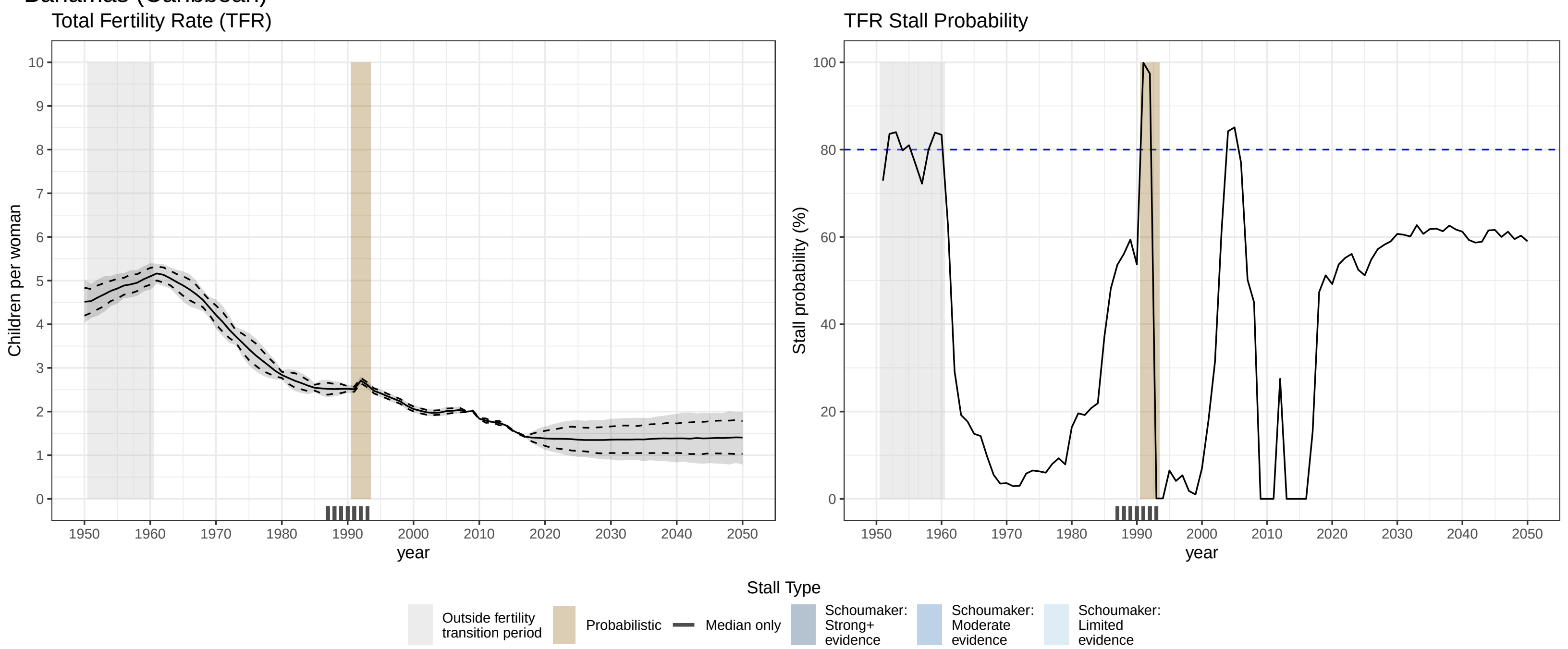

Switzerland (Western Europe)
Total Fertility Rate (TFR)
Children per woman
year
TFR Stall Probability
Stall probability (%)
year
Stall Type
Outside fertility transition period
Probabilistic
Median only
Schoumaker: Strong+ evidence
Schoumaker: Moderate evidence
Schoumaker: Limited evidence


Antigua and Barbuda (Caribbean)
Total Fertility Rate (TFR)
Children per woman
year
TFR Stall Probability
Stall probability (%)
year
Stall Type
Probabilistic
Median only
Schoumaker: Strong+ evidence
Schoumaker: Moderate evidence
Schoumaker: Limited evidence

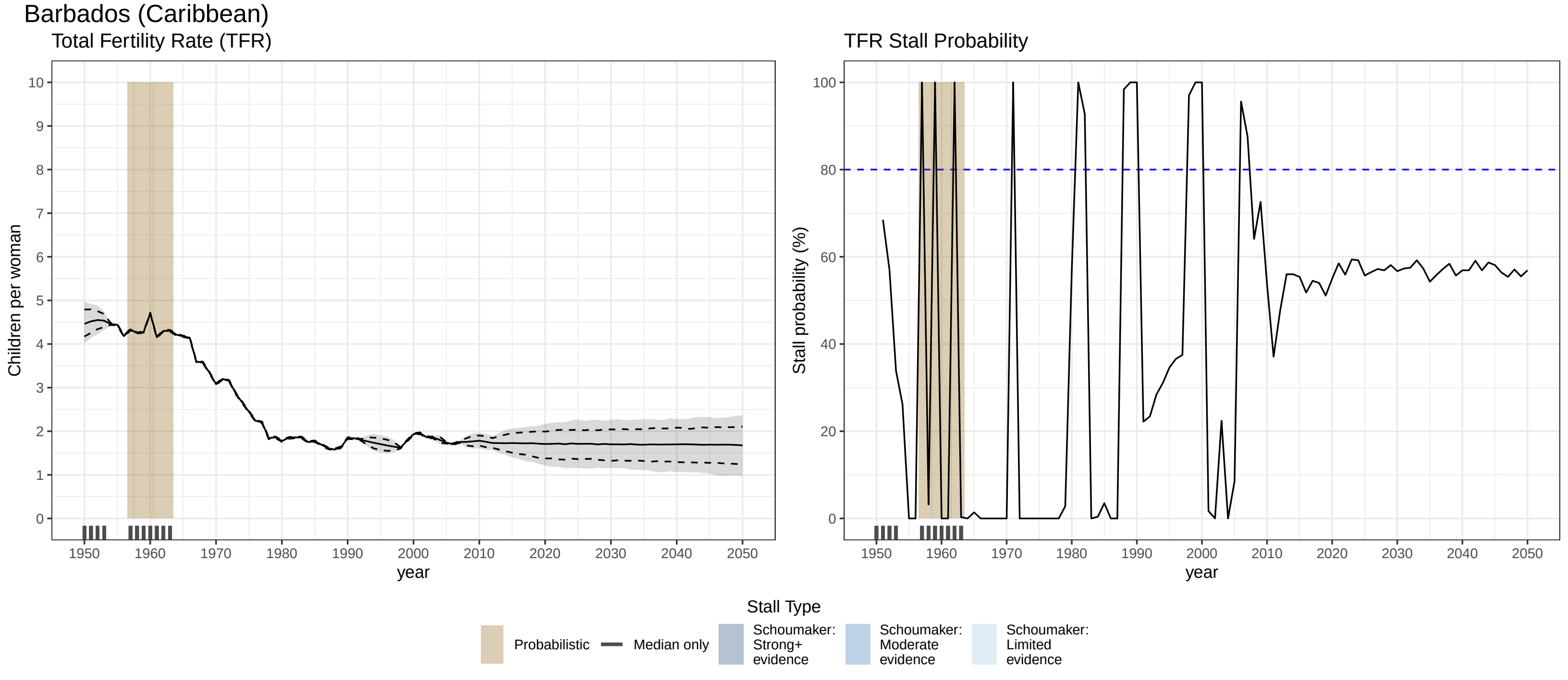
Aruba (Caribbean)



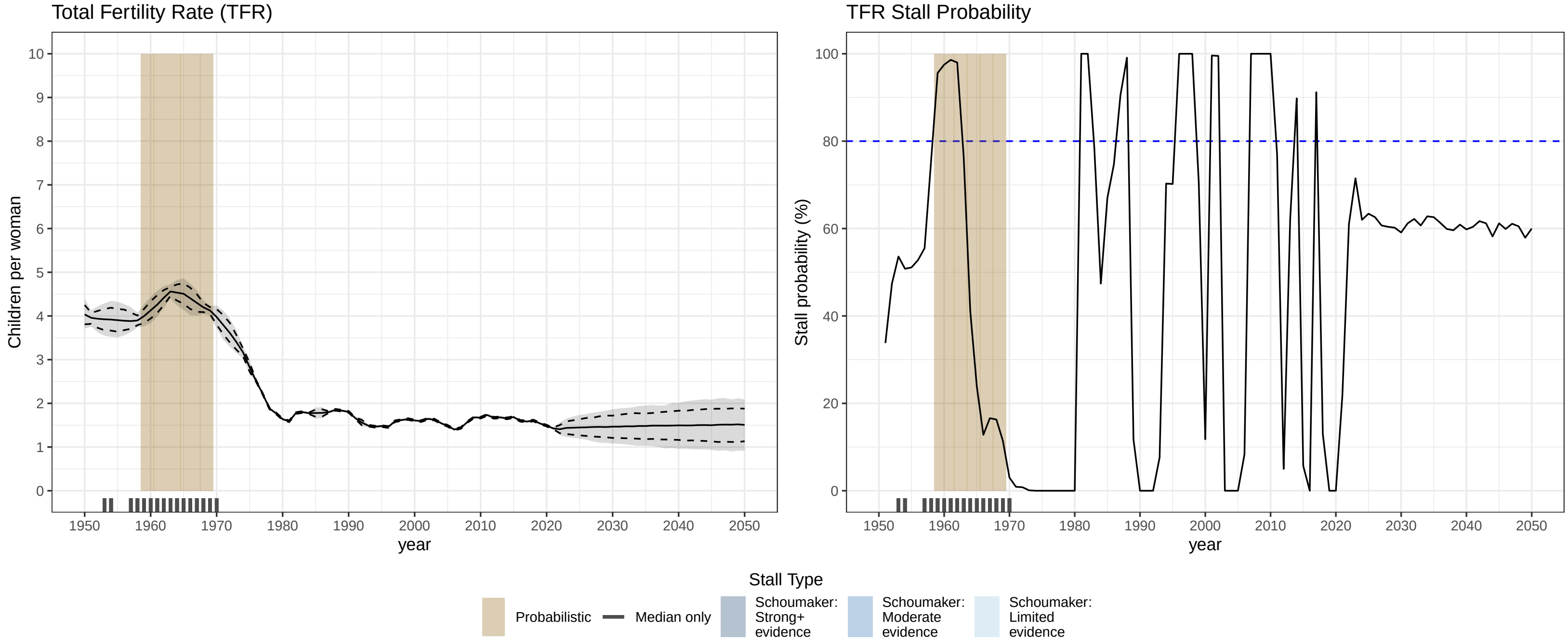
Bahamas (Caribbean)



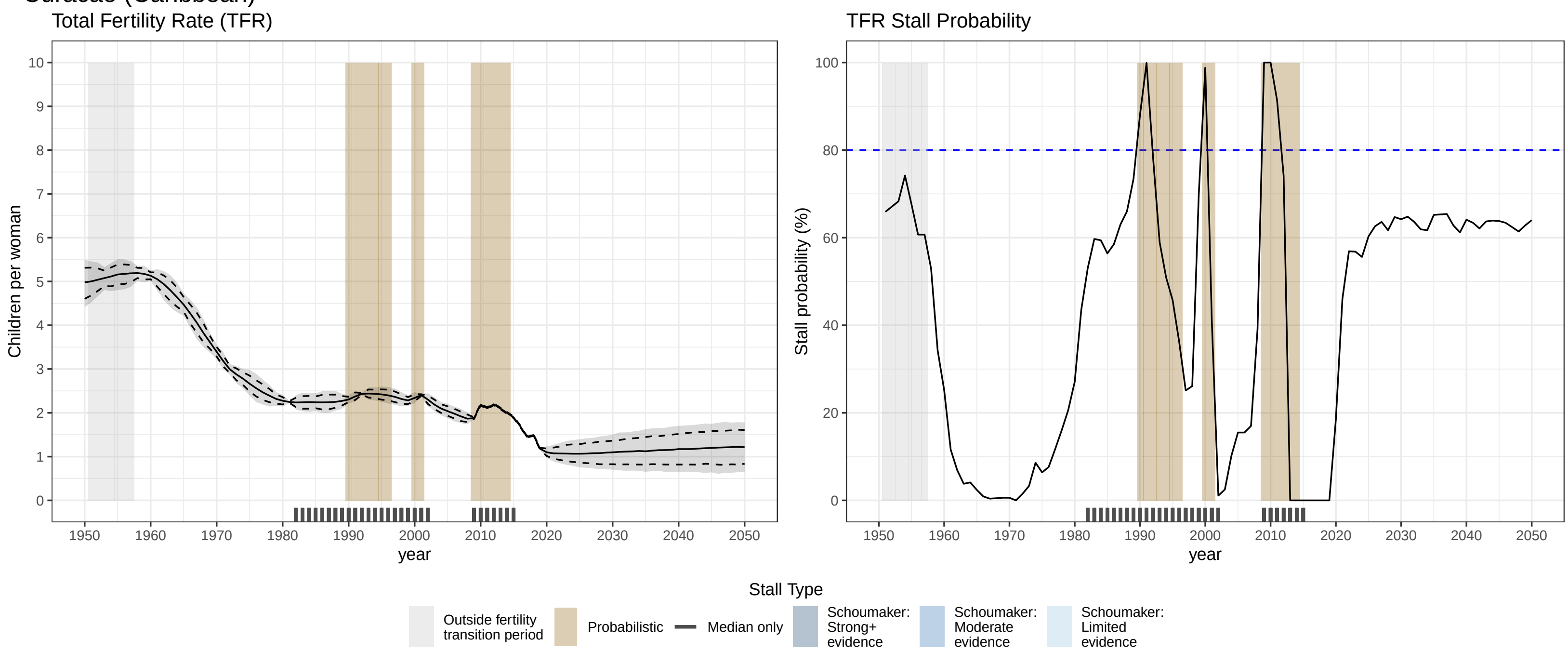
Barbados (Caribbean)



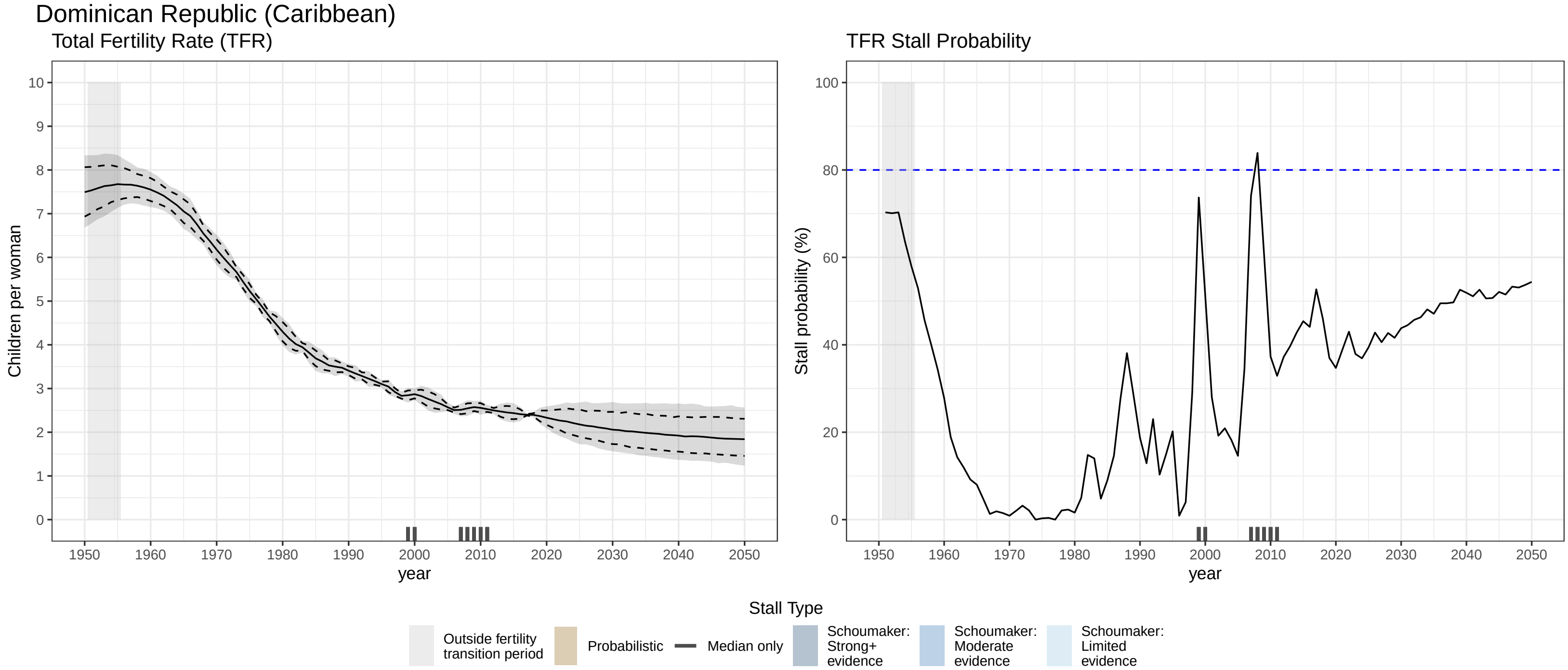
Cuba (Caribbean)



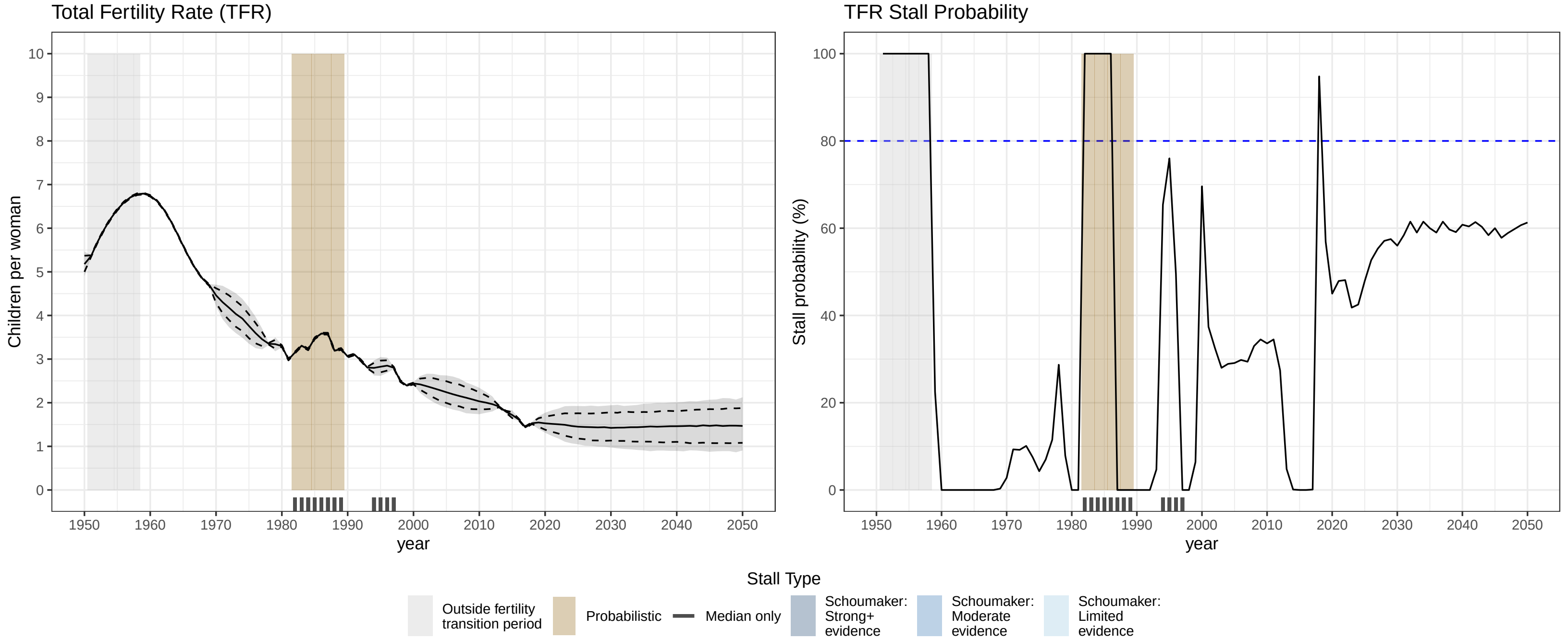
Curacao (Caribbean)



