

Forecasting welfare gains from biosimilar entry in the U.S. basal insulin market

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Key Takeaways

- **Intensive Margin:** The *first* biosimilar basal insulin entry can reduce the mean net price between 2020 and 2030 by **7.26%**. The *first two* biosimilar basal insulin entries can reduce the mean net price by **12.51%** by 2030.
- **Extensive Margin:** **0.83 million** more patient-years of treatment could result from the *first* biosimilar basal insulin entry between 2020 and 2030. **1.49 million** more patient-years of treatment could result from the *first two* biosimilar basal insulin entries between 2020 and 2030.
- **Budget impact:** The *first* biosimilar basal insulin entry can save **\$1.44 billion** between 2020 and 2030. The *first two* biosimilar basal insulin entries can save **\$2.50 billion** between 2020 and 2030.
- **Cost savings** for existing patients: The *first* biosimilar basal insulin entry can save existing patients **\$2.01 billion** between 2020 and 2030. The *first two* biosimilar basal insulin entries can save existing patients **\$3.45 billion** between 2020 and 2030.

Objectives

The emergence of biosimilar products has resulted in hopes of significant cost savings on biologic therapies. While previous work has analyzed generic competition in small molecule products, there is limited empirical knowledge of the impact of biosimilar entry on the extensive margin (utilization of drugs) as well as the intensive margin (impact on unit prices). We studied select measures of welfare gains from biosimilar entry in the basal insulin market in the United States.

Methods

We implemented a **nested logit discrete-choice Bertrand oligopoly model** to quantify the welfare gains from biosimilar entry in the U.S. basal insulin market. We draw market-level data on net annual sales and net treatment costs from the **SSR Health US Brand Rx Net Pricing Tool**. More specifically, net sales and net prices data of products in the long-acting insulin SSR class between 2017 and 2020 are used as input in our model. We leverage the SSR Net Pricing Tool to analyze average treatment costs of reference biologics in the wake of biosimilar entry. We assume that each product is a separate firm that maximizes the profit of this 1 product. The profit maximization problem of firm j is as follows. (eq (8) of (Berry 1994))

$$\max_{p_{jt}^m} (p_{jt}^m - c_{jt}) \cdot M_t \cdot s_{jt}(p_{k \in \mathcal{J}}^c, \alpha) - F_{jt} \quad (1)$$

Solving this maximization problem yields the first order condition (equation (33) of (Berry 1994)):

$$[p_{jt}^m]: p_{jt}^m = c_{jt} + \left[\frac{1 - \sigma}{\alpha} / [1 - \sigma \bar{s}_{j/g,t} - (1 - \sigma) s_{jt}] \right] \quad (2)$$

The Nash equilibrium is used sequentially in our paper. We first use it to recover intrinsic utility and marginal cost parameters, taking market shares and net prices data between 2017 and 2020 as input. We then use it a second time to make out-of-sample counterfactual forecasts of market shares and net prices up to 2030, taking the previously estimated intrinsic utility and marginal cost parameters as input.

