CP-violating phases; these would manifest themselves as apparent inconsistencies among different measurements of quantities which should be identical within the standard CKM picture. Thus a precise determination of the ratio ξ will help to constrain physics beyond the Standard Model. Furthermore, possible indications of new physics in B_d^0-mixing at the $\sim$2.7-σ level [13] make the lattice calculation of B-meson mixing parameters timely.

Recently, the HPQCD Collaboration published the first unquenched determination of ξ with an accuracy of 2.6% [14], and the Fermilab Lattice and MILC Collaborations expect to have a result with similar errors soon [15]. The HPQCD calculation employs a nonrelativistic QCD (NRQCD) action for the heavy b-quark [16], while the Fermilab/MILC calculation uses the relativistic "Fermilab" action for the b-quark [17]. Both of these computations, however, rely on the same "2+1" flavor asqtad-improved staggered ensembles generated by the MILC Collaboration [18], which include the effects of two degenerate light quarks and one heavier close-to-strange quark in the sea sector.

For such a phenomenologically important quantity as ξ, it is valuable to have an independent crosscheck using different formulations of the lattice action for both the light and heavy quarks. Our calculation employs the 2+1 flavor dynamical domain-wall ensembles generated by the RBC and UKQCD Collaborations with a lattice spacing of $a \approx 0.11$ fm ($a^{-1} = 1.729$ GeV) [19]. The use of domain-wall fermions [20–22] has the advantage over other light-quark formulations that the chiral perturbation theory expressions needed to extrapolate domain-wall lattice results to the physical u- and d-quark masses are closer to the continuum forms and have fewer parameters than in the Wilson or staggered cases [23, 24]. We compute the b-quarks in the static limit ($m_b \to \infty$), which leads to correlation functions that are noisier than those with propagating b-quarks such as in the Fermilab [17] or NRQCD actions [16]. We therefore use the static-quark formulation of Refs. [25, 26] with either APE [27, 28] or HYP [29] smearing of the static-quark gauge links to increase the signal-to-noise ratio and reduce scaling violations (for some quantities) as compared to the Eichten-Hill action [30]. Furthermore, the approximate chiral symmetry of the domain-wall action combined with the spin symmetry of the static action simplifies the lattice-to-continuum operator matching as compared to the Wilson case by reducing the number of additional lattice operators which appear [31, 32]. The results of this work extend an earlier study with two flavors of dynamical quarks and heavier light-quark masses in Ref. [33].

The primary purpose of this paper is to demonstrate the viability of our method for