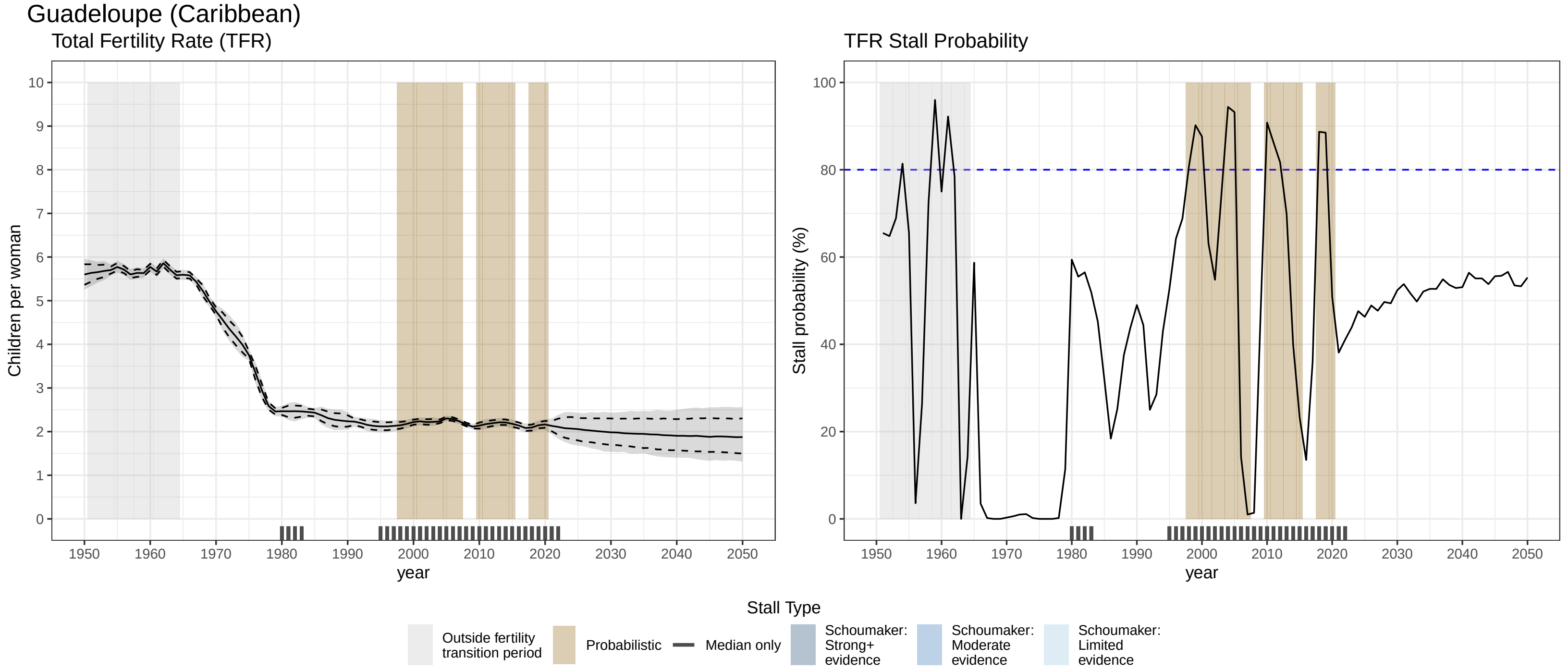
Dominican Republic (Caribbean)



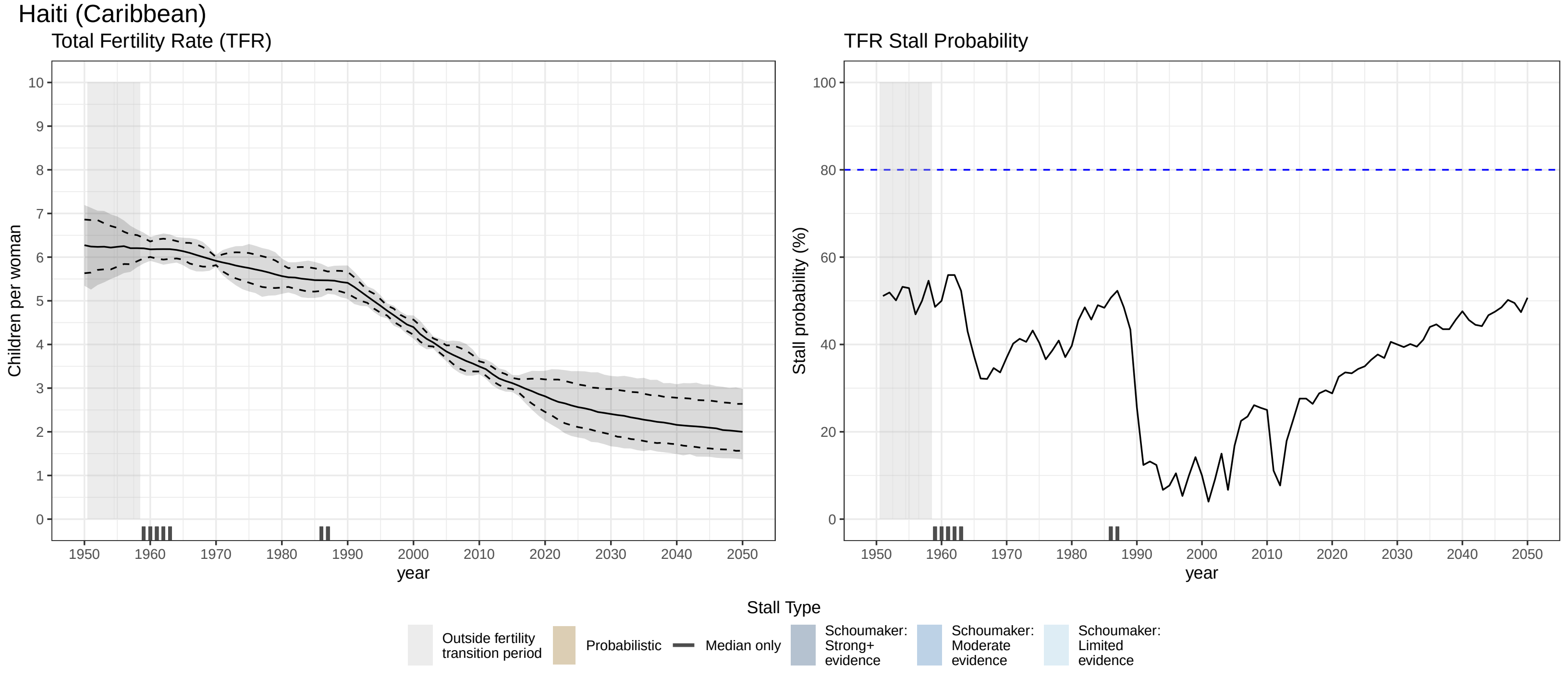
Grenada (Caribbean)



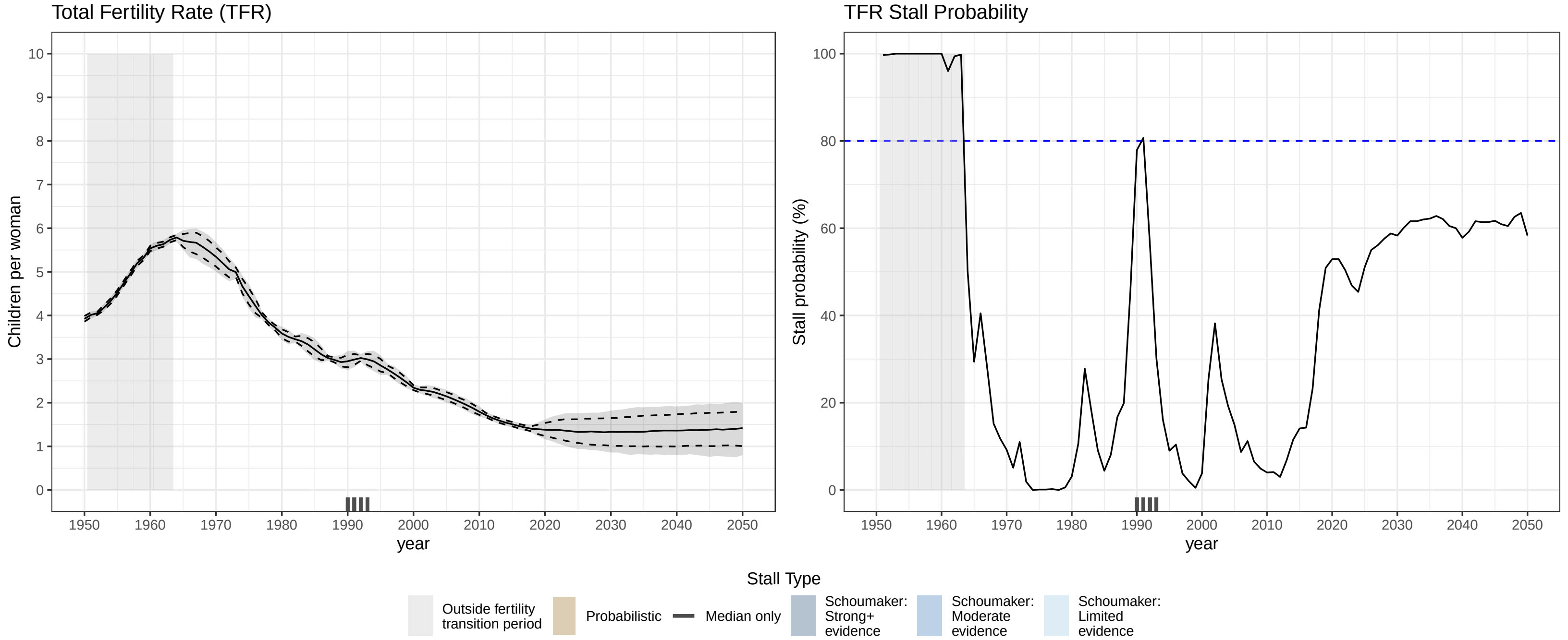
Guadeloupe (Caribbean)



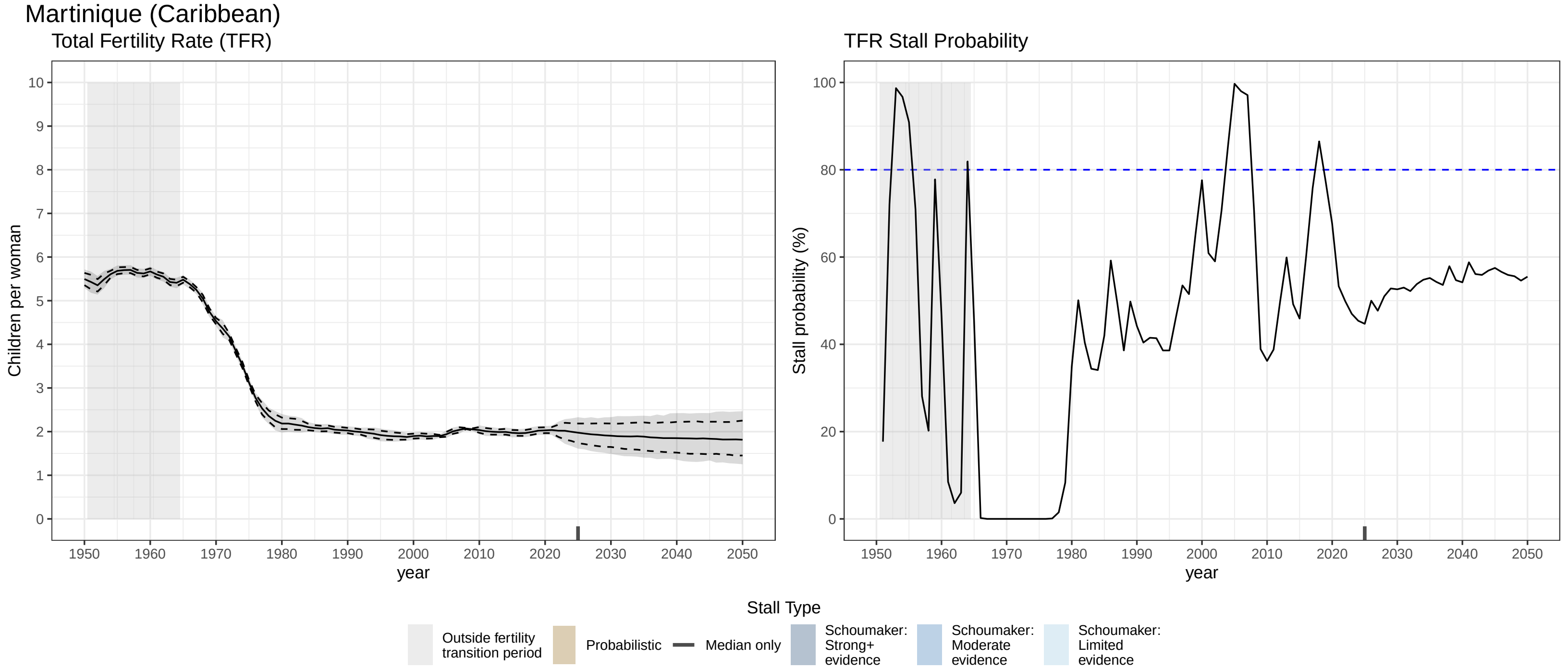
Haiti (Caribbean)



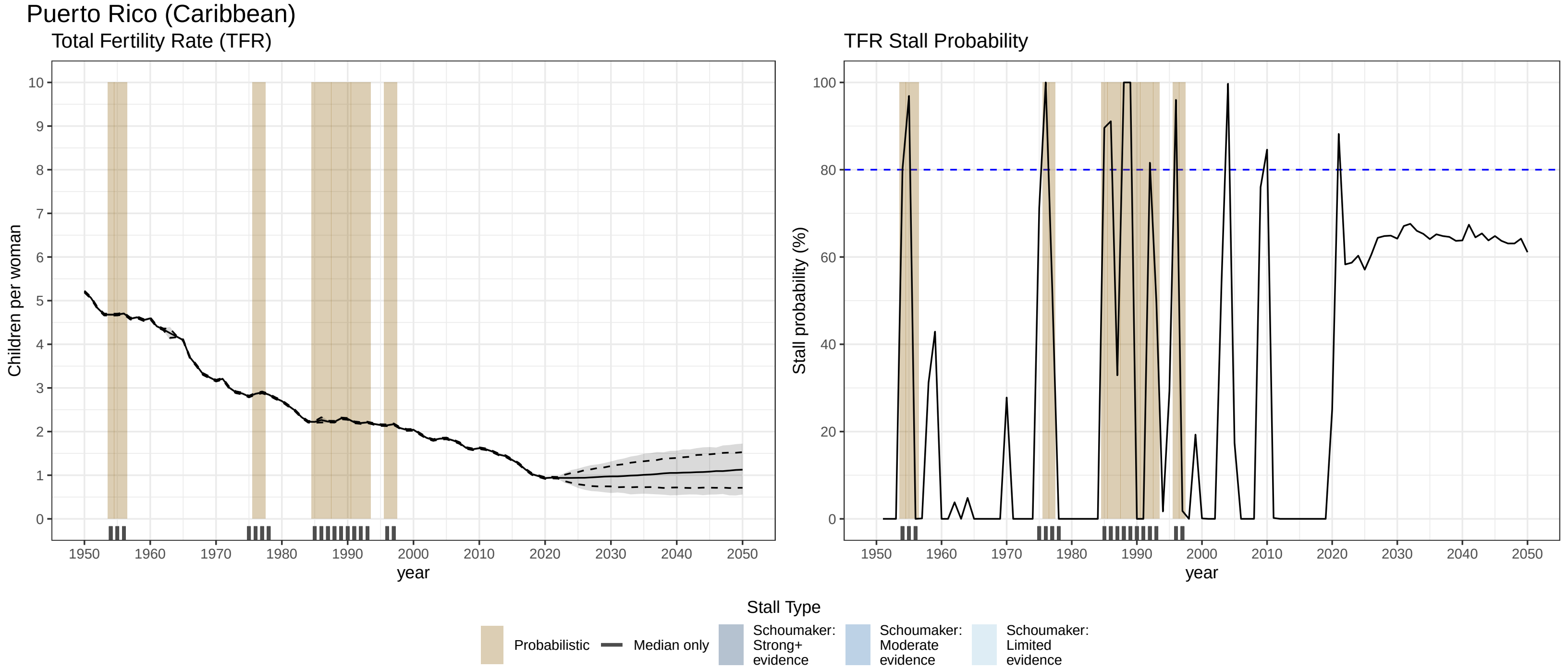
Jamaica (Caribbean)



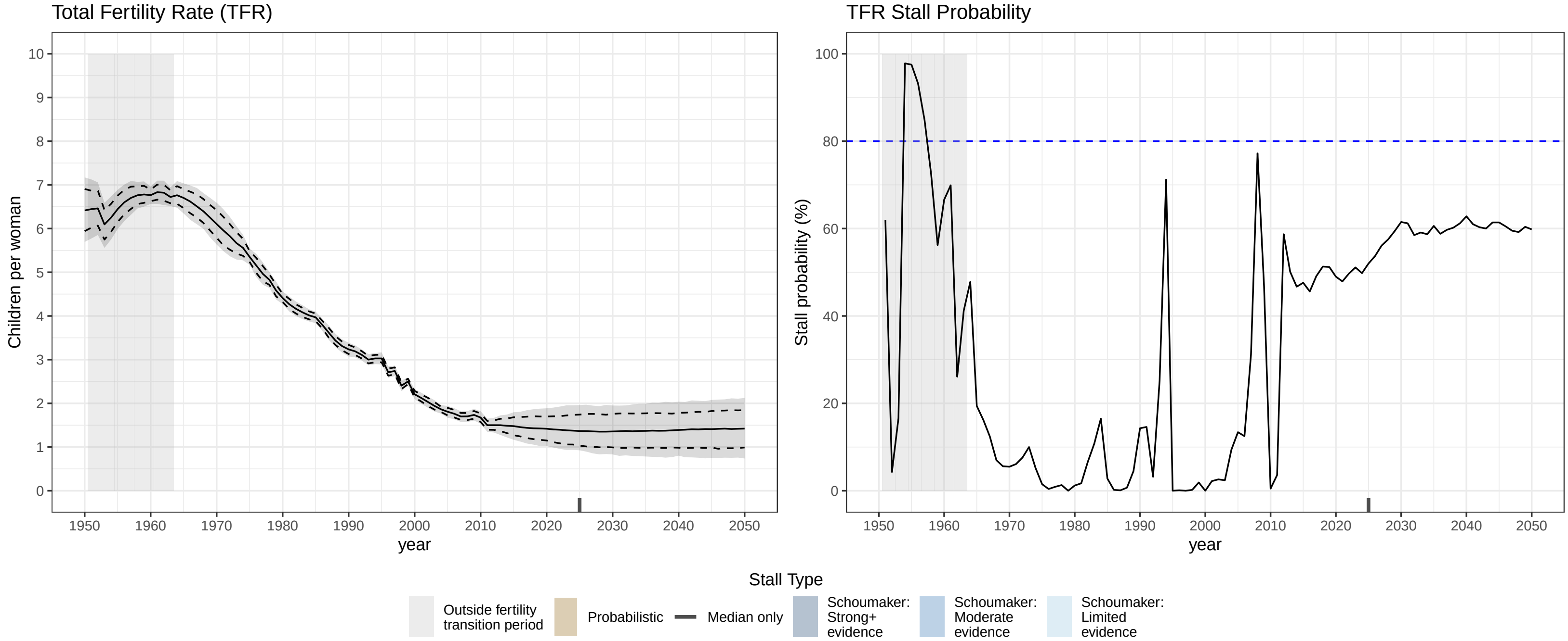
Martinique (Caribbean)