Results

Counterfactual Out-of-sample Predictions

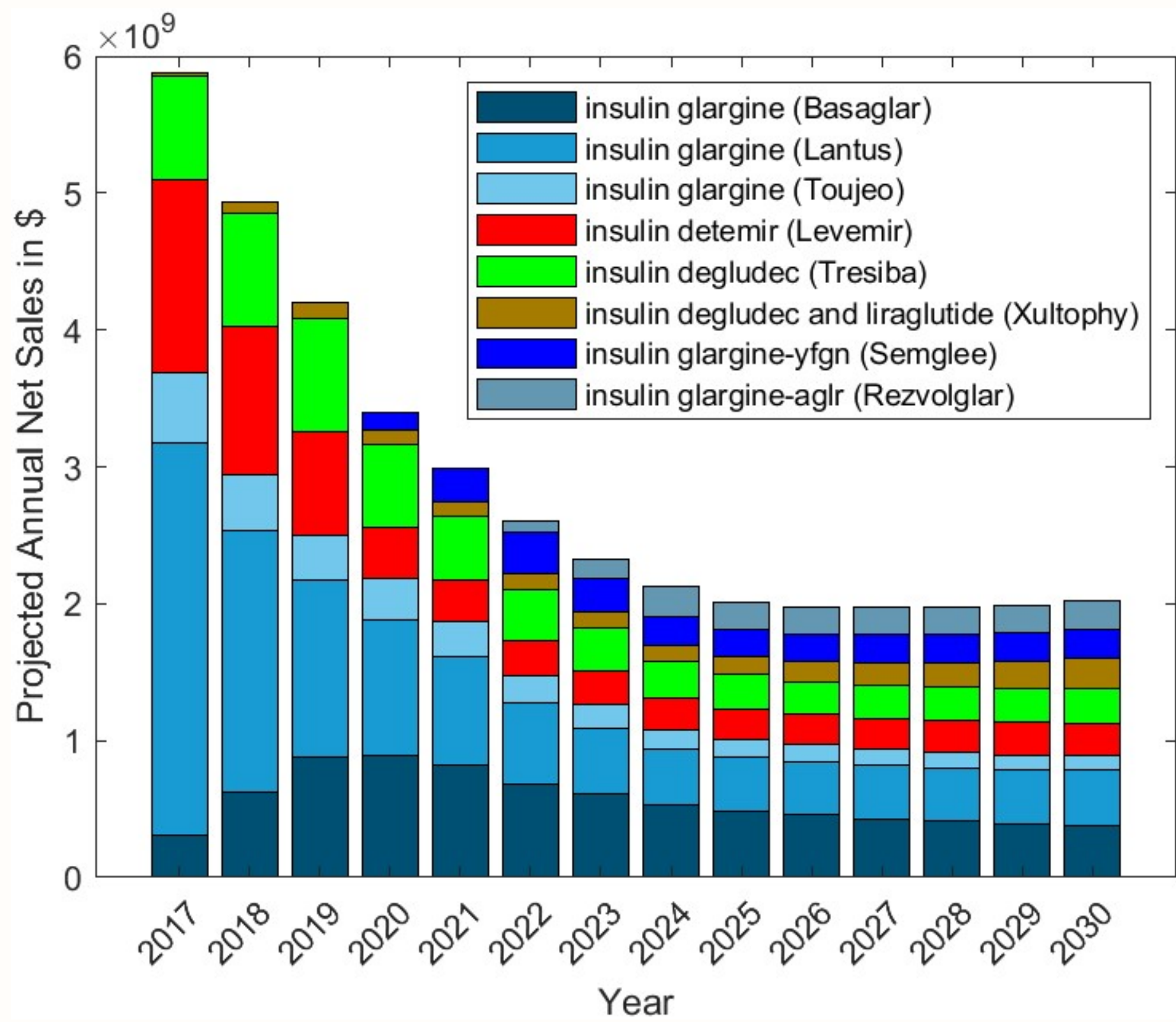


Figure 1: Historical and Projected Annual Net Sales in \$

Notes: Data between 2017 and 2019 are historical data. Data starting from 2020 are projected by the model.