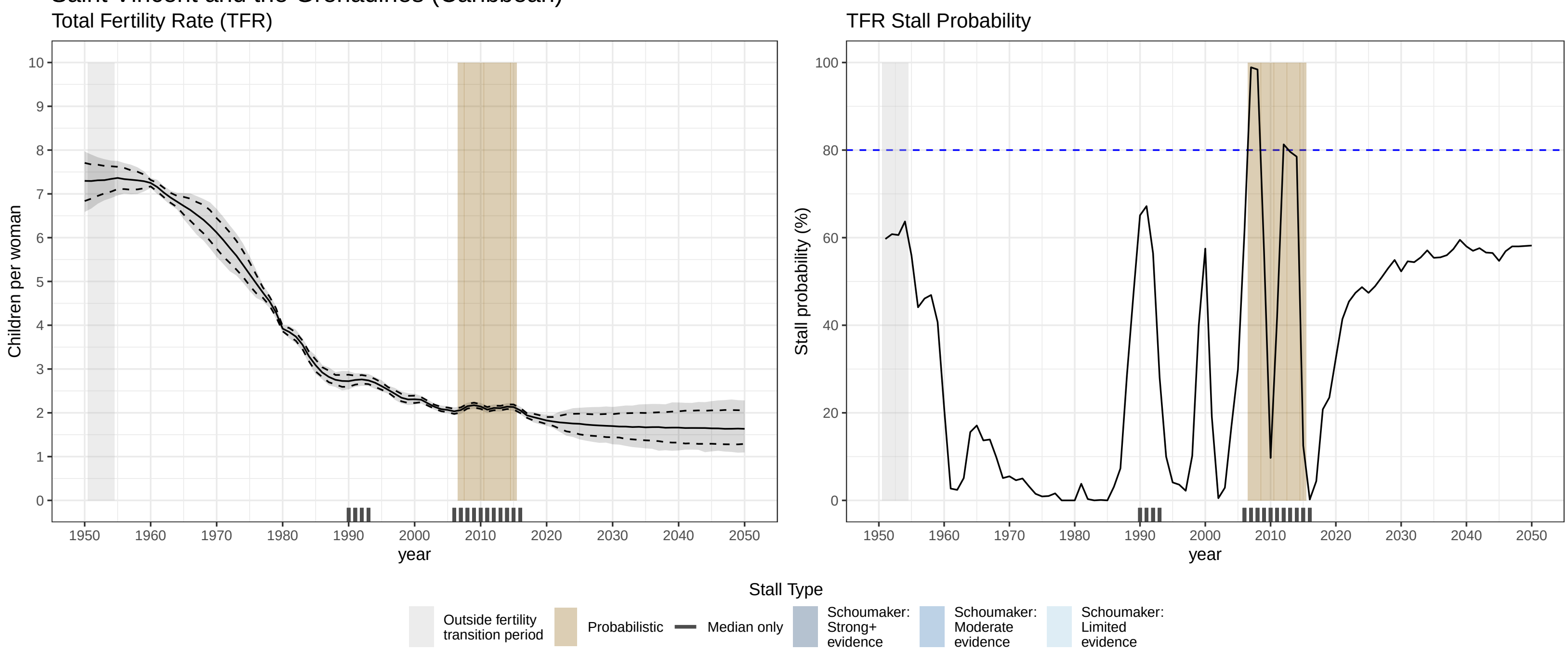
Puerto Rico (Caribbean)



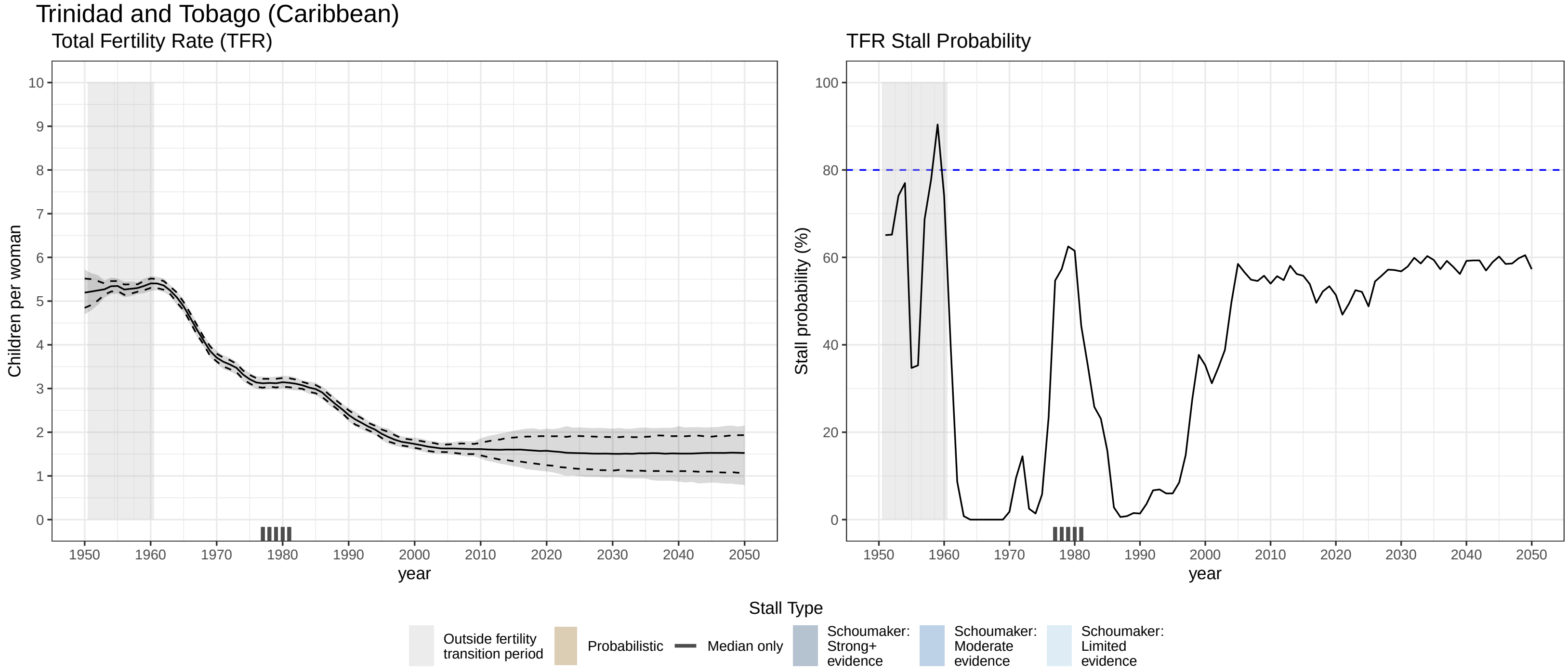
Saint Lucia (Caribbean)



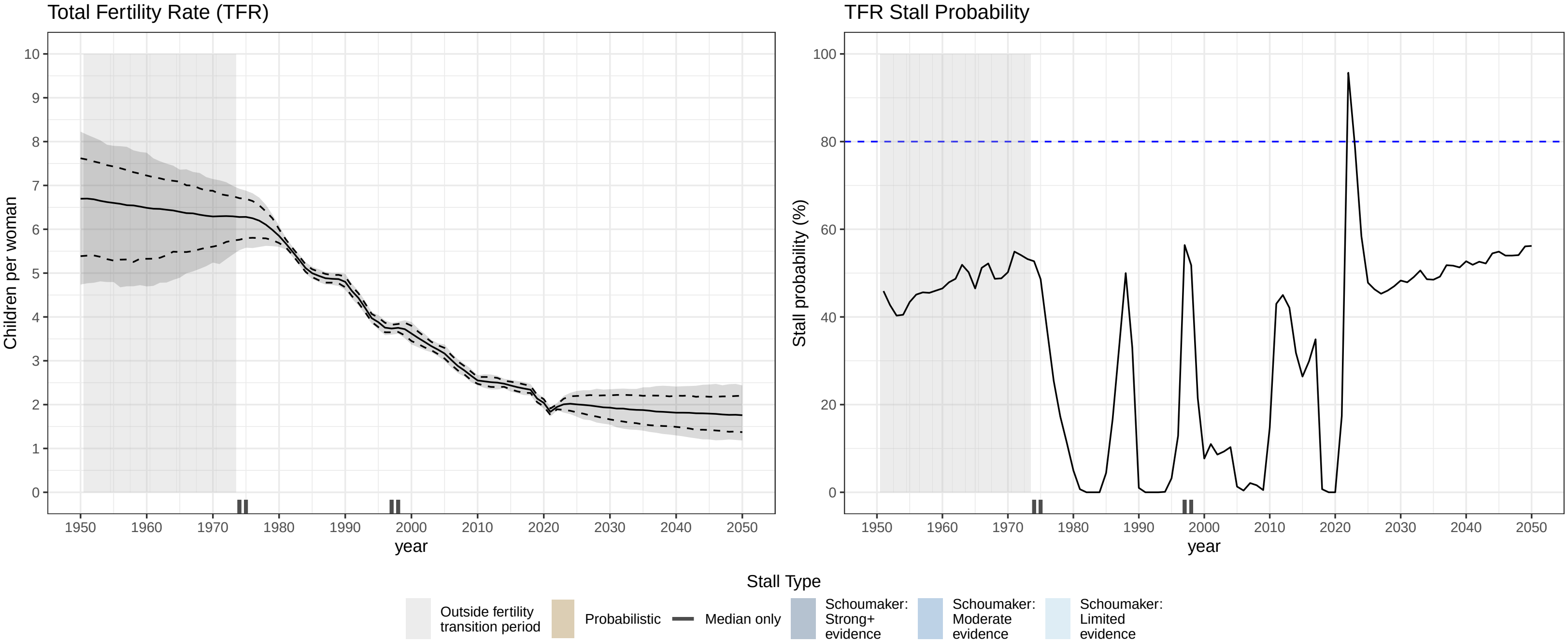
Saint Vincent and the Grenadines (Caribbean)



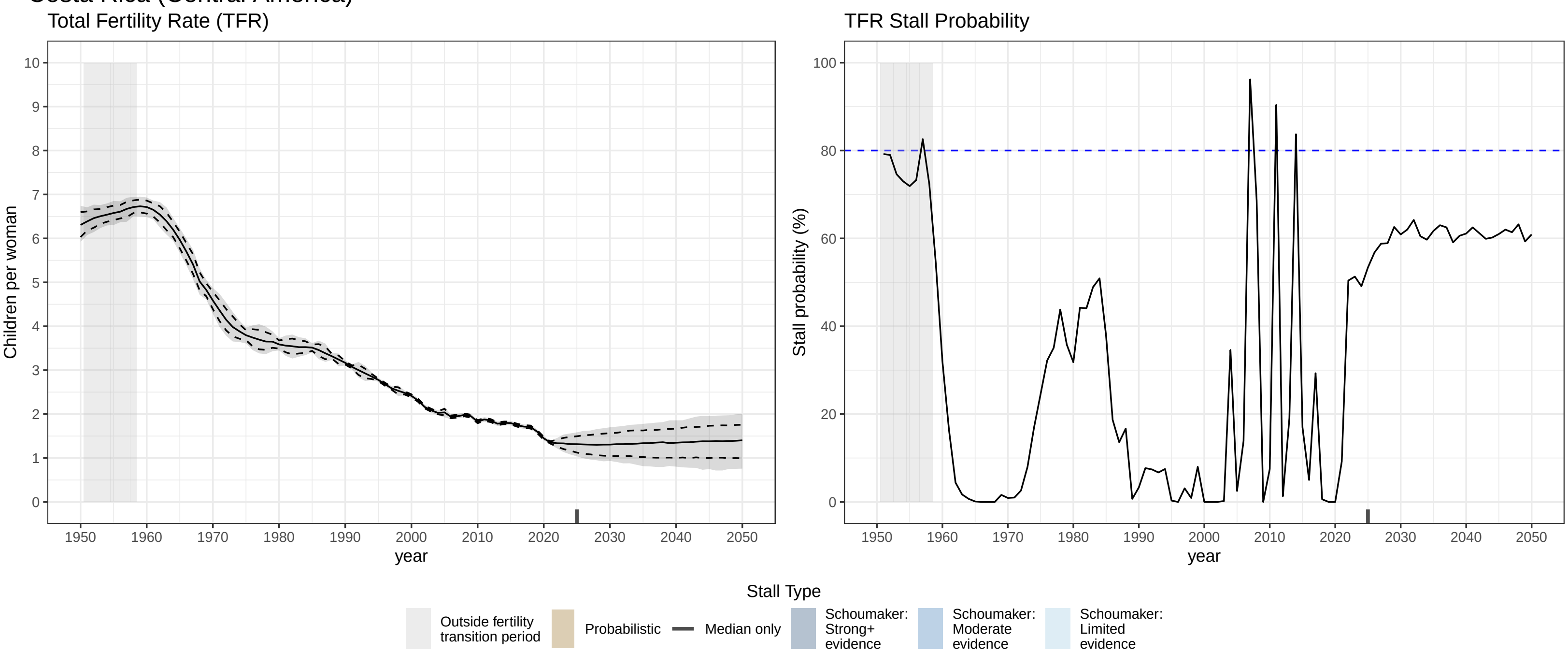
Trinidad and Tobago (Caribbean)



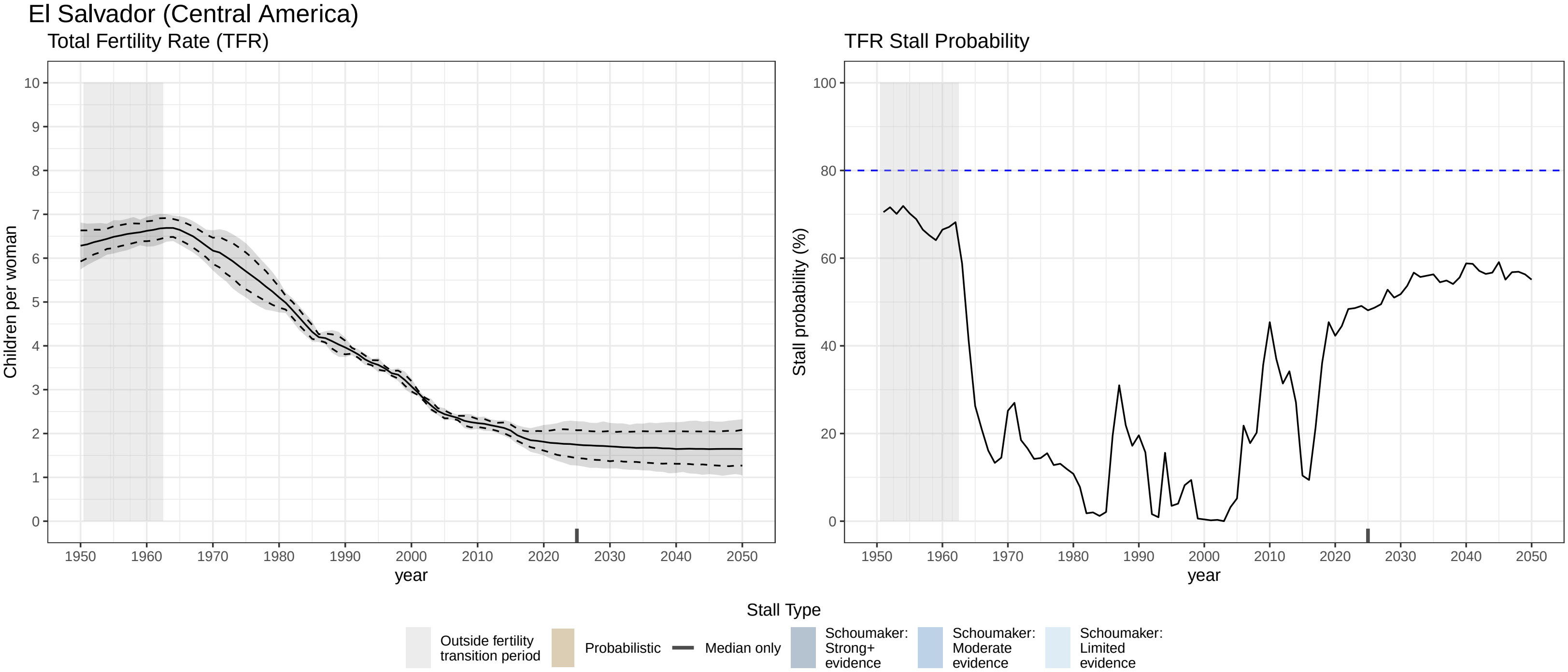
Belize (Central America)



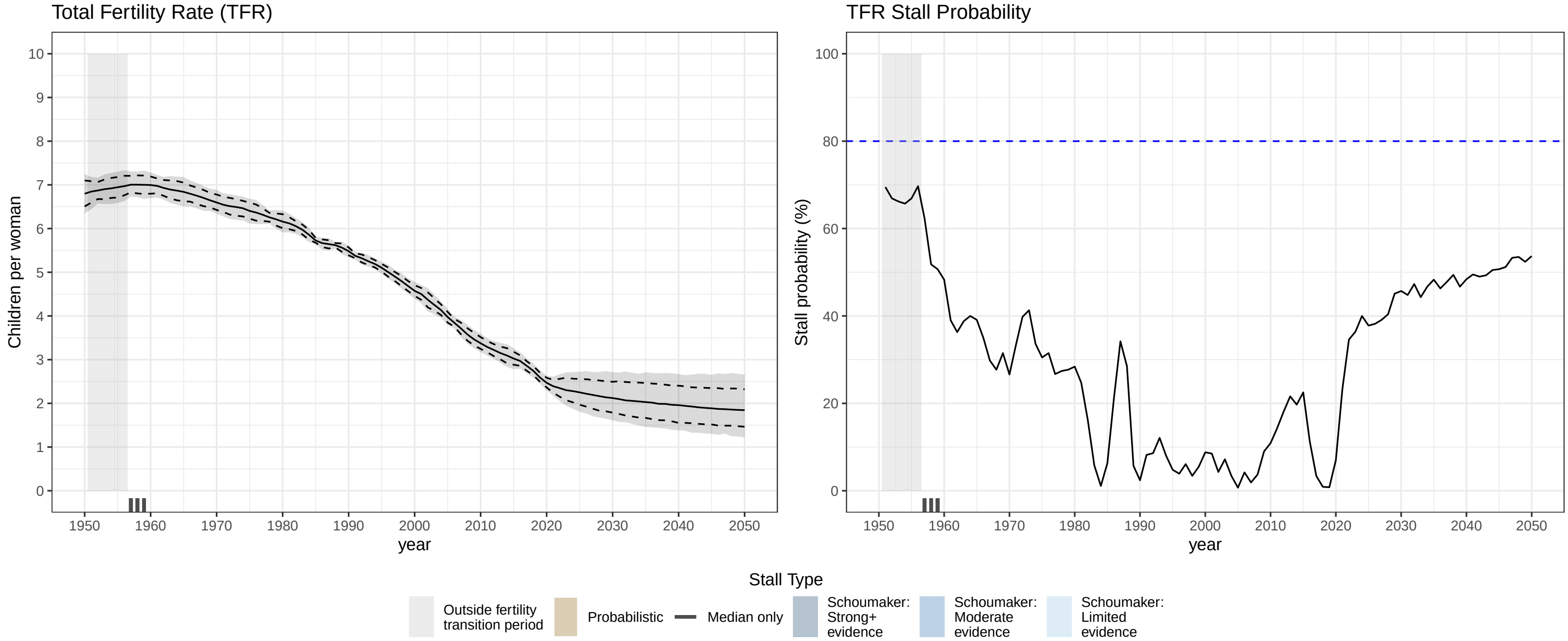
Costa Rica (Central America)



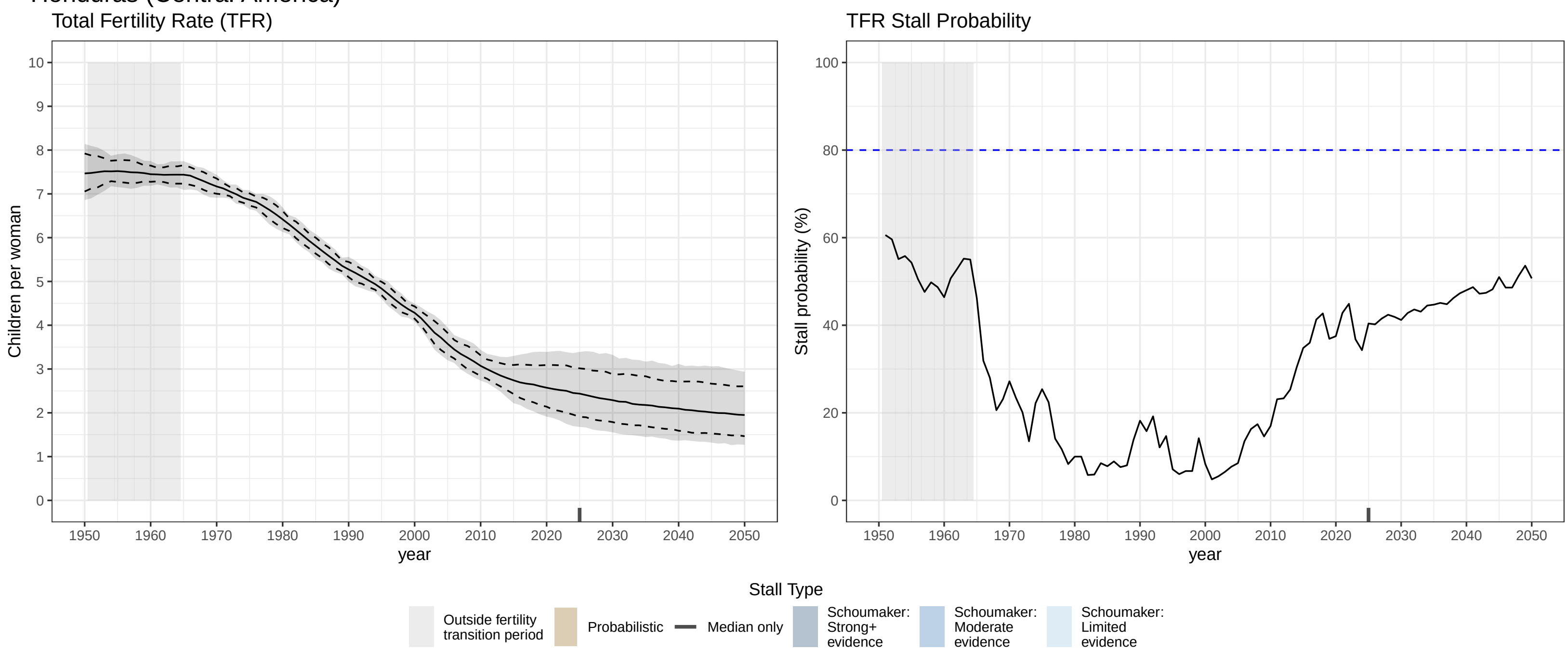
El Salvador (Central America)



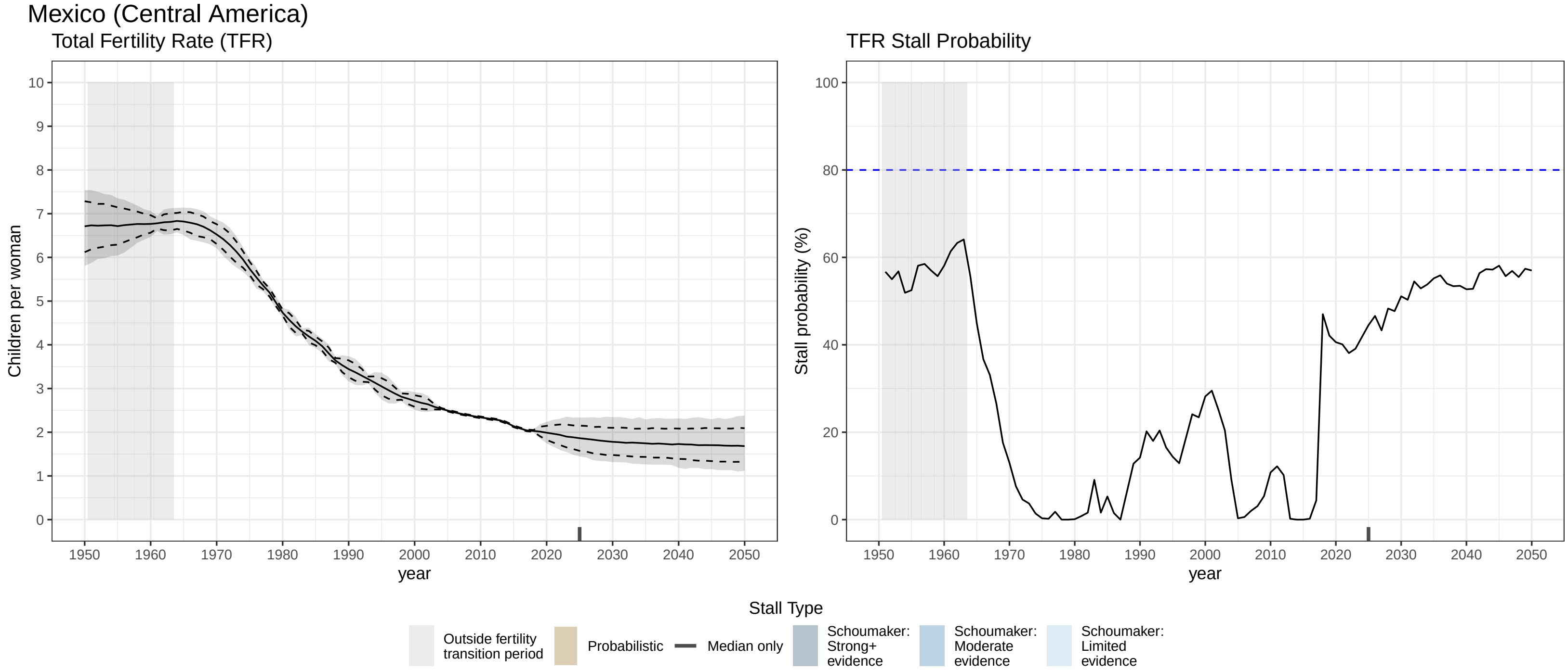
Guatemala (Central America)



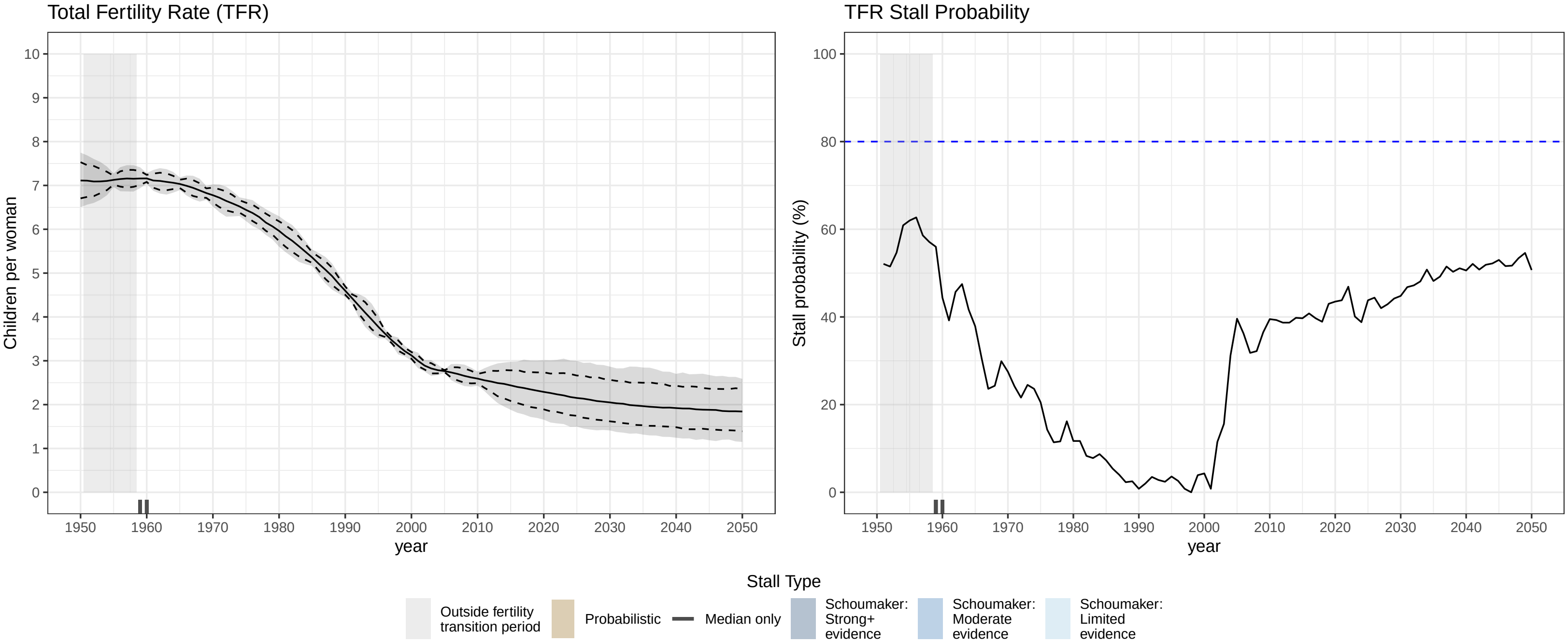
Honduras (Central America)



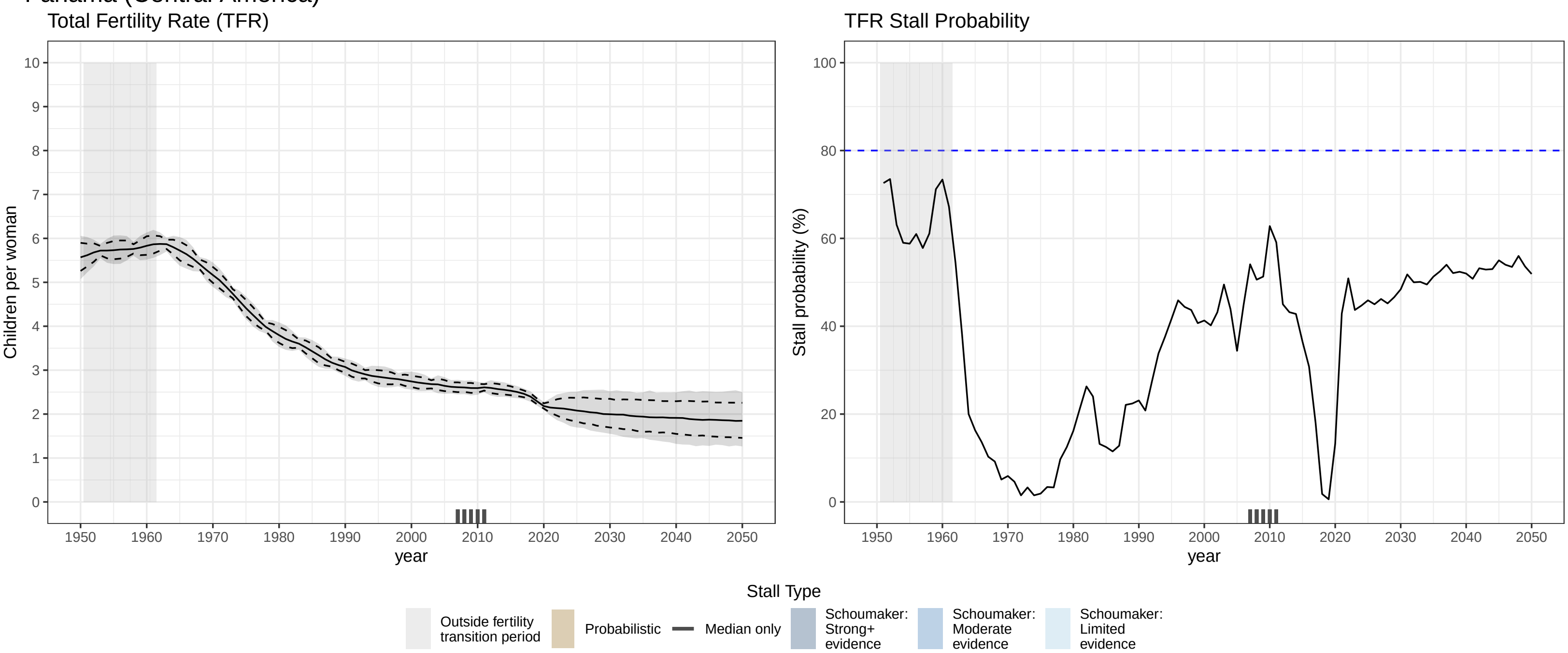
Mexico (Central America)



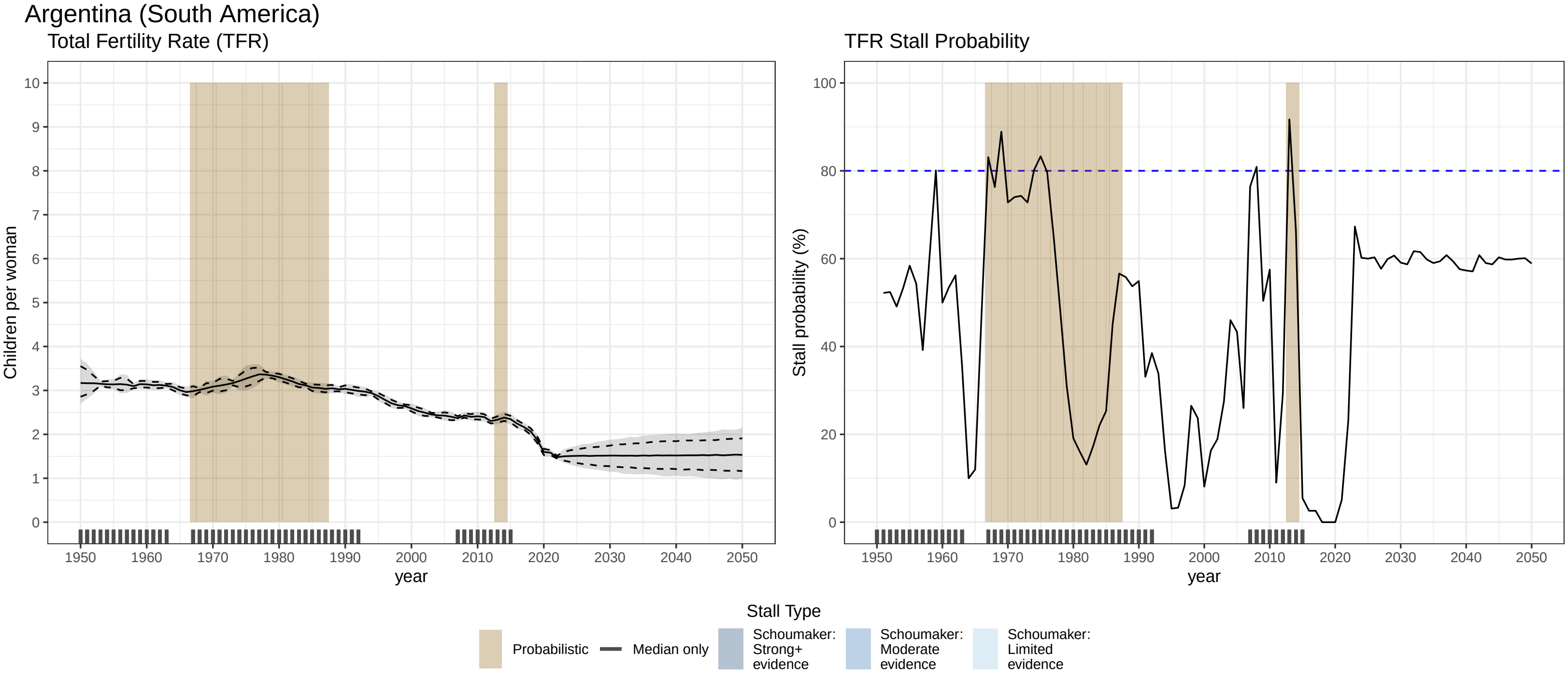
Nicaragua (Central America)



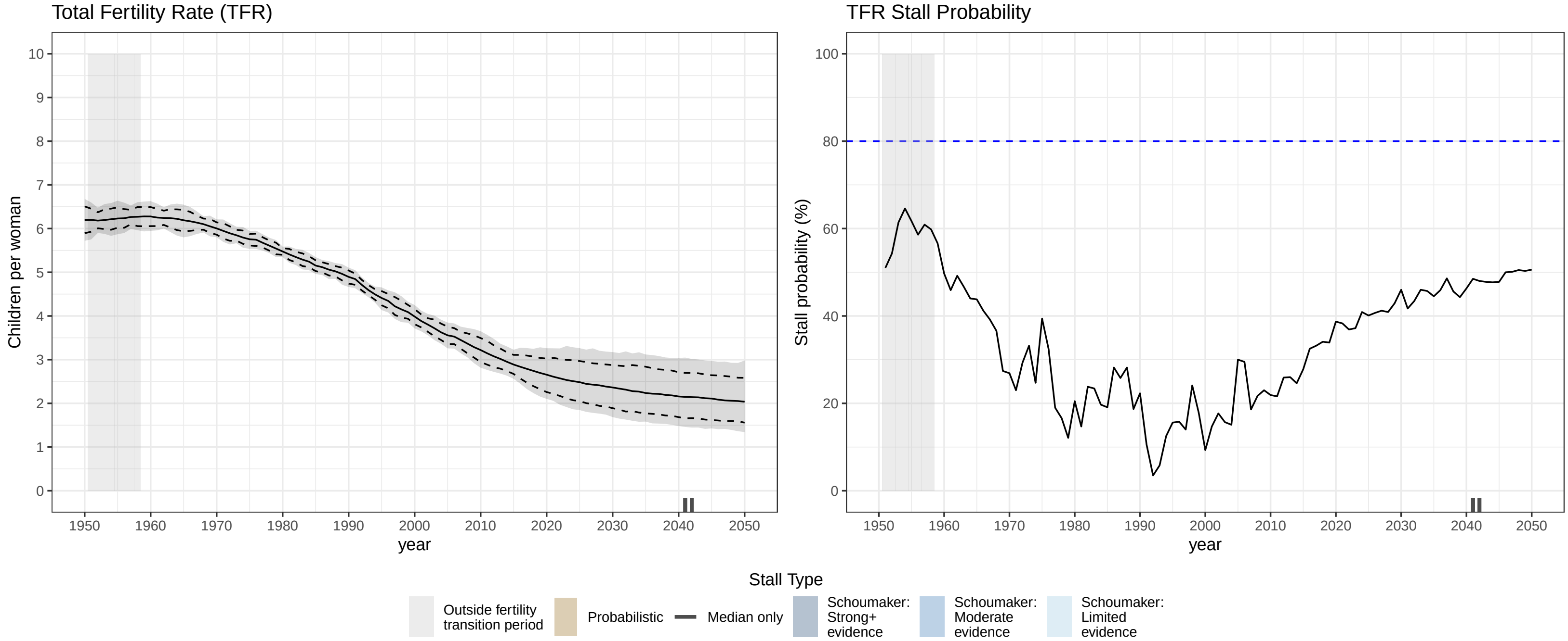
Panama (Central America)



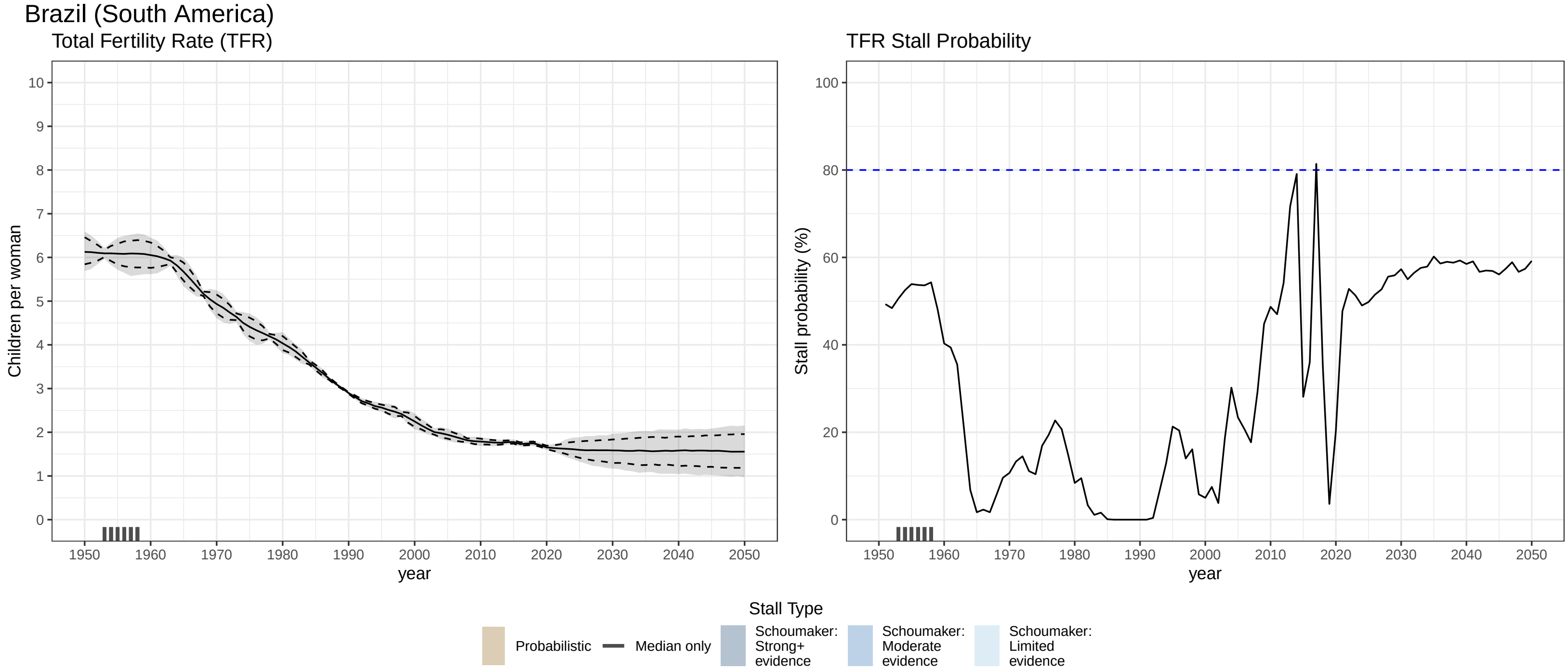
Argentina (South America)