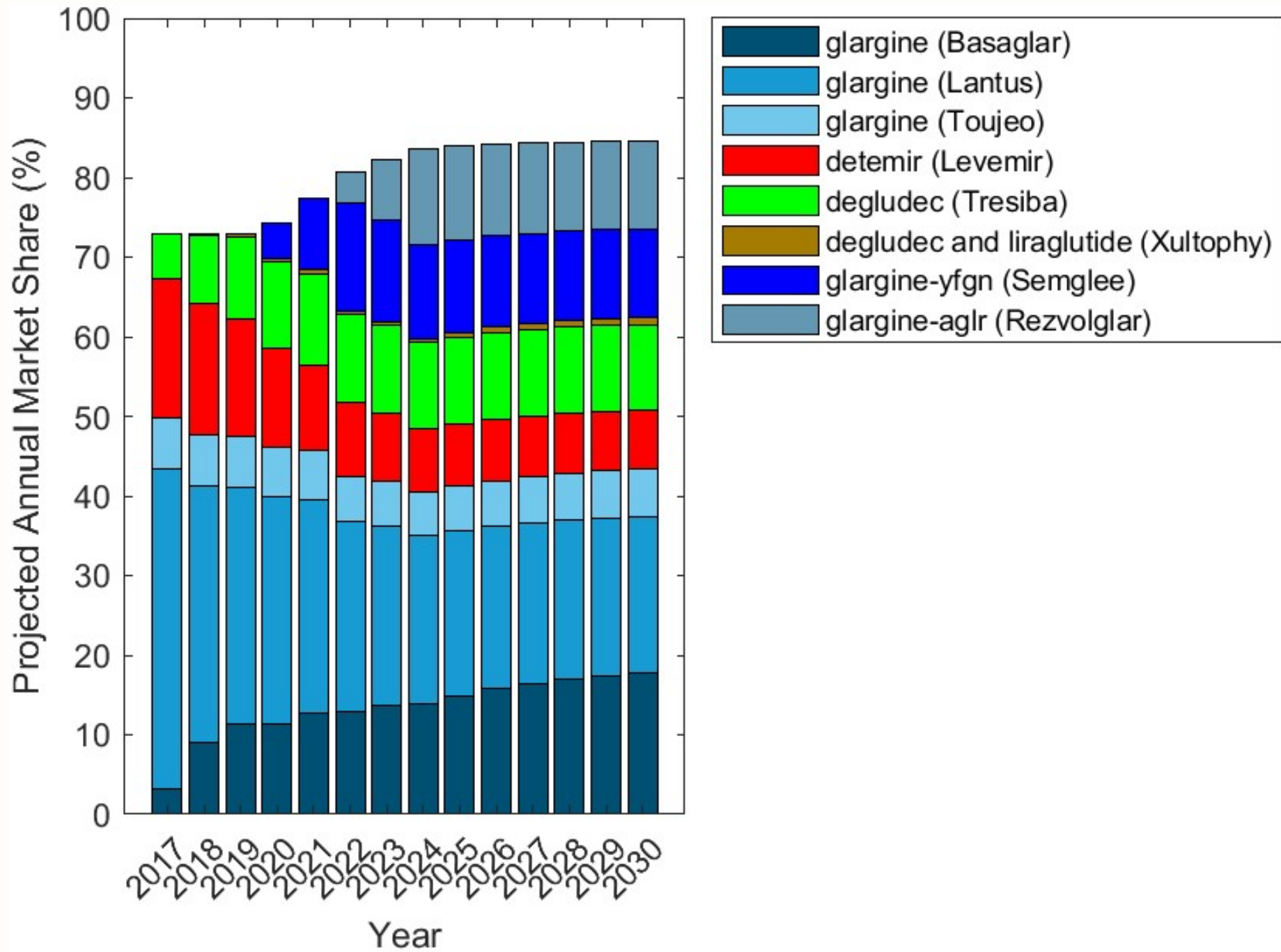


Figure 2: Historical and Projected Annual Market Share (%)

Notes: Data between 2017 and 2019 are historical data. Data starting from 2020 are projected by the model.