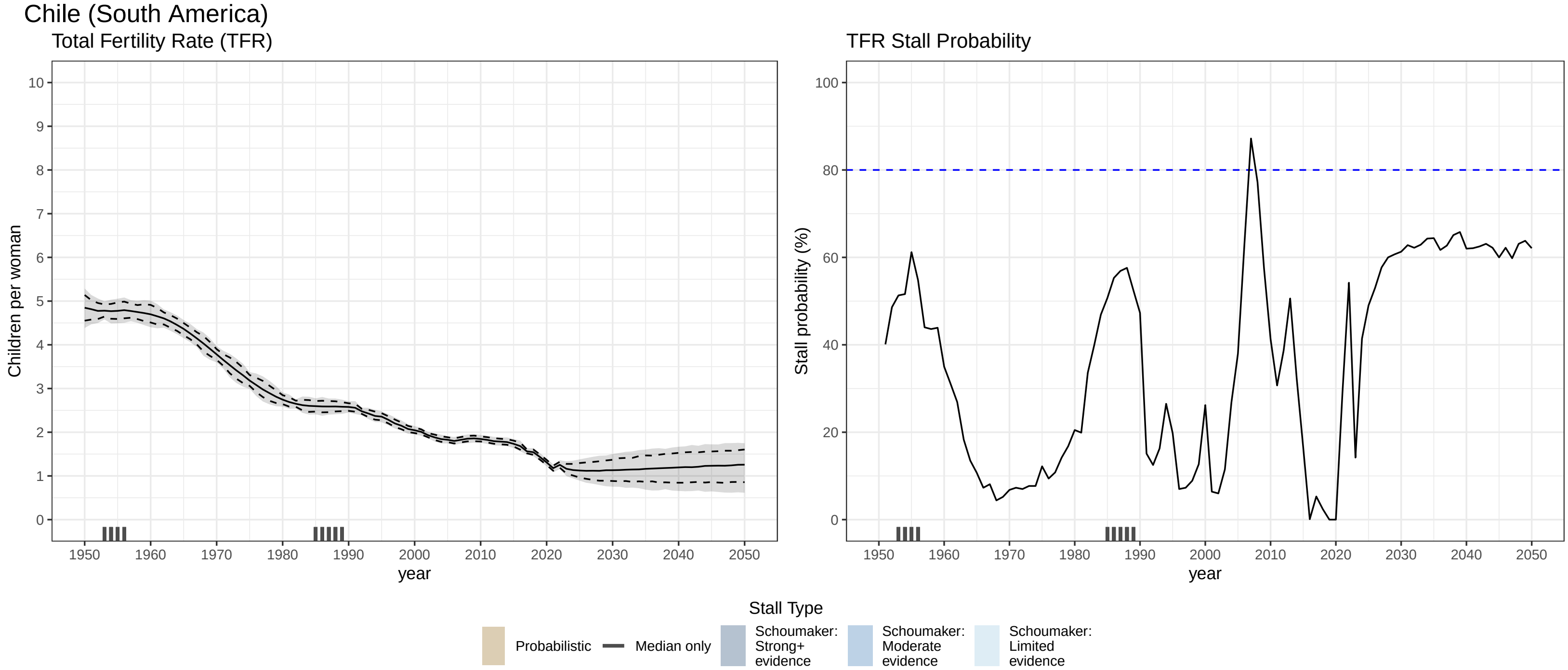
Bolivia (Plurinational State of) (South America)



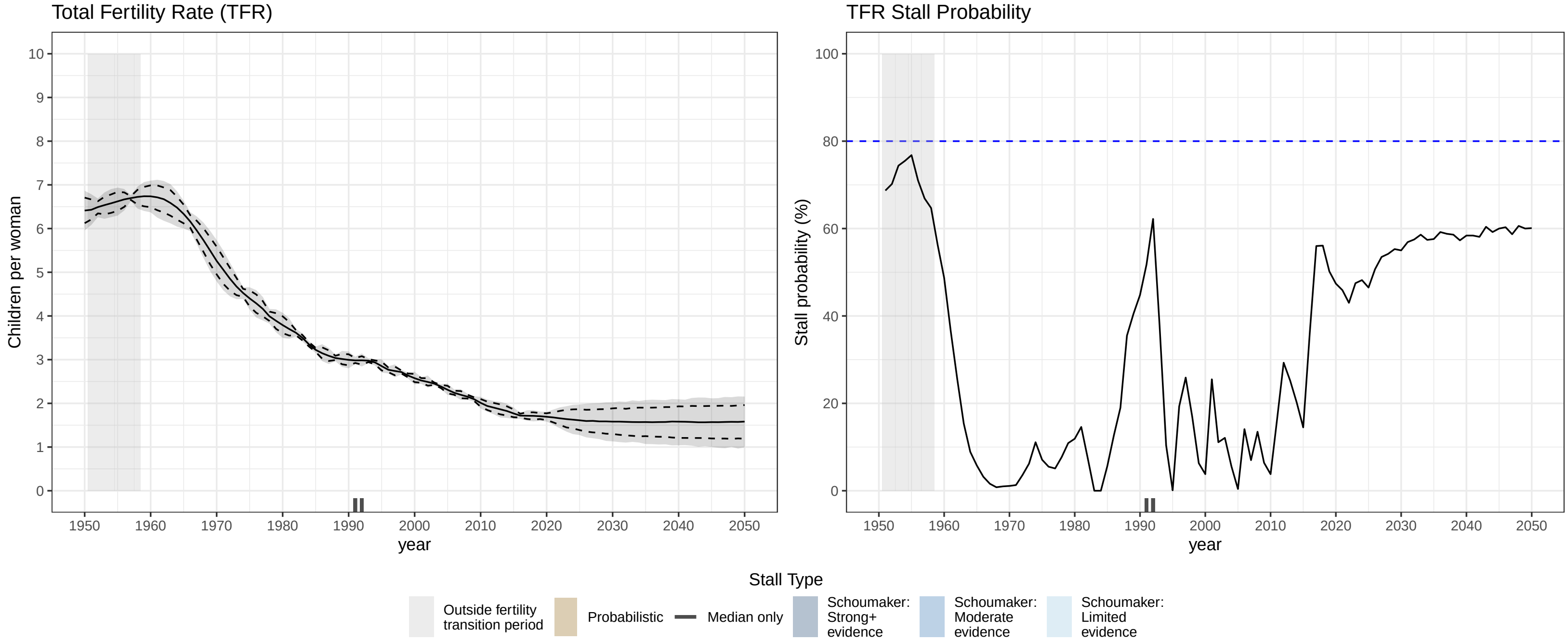
Brazil (South America)



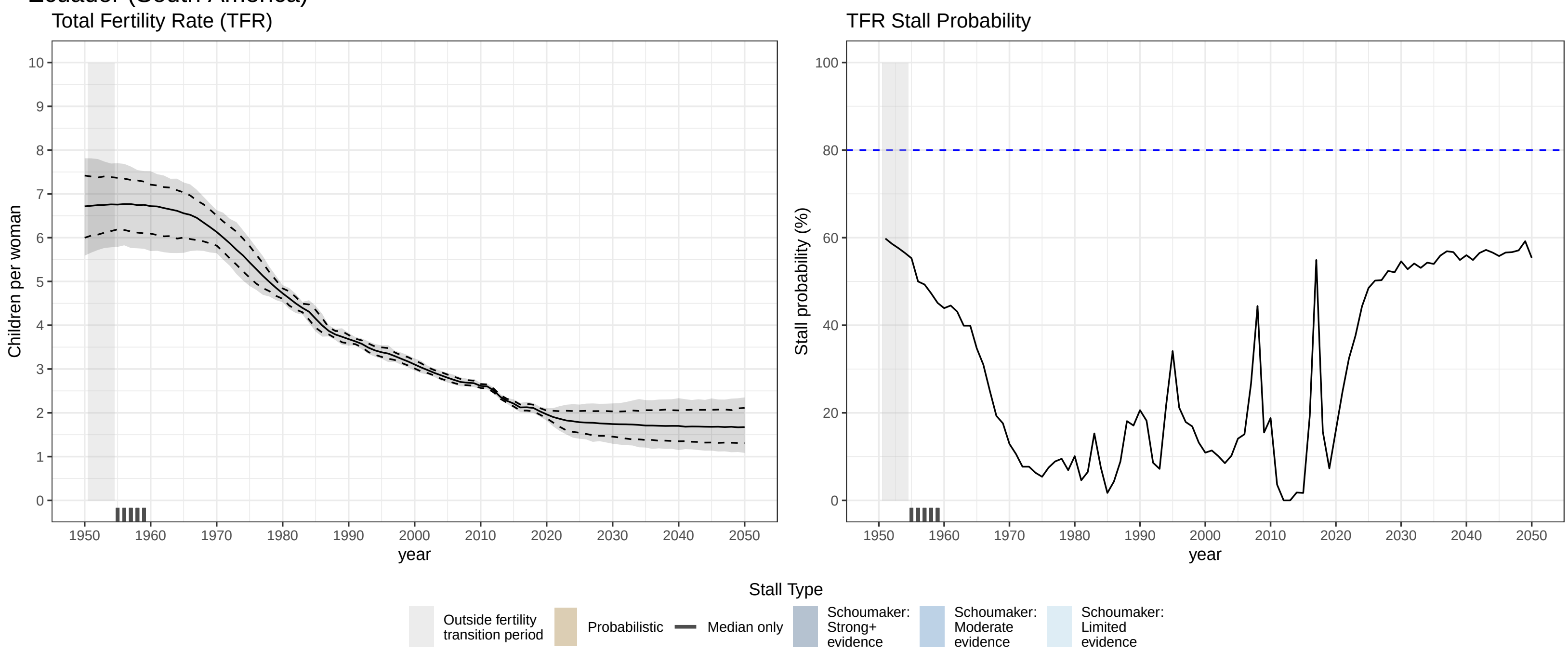
Chile (South America)



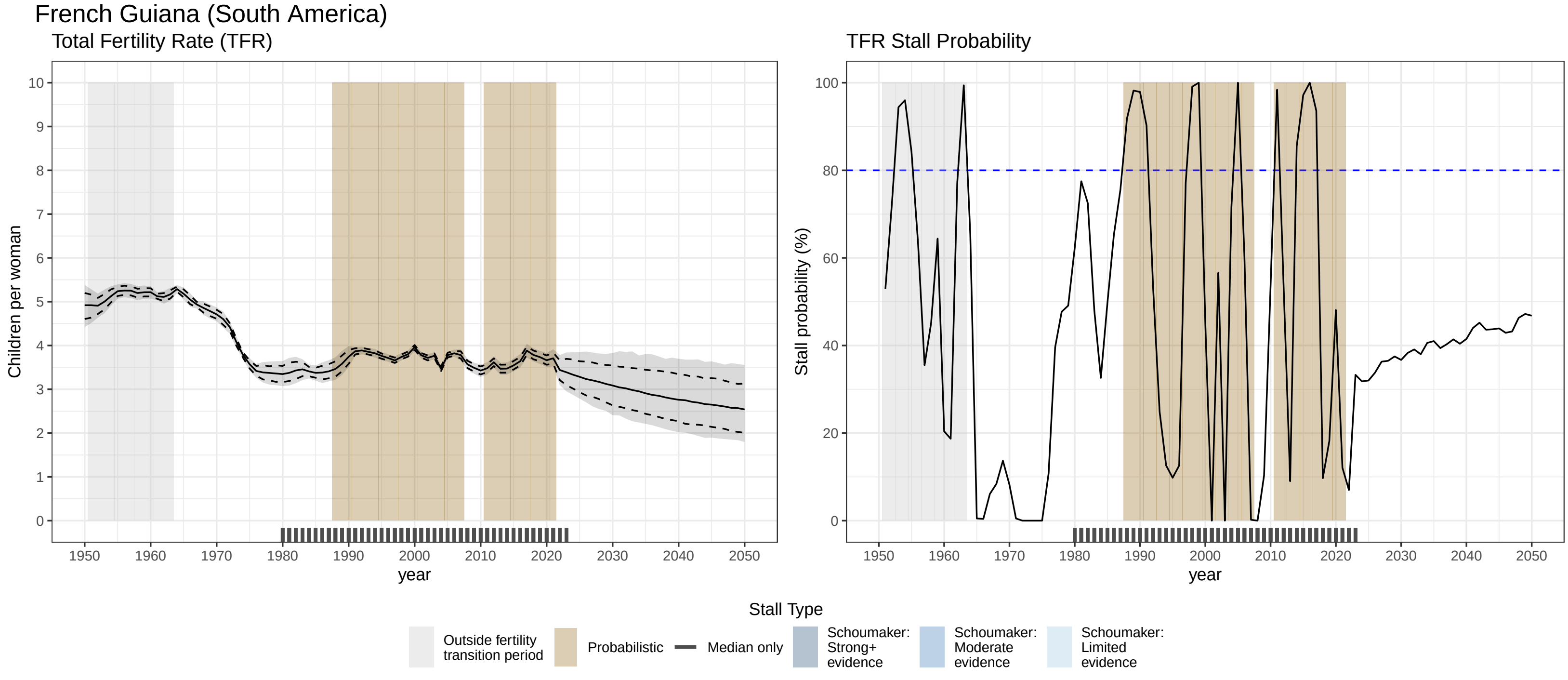
Colombia (South America)



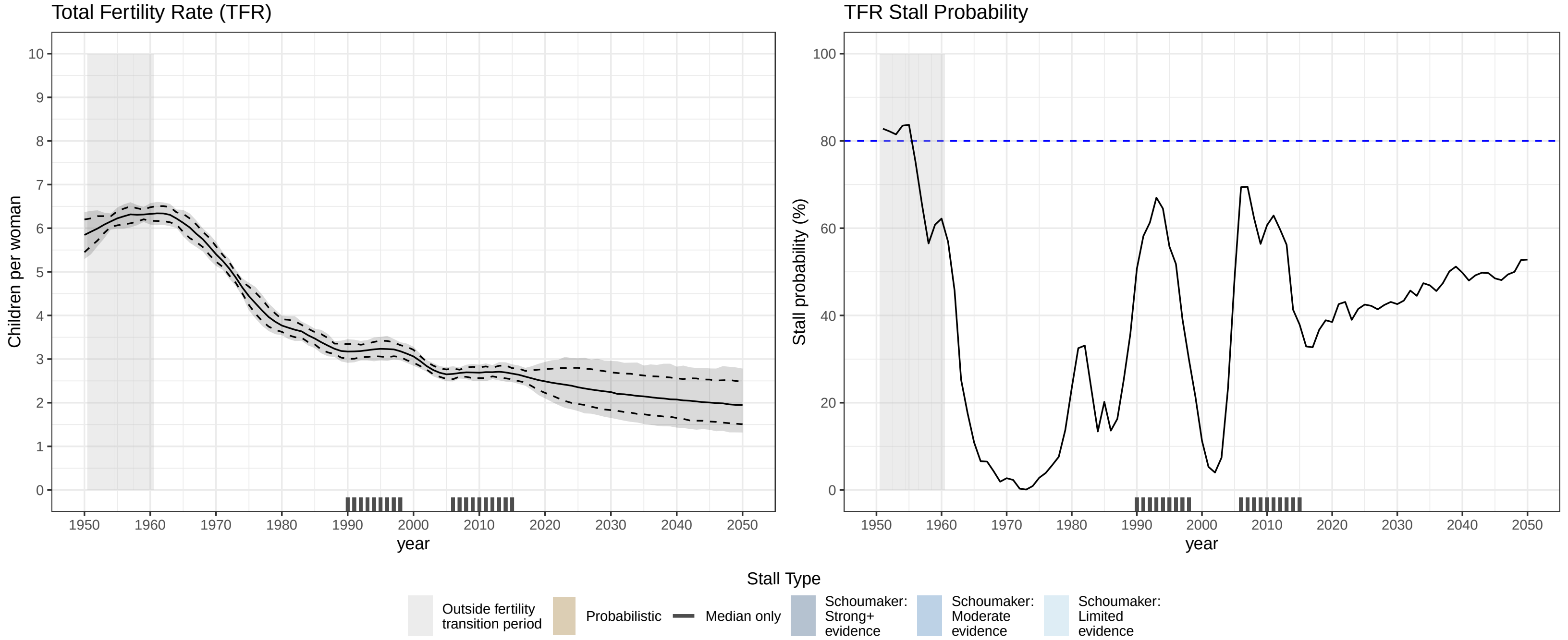
Ecuador (South America)



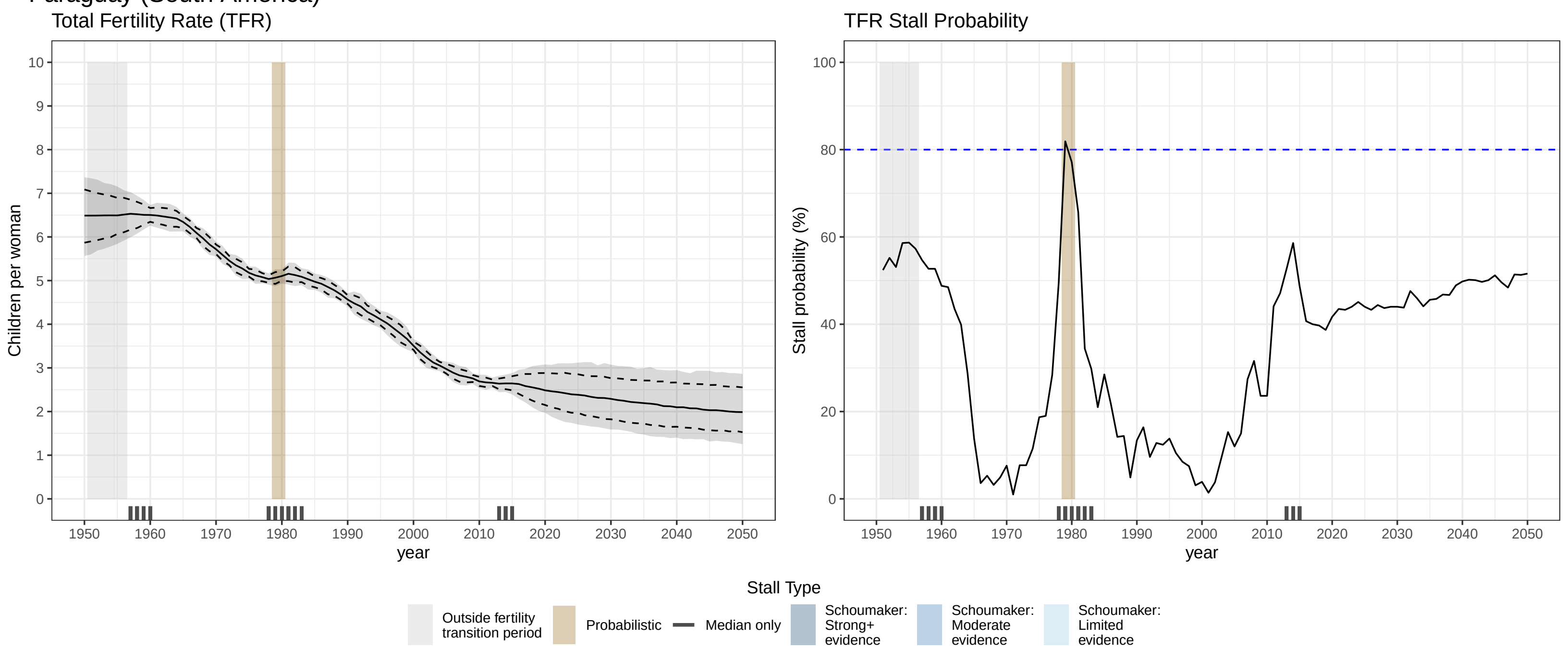
French Guiana (South America)