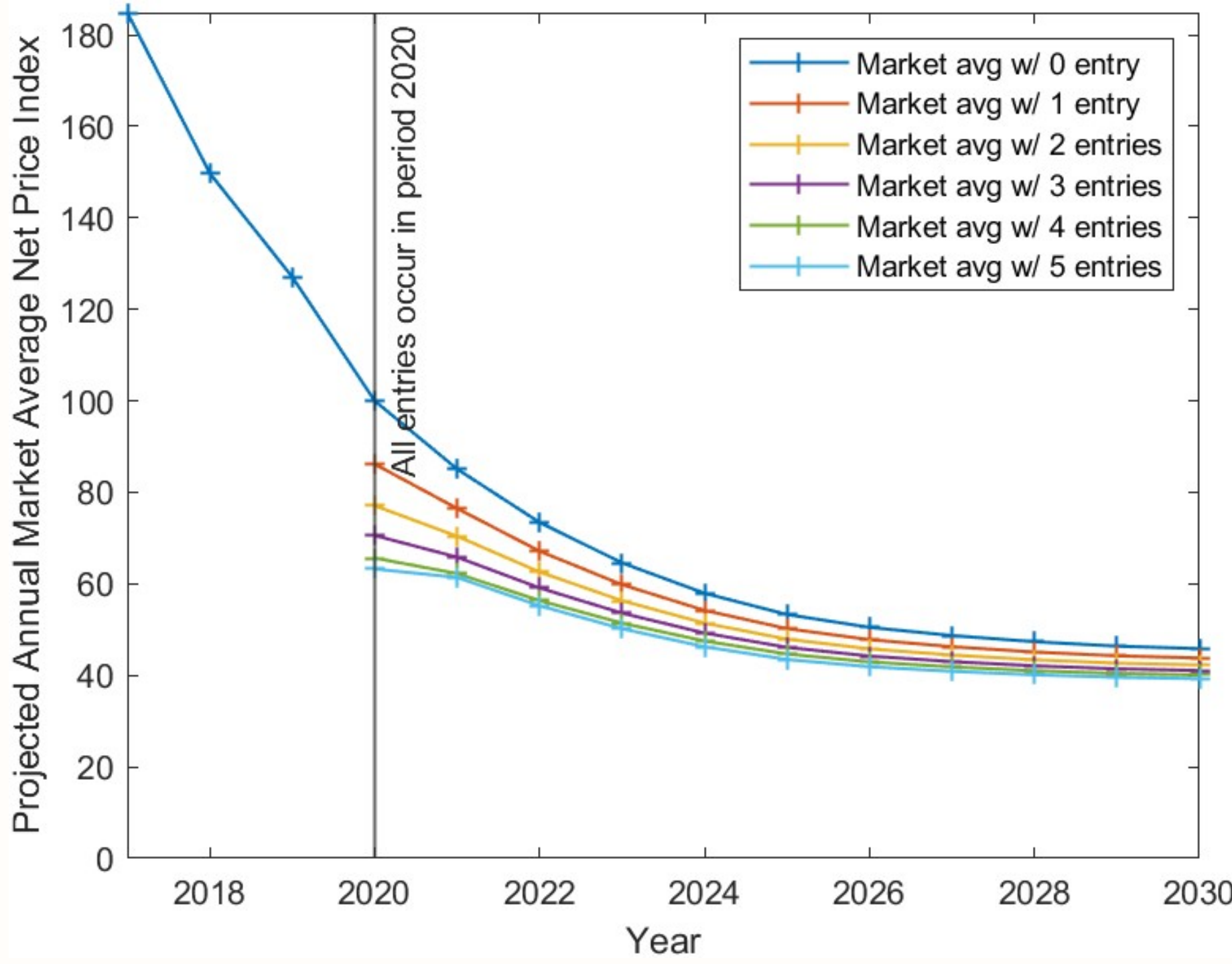


Figure 3: Historical and Projected Annual Market Average net price level

Notes: Data between 2017 and 2019 are historical data. Data starting from 2020 are projected by the model.

The price index is normalized relative to the no-entry scenario in 2020 (shown as 100).

Definition of select welfare measures

- 1 The **intensive margin** measures the **annual treatment cost savings**. This is the percentage difference between the expected average price index of both the biosimilar(s) and the existing products following biosimilar entry and the expected average price index of the existing products in the status-quo scenario.
- 2 The **extensive margin** measures **utilization gains**, in other words, the additional number of patients treated.
- 3 The **budget impact** measures the **gross reduction in total costs**. This is the **difference between the expected total costs** of both the biosimilar(s) and the existing products **following biosimilar entry** and the expected total costs of the existing products in the **status-quo** scenario. The budget impact can be decomposed into 2 parts:
 - 1 Additional costs as more patients are treated after biosimilar entry;
 - 2 Cost savings for existing patients.

Select welfare measure results

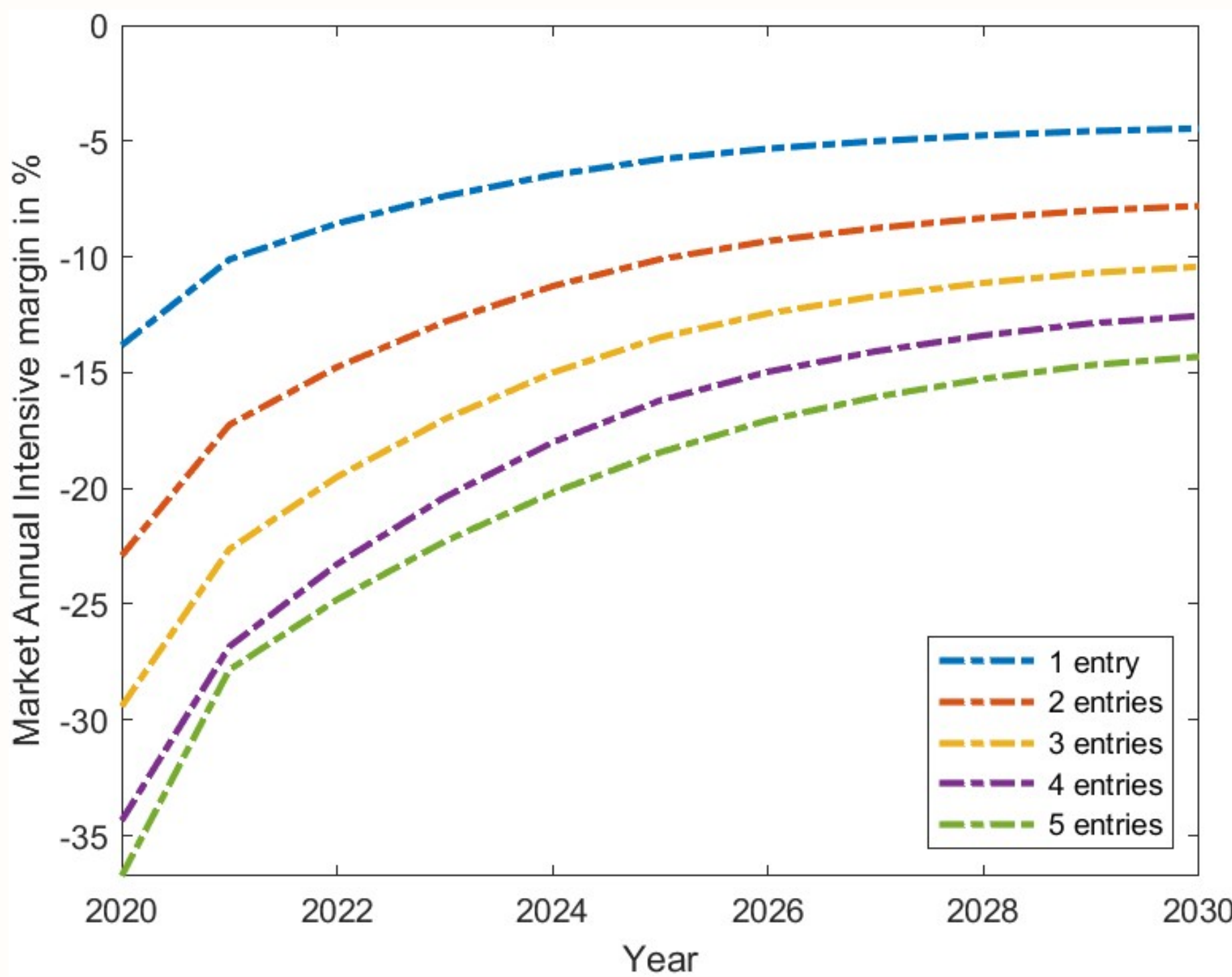


Figure 4: Intensive Margin Relative To No Entry Each Year

The market-level mean intensive margin due to 1, 2, 3, 4, and 5 entries, respectively, is estimated to be 7.26%, 12.51%, 16.52%, 19.71%, and 21.58%, respectively, over the period of 2020 to 2030. Similarly, the glargine-level average intensive margin from 1, 2, 3, 4, and 5 entries between 2020 and 2030 is estimated to be 9.48%, 15.81%, 20.36%, 23.79%, and 25.53%. The reason why the glargine-level intensive margin is higher than the market-level intensive margin is that the biosimilar products of insulin

glargine (Lantus) compete more directly with other insulin glargine products than with other non-glargine insulin products.