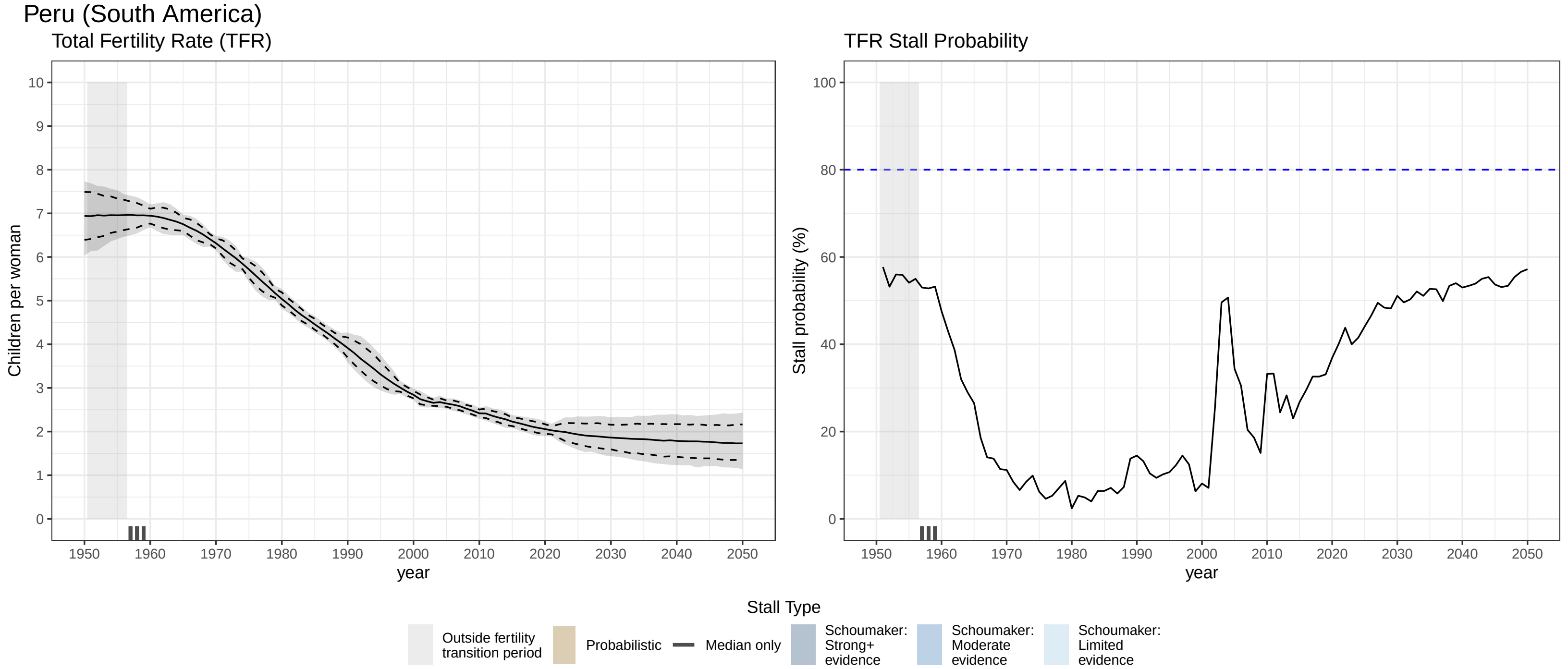
Guyana (South America)



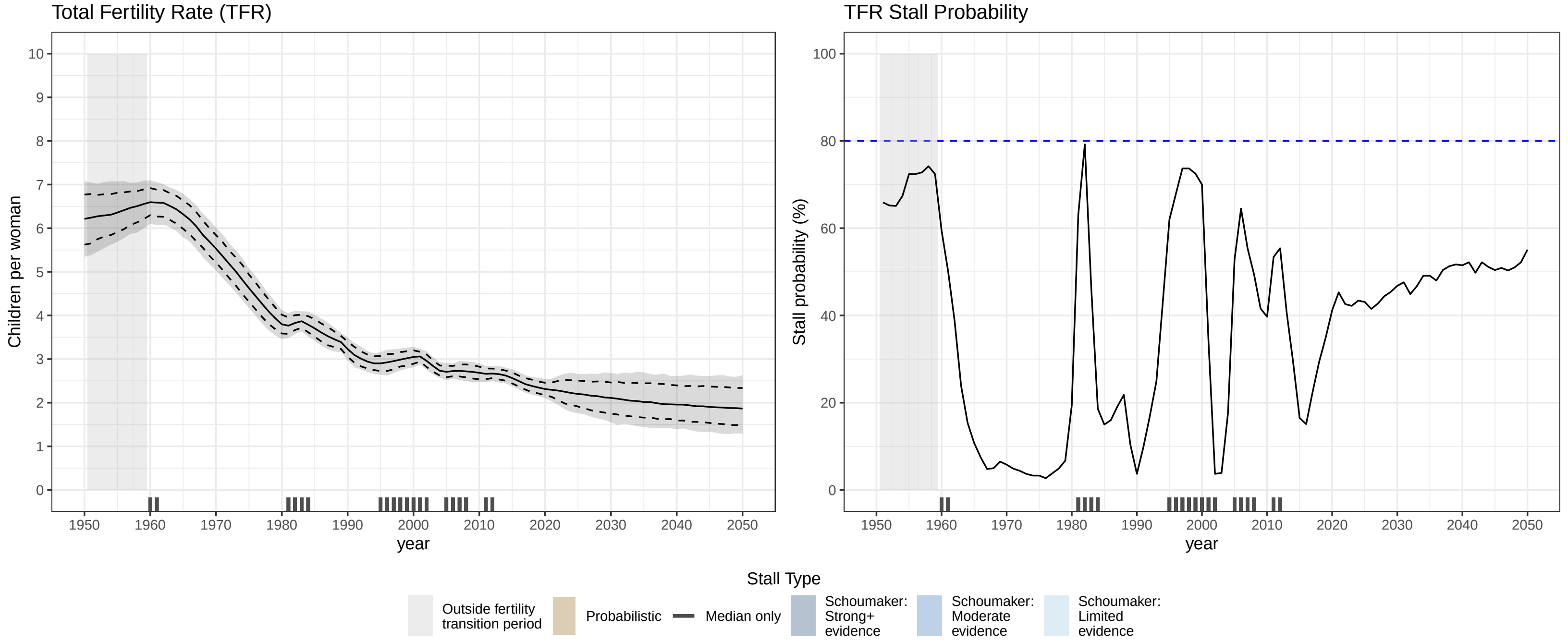
Paraguay (South America)



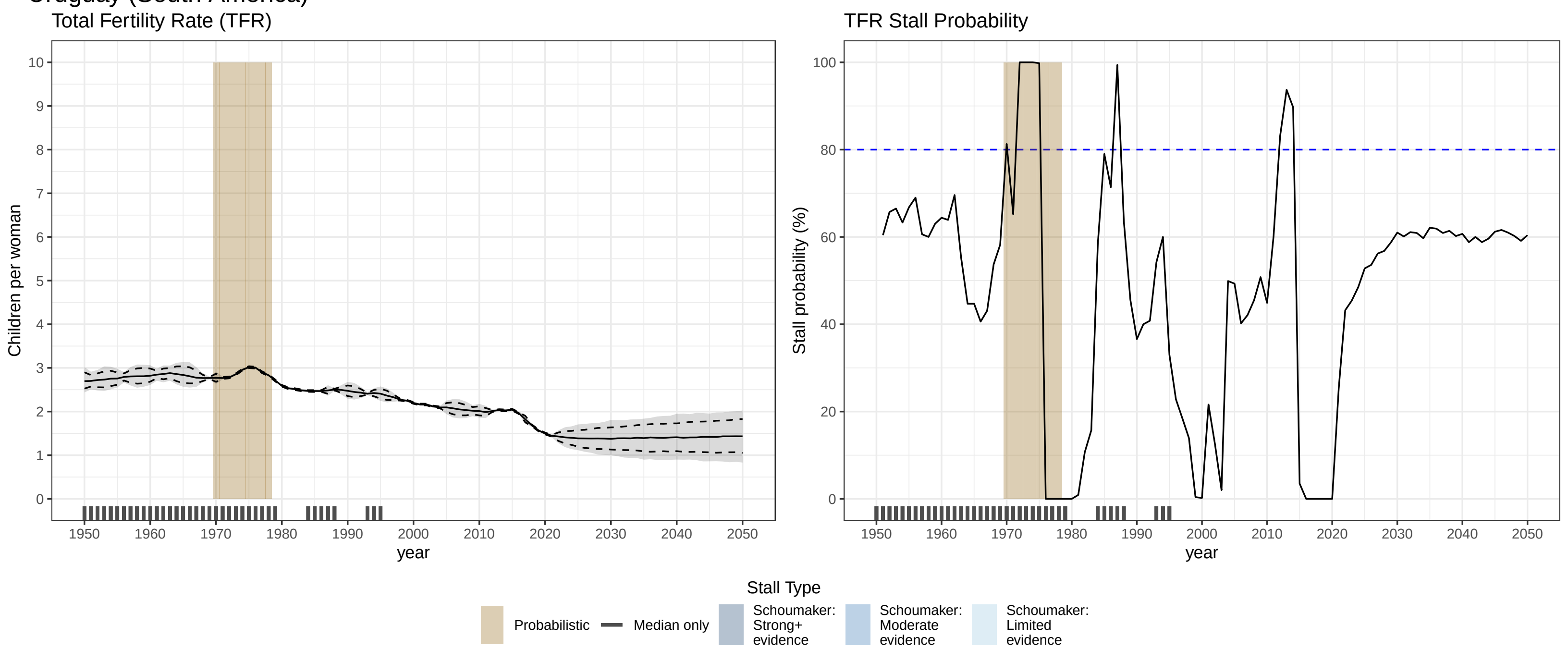
Peru (South America)



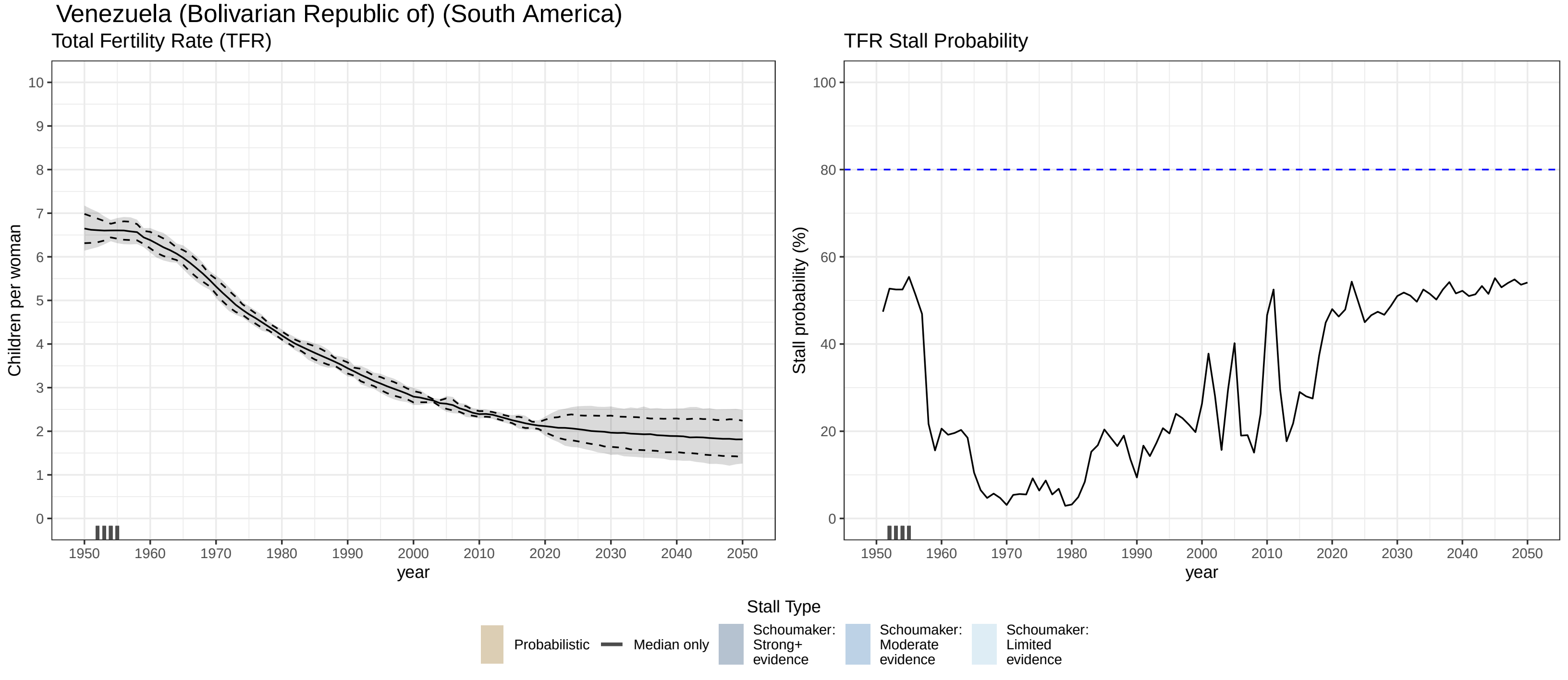
Suriname (South America)



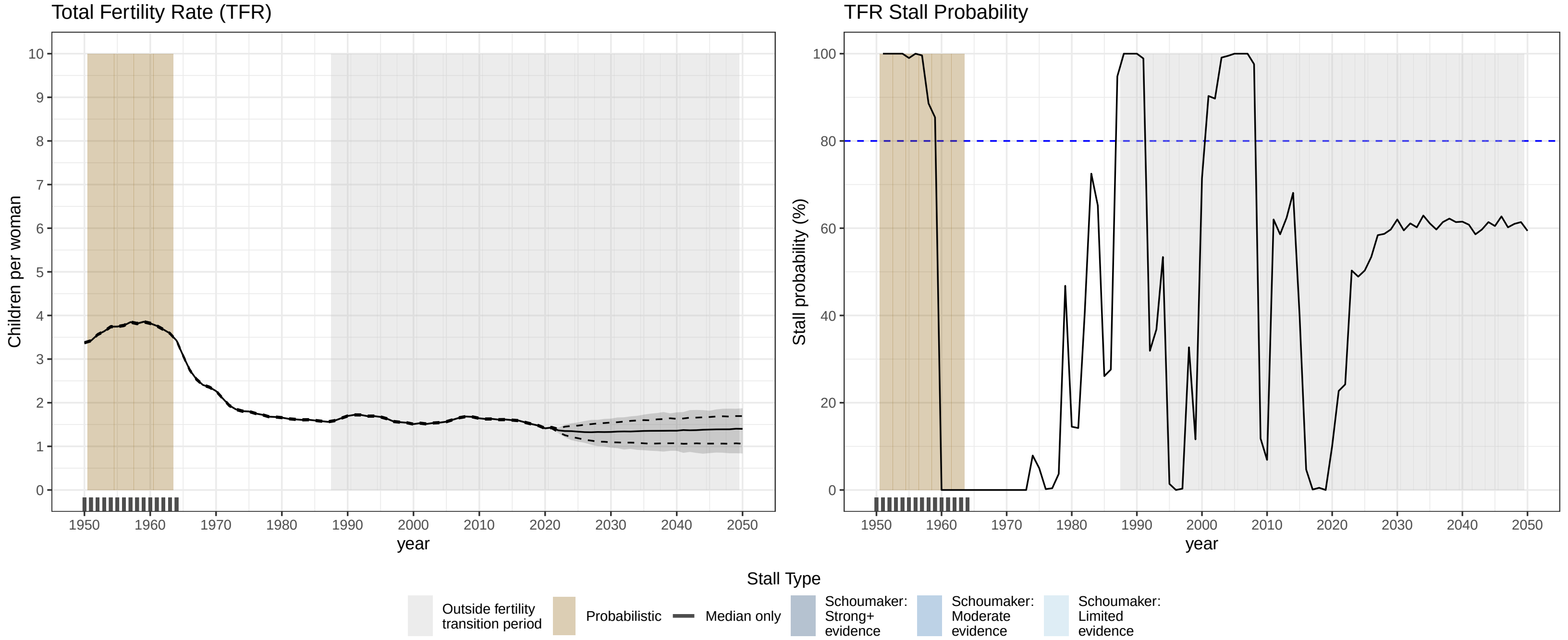
Uruguay (South America)



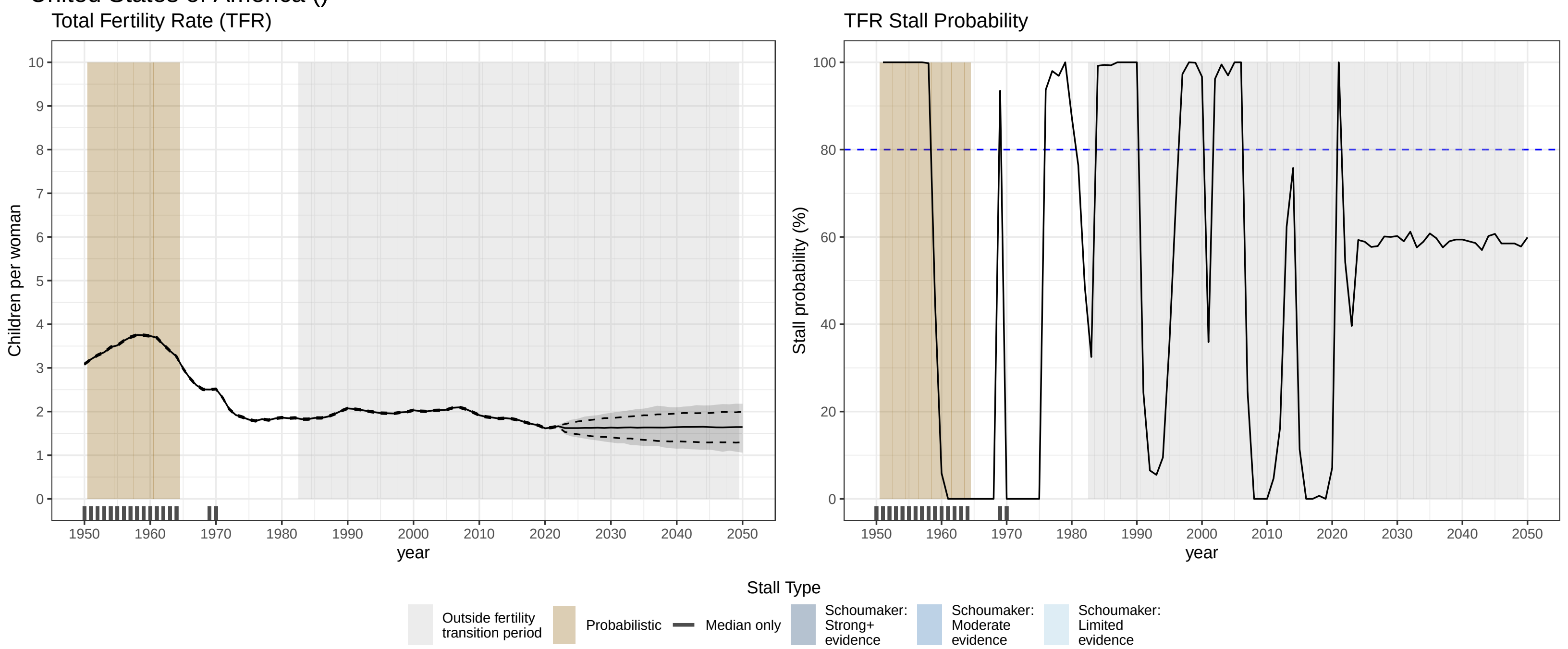
Venezuela (Bolivarian Republic of) (South America)