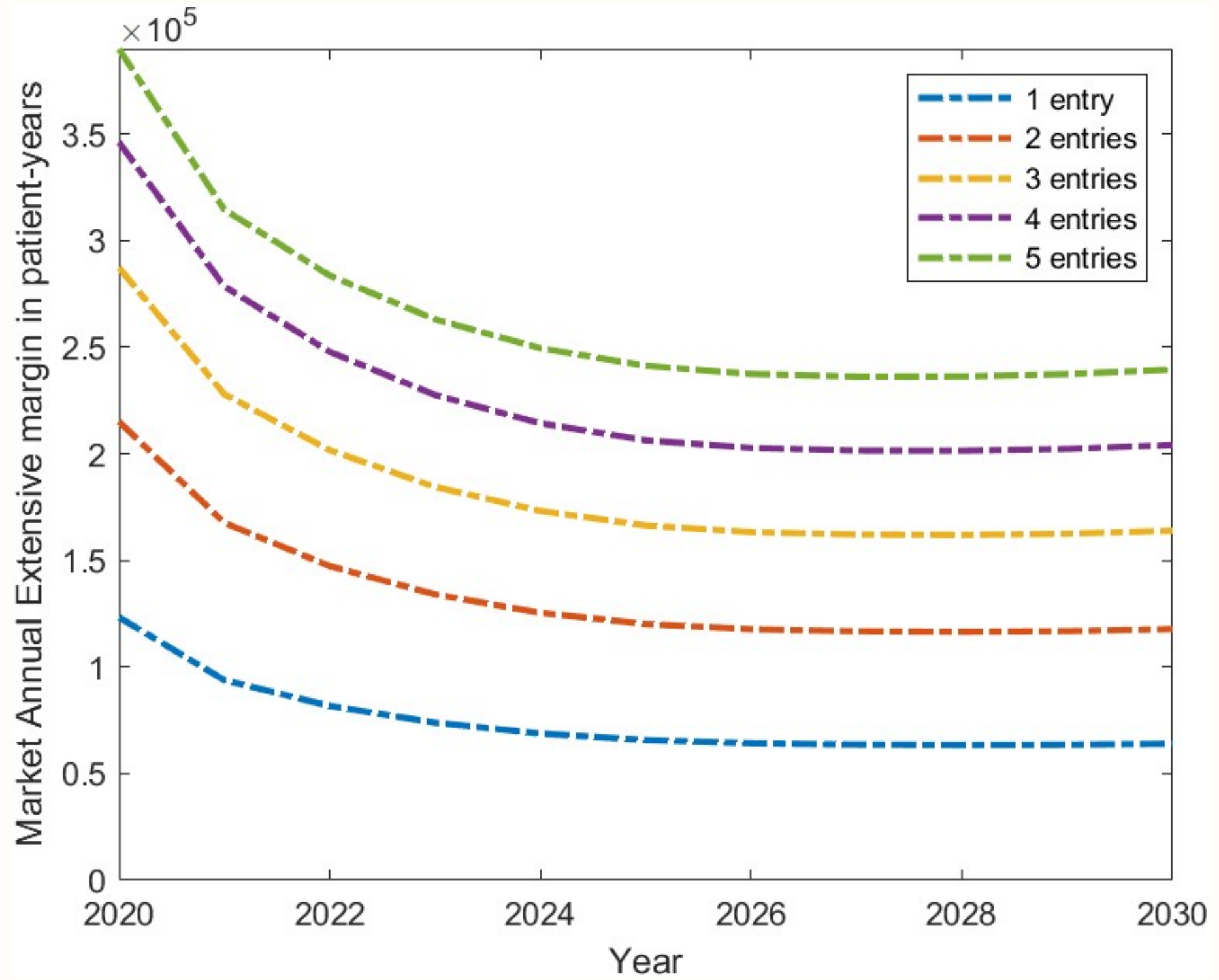


Figure 5: Extensive Margin Relative To No Entry Each Year

The market-level cumulative extensive margin from 1, 2, 3, 4, and 5 entries is estimated to be 0.83, 1.49, 2.05, 2.53, and 2.93 million patient-years, respectively, over the period of 2020 to 2030. Similarly, the glargine-level cumulative extensive margin from 1, 2, 3, 4, and 5 entries is estimated to be 1.73, 3.13, 4.31, 5.32, and 6.16 million patient-years over the period of 2020 to 2030. In our model, the extensive margin at the long-acting insulin level is composed of patient who would otherwise take an outside option. At the glargine product level, however, this may include patients who previously took an outside option and those who took non-glargine insulin products and subsequently switched to insulin glargine products. This results in a higher glargine-level extensive margin than the market-level extensive margin in any given year.