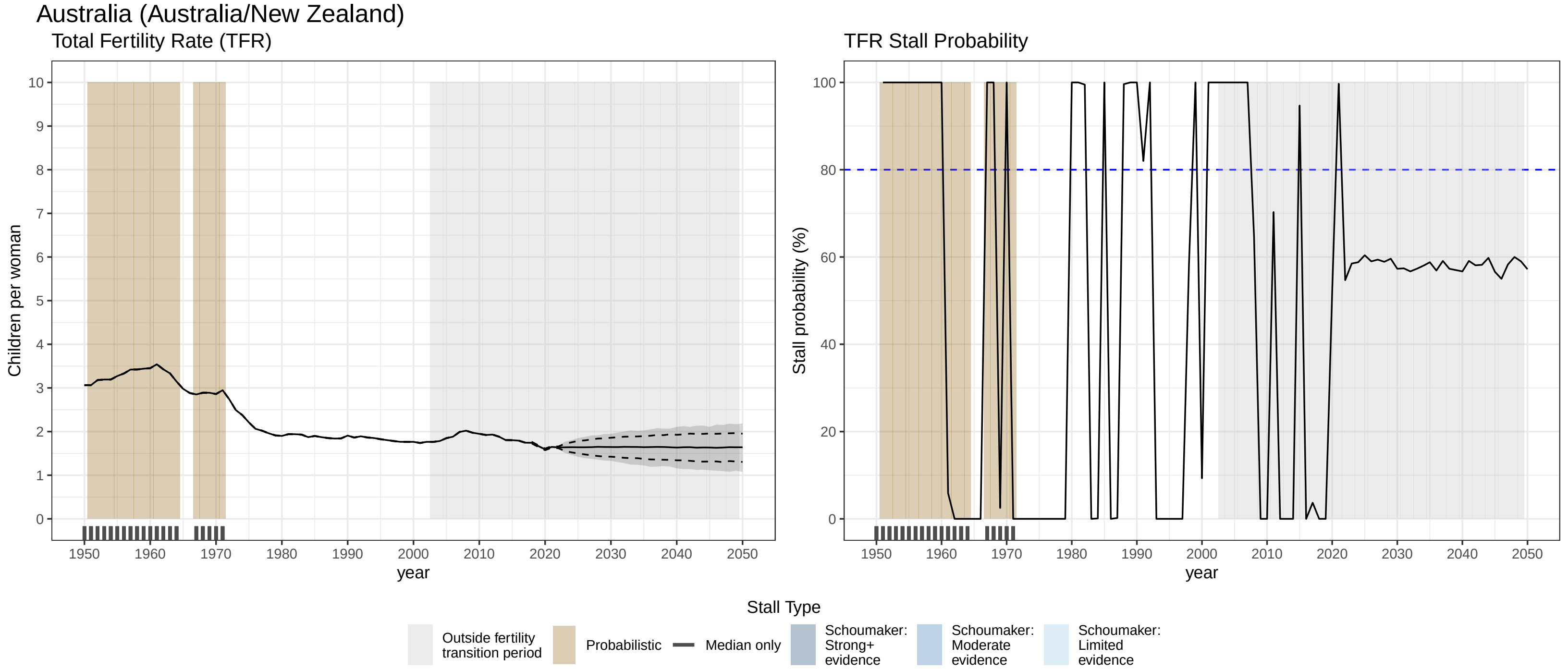
Canada ()



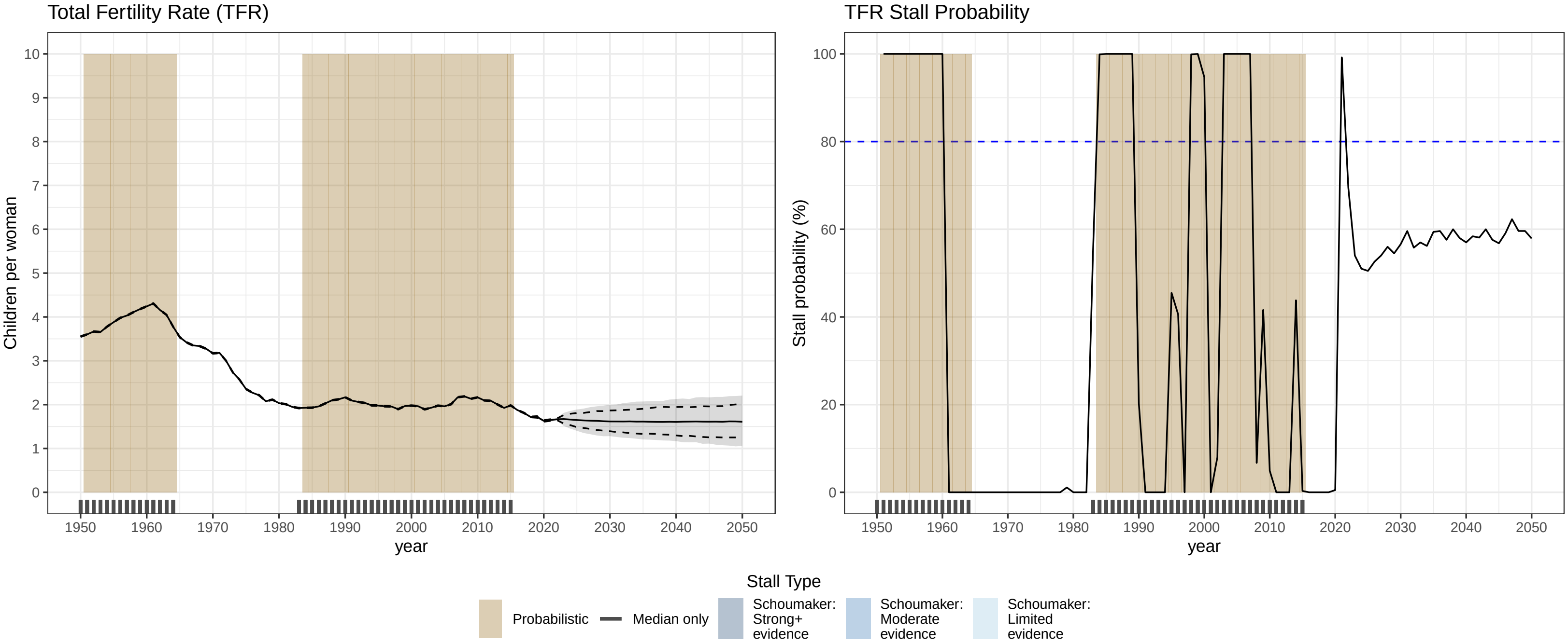
United States of America ()



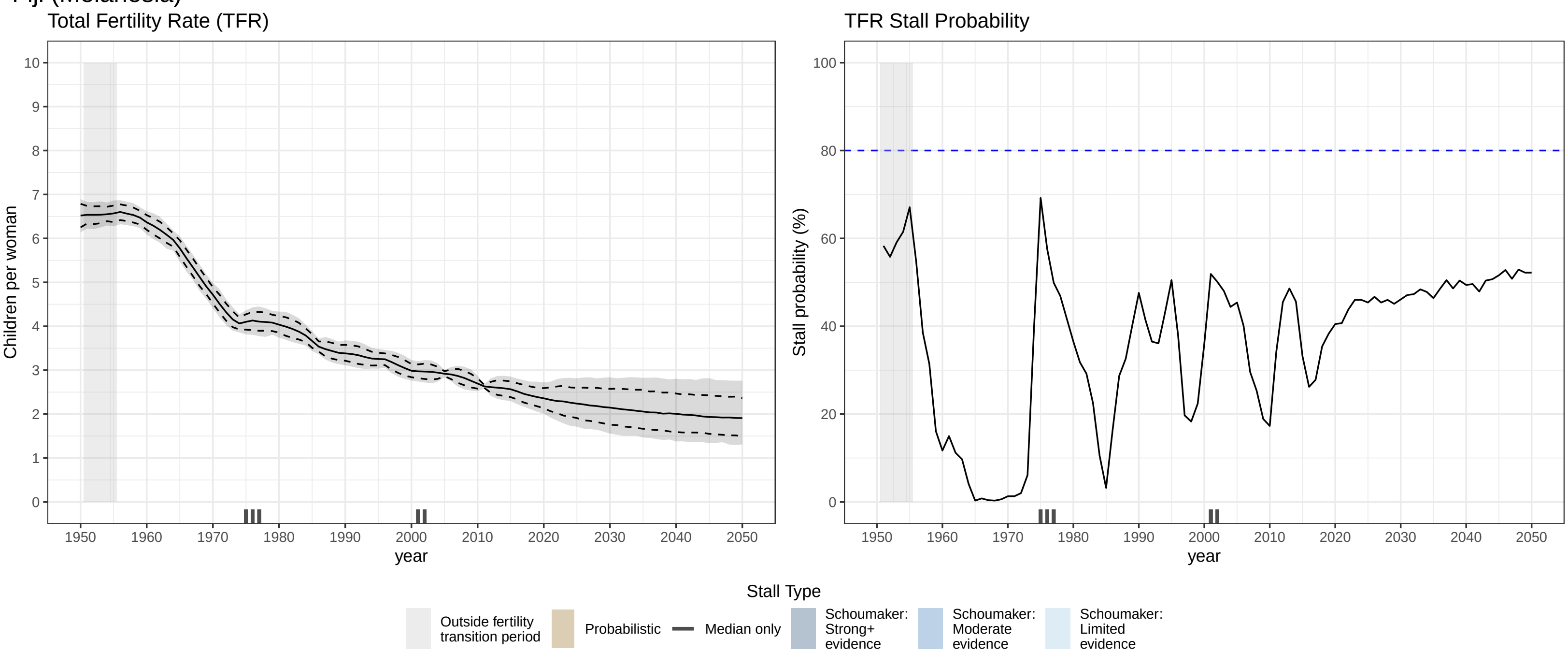
Australia (Australia/New Zealand)



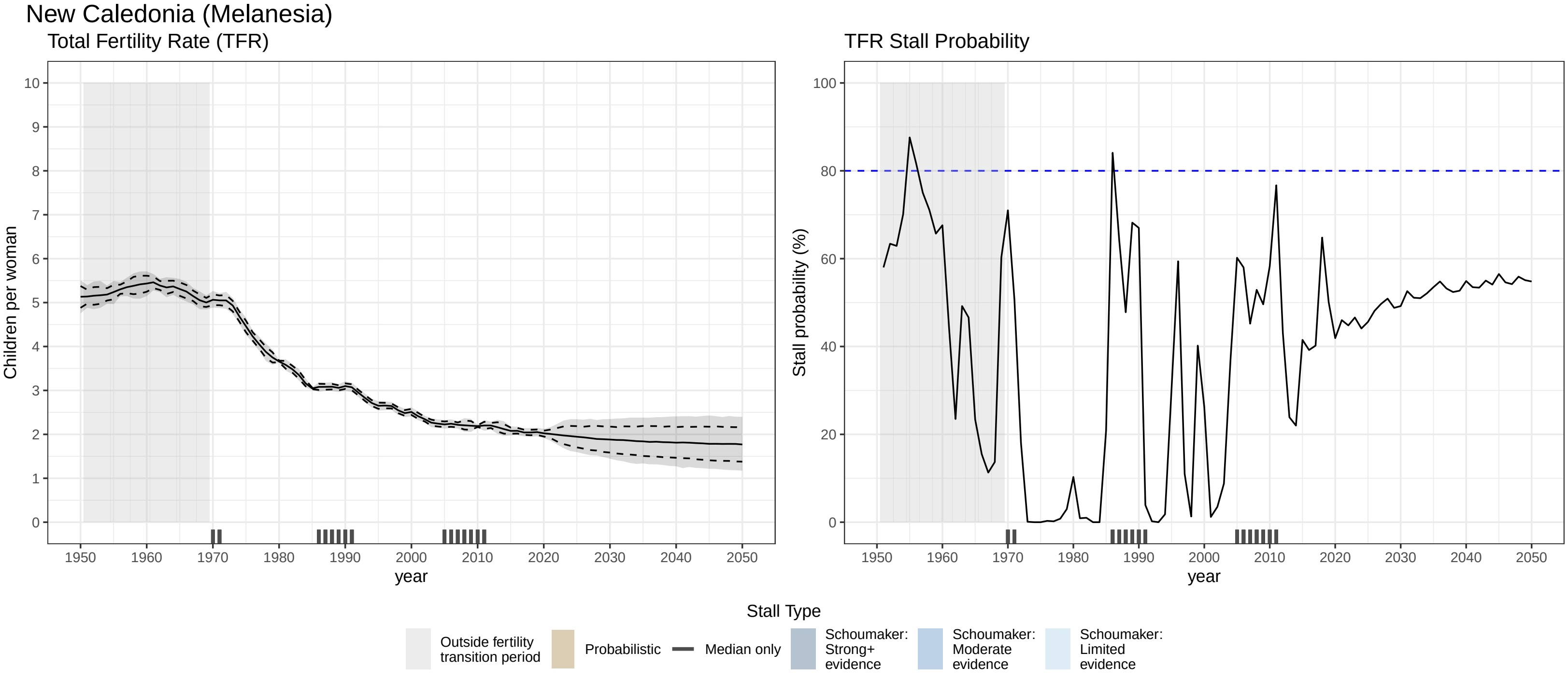
New Zealand (Australia/New Zealand)



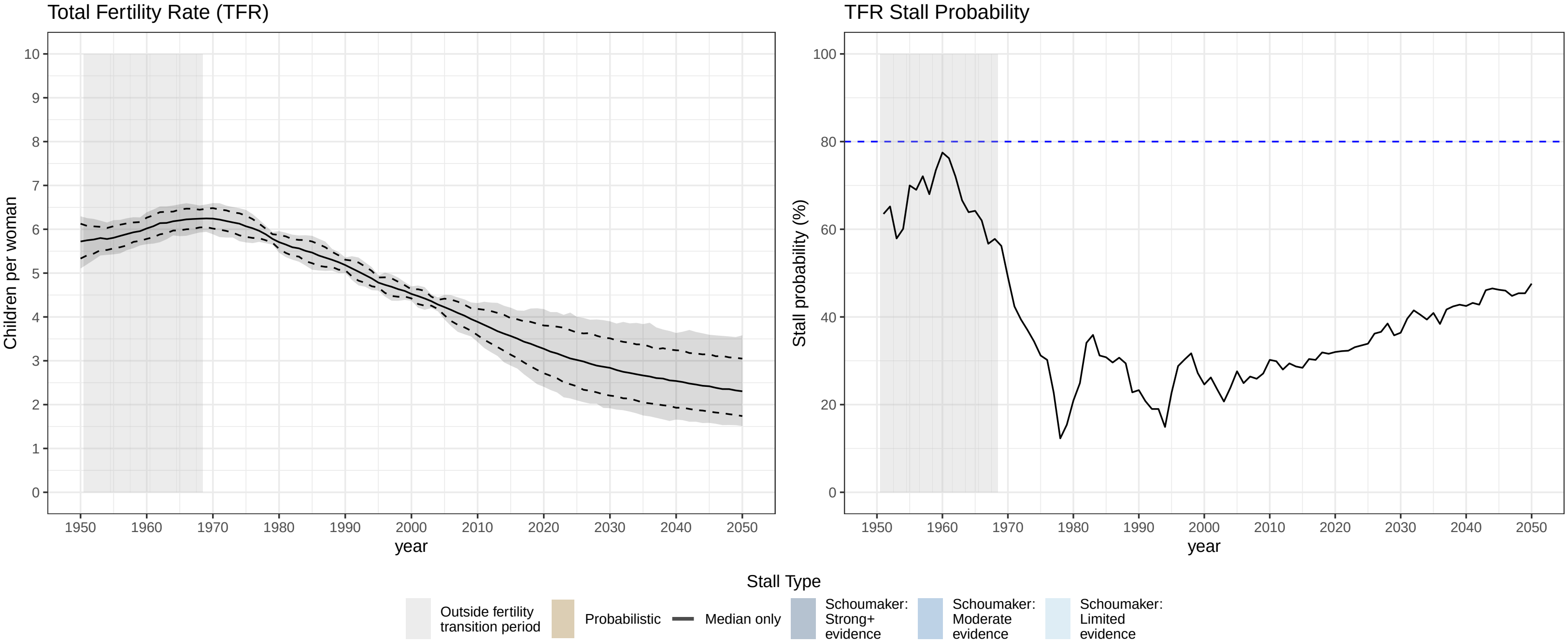
Fiji (Melanesia)



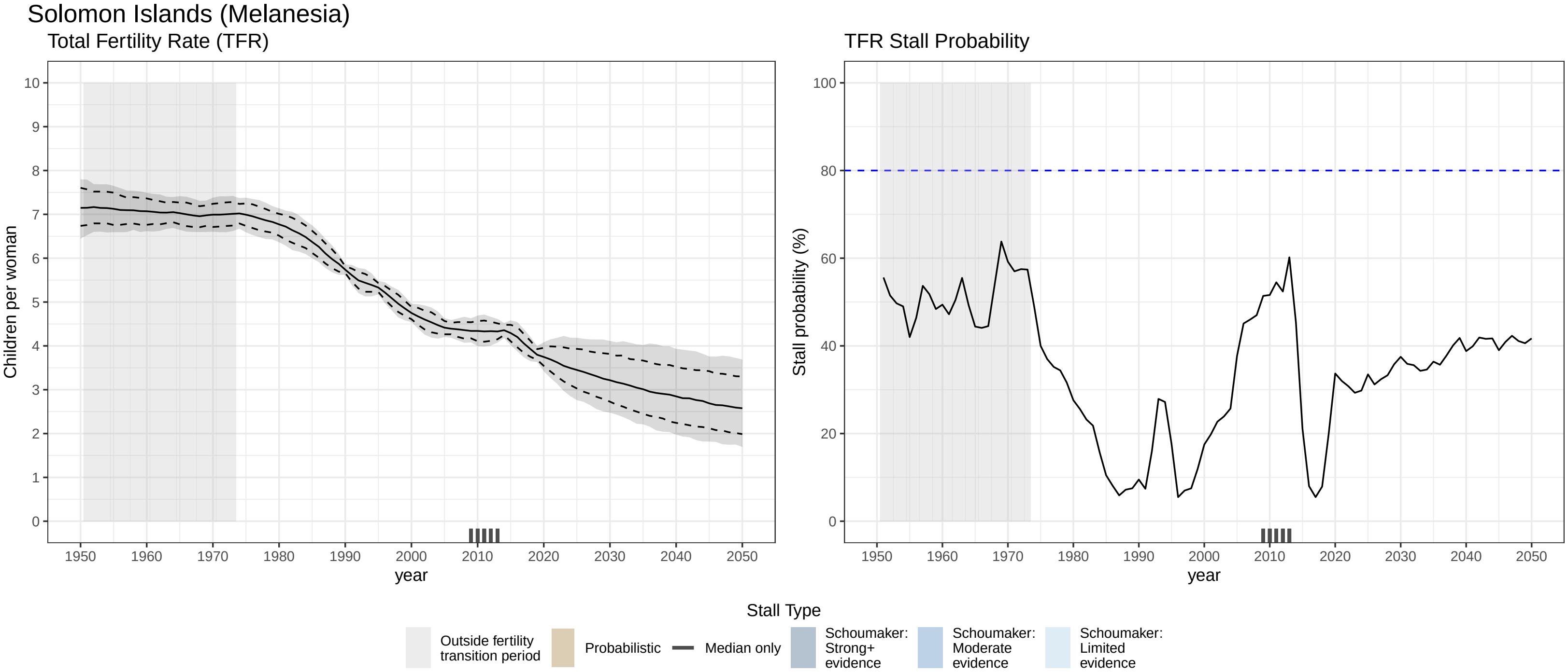
New Caledonia (Melanesia)



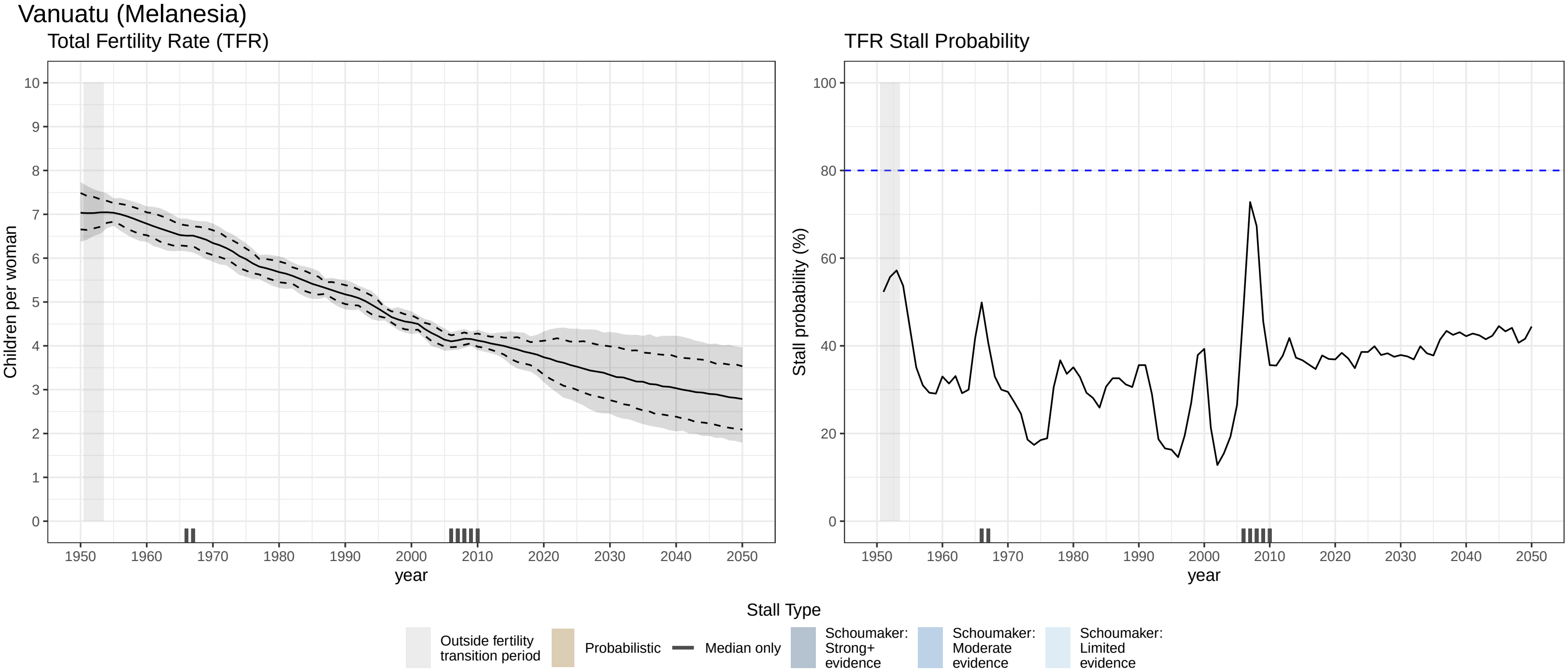
Papua New Guinea (Melanesia)

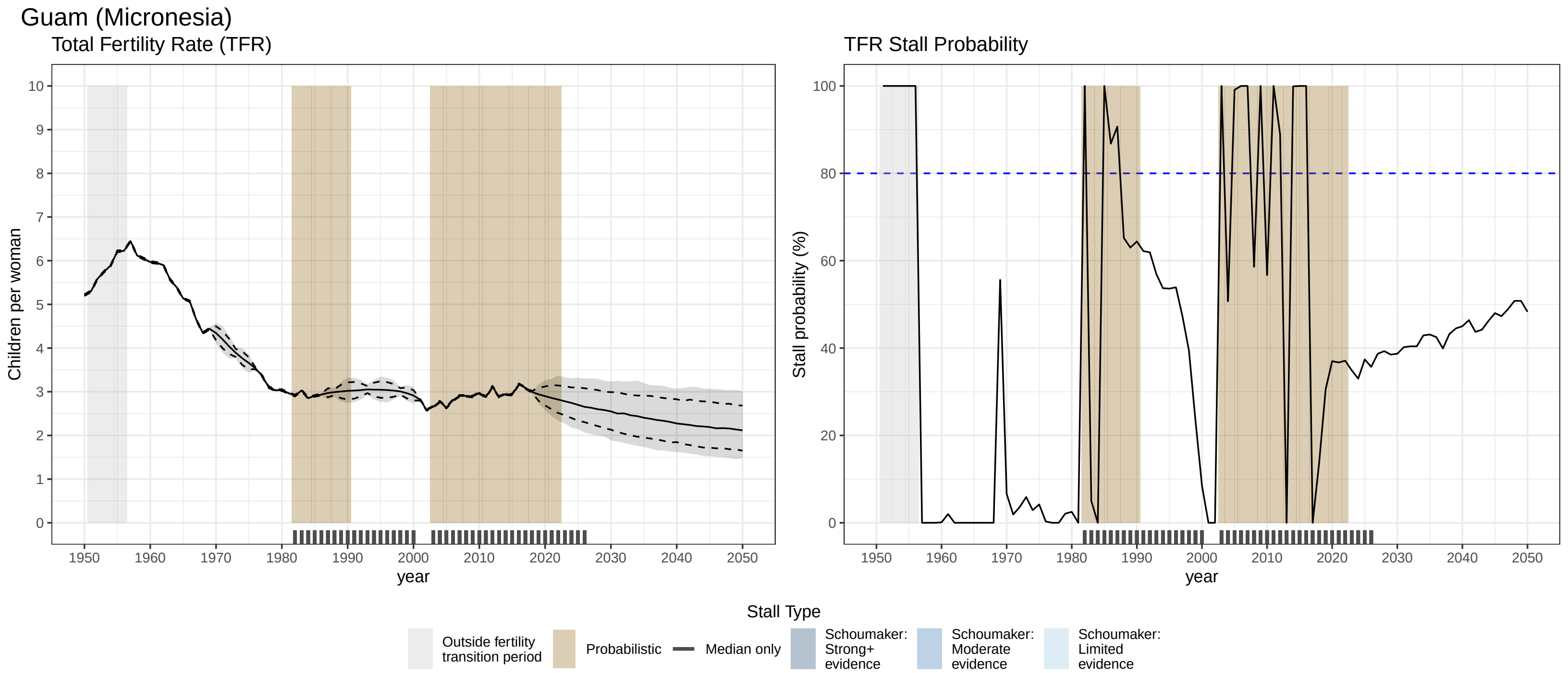


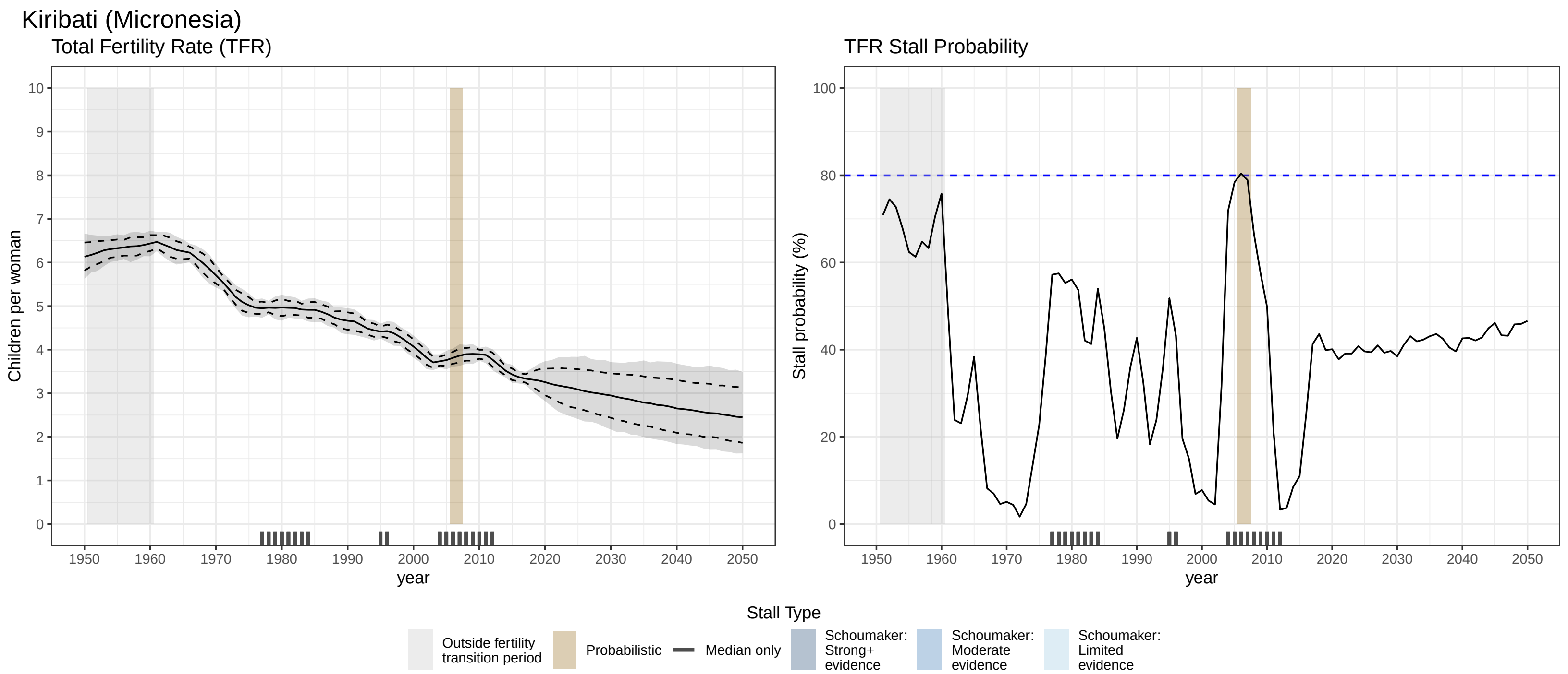
Solomon Islands (Melanesia)

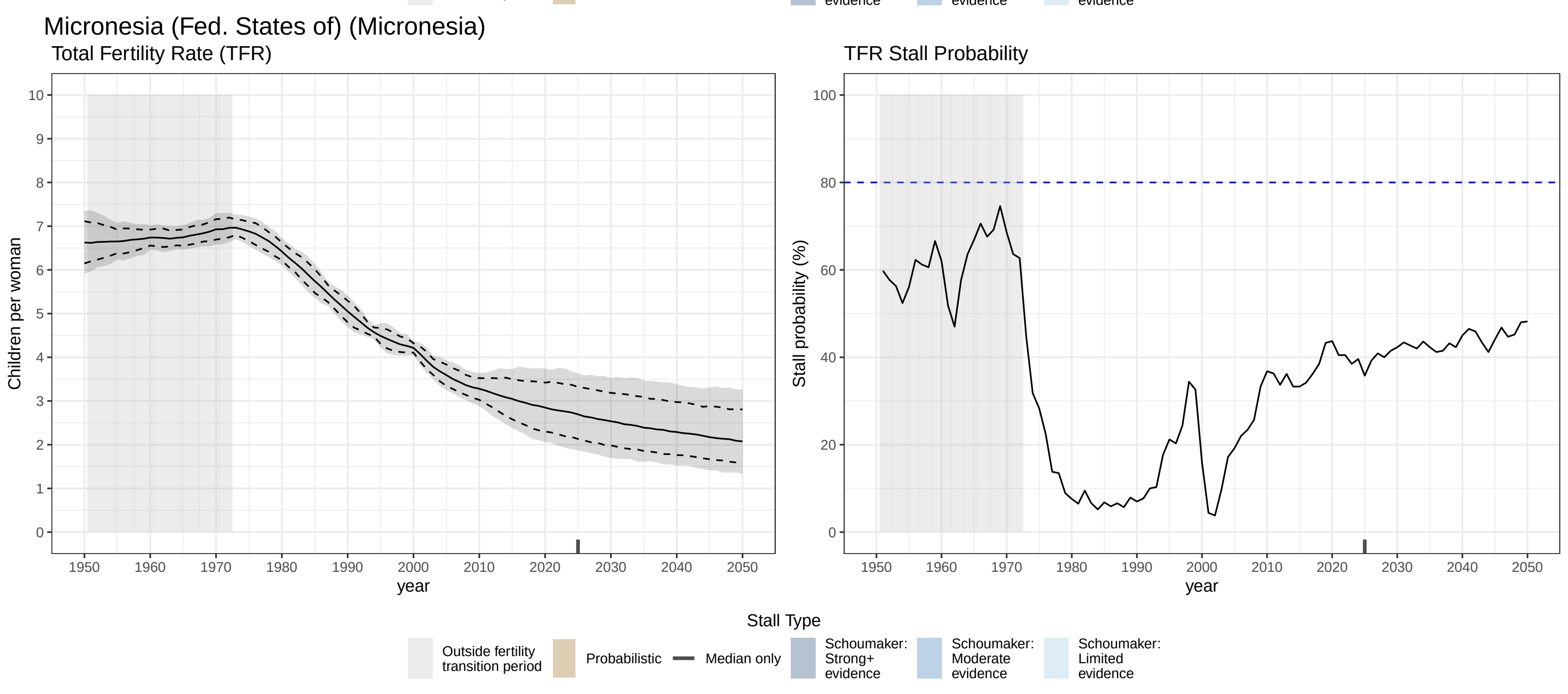


Vanuatu (Melanesia)

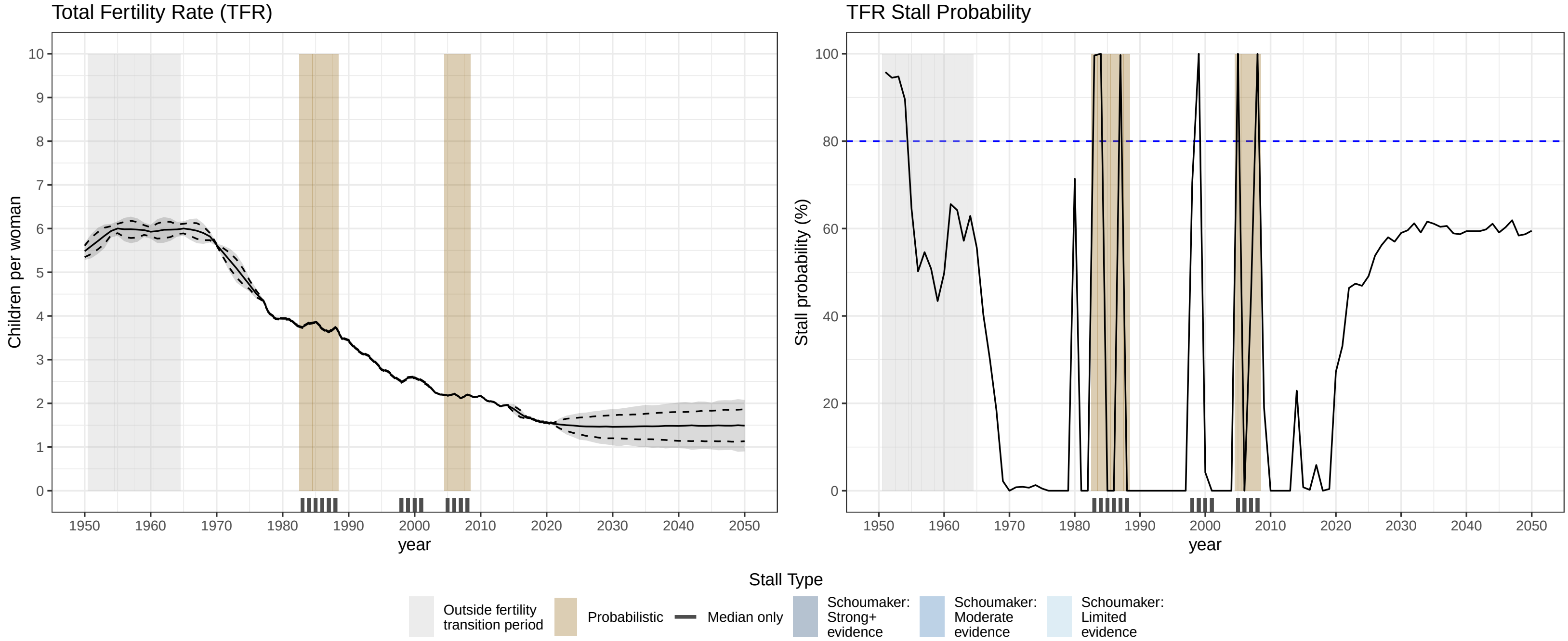



Guam (Micronesia)
Total Fertility Rate (TFR)
Children per woman
year
TFR Stall Probability
Stall probability (%)
year
Stall Type
Outside fertility transition period
Probabilistic
Median only
Schoumaker: Strong+ evidence
Schoumaker: Moderate evidence
Schoumaker: Limited evidence

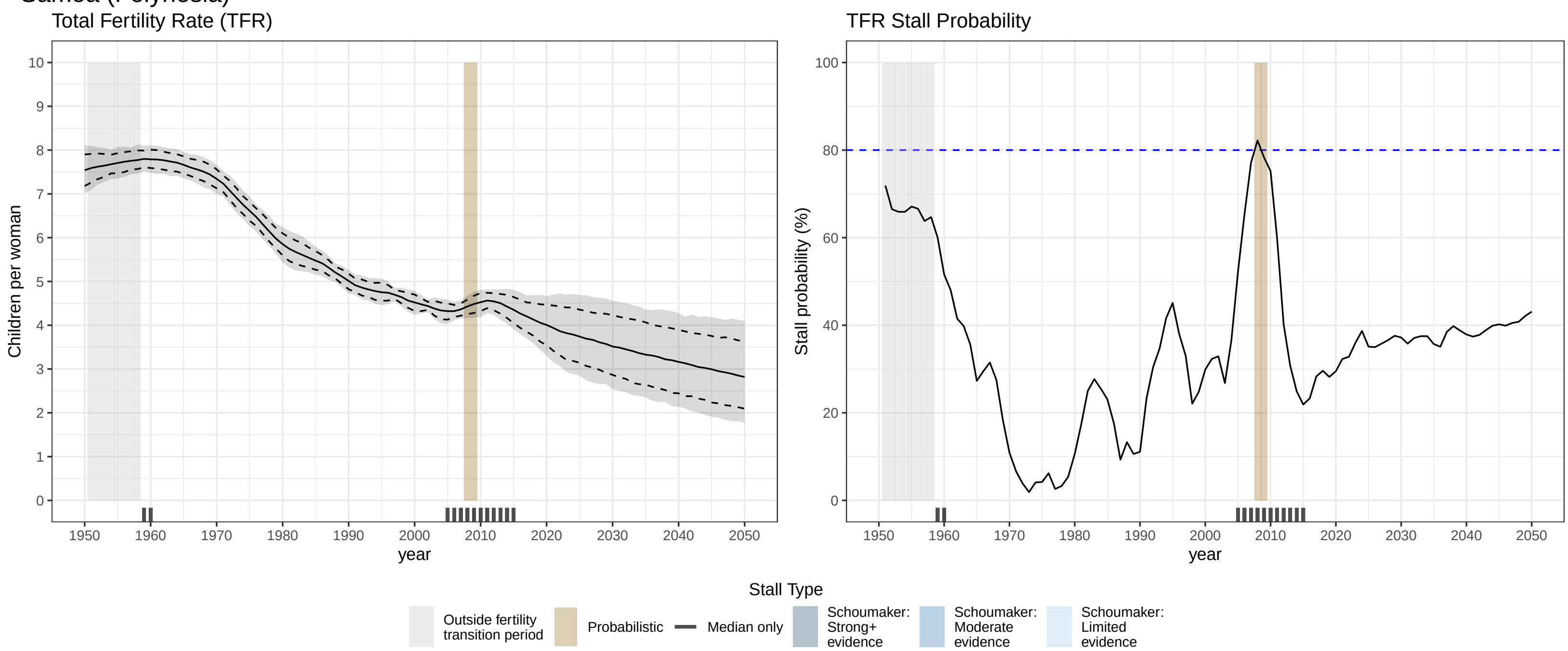

Kiribati (Micronesia)
Total Fertility Rate (TFR)
Children per woman
year
TFR Stall Probability
Stall probability (%)
year
Stall Type
Outside fertility transition period
Probabilistic
Median only
Schoumaker: Strong+ evidence
Schoumaker: Moderate evidence
Schoumaker: Limited evidence


Micronesia (Fed. States of) (Micronesia)
Total Fertility Rate (TFR)
Children per woman
year
TFR Stall Probability
Stall probability (%)
year
Stall Type
Outside fertility transition period
Probabilistic
Median only
Schoumaker: Strong+ evidence
Schoumaker: Moderate evidence
Schoumaker: Limited evidence

French Polynesia (Polynesia)



Samoa (Polynesia)



Tonga (Polynesia)