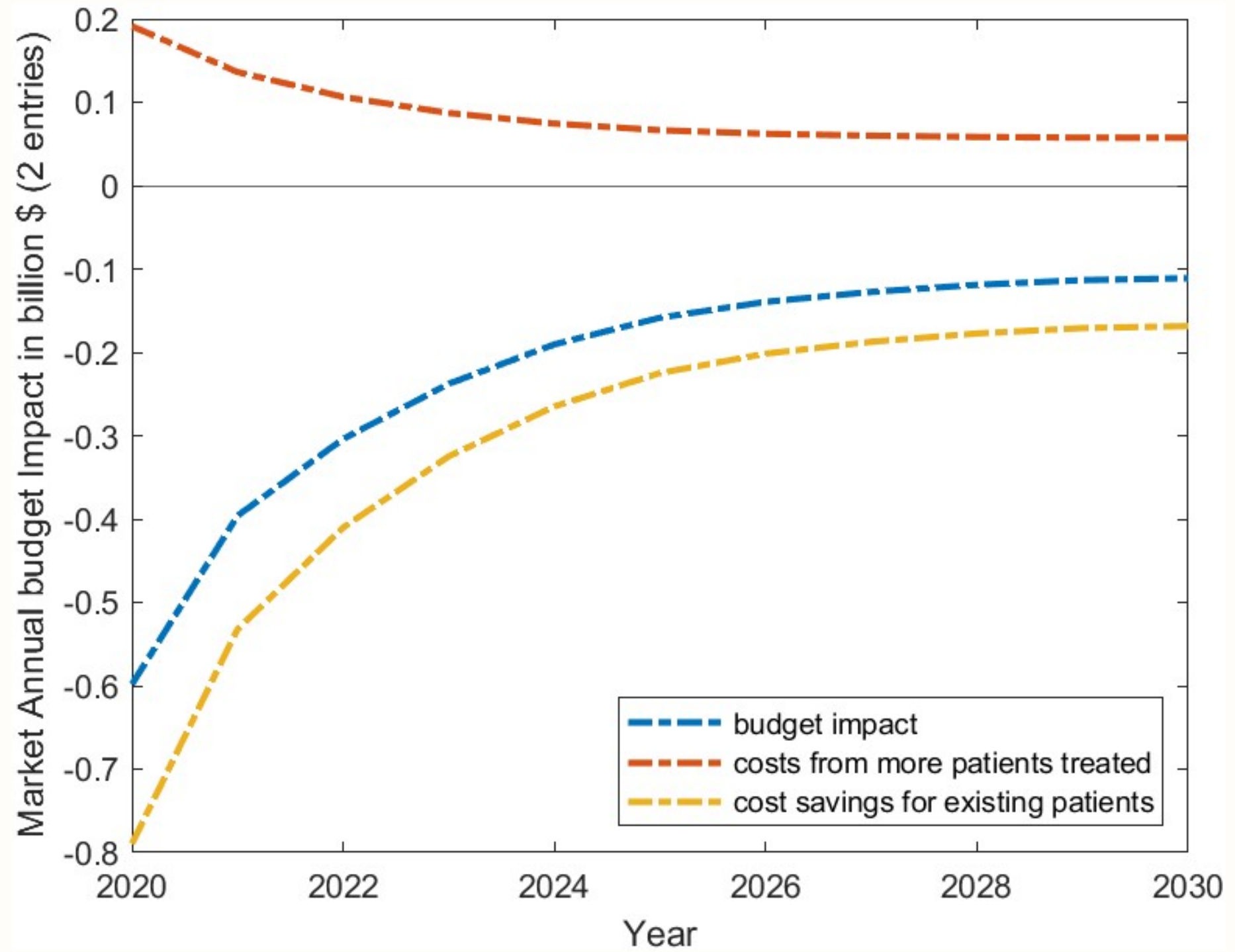


Figure 6: Annual Budget Impact in billion \$ (2 entries)

In our baseline scenario, two biosimilar entries were modeled. Their first-year budget impact on the entire basal insulin market represents a saving of nearly \$0.6 billion. This is a result of an increase in spending (extensive margin) and the cost saving for existing patients (intensive margin). Over time, the budget impact becomes less pronounced as both the extensive and intensive margins decrease. The cumulative savings, however, increase and depend on the number of entries modeled.

Limitations

- 1 We abstract from complex bargaining dynamics on the biosimilar market, which involves pharmacy benefit managers (PBMs), wholesalers and includes rebates and other pricing distortions.
- 2 Physician prescription behaviors and insurance coverage policies are not explicitly modeled. The model implicitly assumes that physicians and insurance companies are perfect agents acting in the best interests of patients.
- 3 When calculating these welfare measures, a countless combination of market entry times and interchangeability status designations could be modeled. For simplicity, we assume that any biosimilar products enter simultaneously in 2020 Q3 and are not upgraded with an interchangeability status over time.

Conclusions

Our model predicts that biosimilar entries can **reduce prices, increase utilization, and save costs** in the basal insulin market. Biosimilar entry in the long-acting insulin market can result in **\$1.44 billion in total savings** between 2020-2030 in the case of the first biosimilar entry, and **\$2.50 billion** in the case of the first two biosimilar entries. Our work also shows the magnitude of the expected **benefit of additional competition** in the insulin market resulting from biosimilar entry. The marginal effect of each additional biosimilar entry is **lower** than the previous one.