PAUL BREWBAKER DIRECT TESTIMONY

PRESENTATION HEARING

Land Block 5, Project 3 (The Launiu) (KAK 23-001)

Q Please state your name, place of employment, and position.

A Paul Brewbaker, Economist and Principal, TZ Economics.

Q What types of services does TZ Economics provide?

A TZ Economics is a Hawaii consultancy doing development impact analysis and other private sector economic research and analysis.

Q Please describe your educational background and professional experience.

A My resume is attached as an exhibit in this proceeding. My private sector background is in research on the Hawaii economy and financial risk analytics at Bank of Hawaii from 1981-2009, as a consultant and a commercial bank economist. I was also a university lecturer from 1980-2017. I am a graduate of Stanford, did graduate work at Wisconsin, and I received my PhD from the University of Hawaii, all in economics.

Q What has your firm been retained to do for this project, The Launiu (Block A)?

A Victoria Ward, Ltd. requested that I provide an analysis and conclusions regarding The Launiu's economic impacts and benefits in the current economic environment. My analysis and conclusions are contained in a report dated March 24, 2023, which is attached as an exhibit in this proceeding, and summarized below.

Q Why are the Project's economic contributions important?

A The Launiu will deliver approximately 486 homes, including 141 studios, 137 one-bedroom units, 143 two-bedroom units, and 65 three-bedroom units; over 21,000 square feet of ground floor commercial space; nearly 16,000 square feet of on- and off-site ground level open space; and over 78,000 square feet of indoor and outdoor recreational areas.

The addition of new condo units in Kaka'ako continues to be a welcome relief, especially given the continuing low inventory of housing. In addition, with Ulana Ward Village (KAK 21-001; Land Block 5, Project 2), VWL has already committed to providing all reserved housing units to satisfy the remaining reserved housing requirements for Ward Village, including the reserved housing for The Launiu, rather than in piecemeal fashion in future market rate projects. The upfront delivery of reserved housing provides

significant public and economic benefits to the community, particularly as housing demand continues to outpace supply, and current housing demand estimates underestimate true demand. In a 2019 study on housing demand in Hawai'i,[1] DBEDT estimated a need for at least another 25,000 housing units over the next 10 years to meet demand, and as many as 47,000, based on an assumed average of three persons occupying each housing unit.

Based on data indicating a significant increase in independent living, *i.e.*, fewer persons occupying each housing unit, I estimate that another 100,000 units are needed in addition to the nearly 50,000 units estimated by DBEDT. Over time, population lifestyle norms have shifted. In 1920, there were 5.5 people per housing unit, but by 1960 that number decreased to 3.3 people per housing unit. Today, that number is 2.9 people per housing unit.

In addition to providing additional housing units, the development will materially contribute to Hawaii's Covid-19 economic recovery and sustain post-recovery growth. Hawaii entered recovery in 2020 from the lowest position among the fifty U.S. states relative to its own peak at end-2020. Post-pandemic economic recovery has not been uniform (monotonic) but uneven. This underscores the significance of the economic benefits from The Launiu development.

Q Please describe your analysis and conclusions.

A The Launiu will have a direct, continuing, and unbroken positive impact on the State of Hawaii and City and County of Honolulu economy. Using the State of Hawaii's input-output model,[2] estimated multi-year development impacts of The Launiu project, in present values of constant 2022 dollars from 2022-2028 are:

- $691 million in output.
- $233.4 million in workers' earnings.
- $42.4 million in state tax revenue (income, GET, and other).
- An annual average of 565 jobs over eight years, peaking at 967 jobs in year two of construction (2025).

[1] https://files.hawaii.gov/dbedt/economic/reports/housing-demand-2019.pdf

[2] https://files.hawaii.gov/dbedt/economic/reports/IO/2017_state_io_study.pdf

Over 30-year period beginning in 2028 in present values of constant 2022 dollars:

- The Launiu's operations and maintenance will generate $189.2 million in future output, $62.7 million in earnings, $11.4 million in state tax revenues (income, GET, and other), and an annual average of 22 jobs. These estimates are included at p. 23 of the PDP Application for The Launiu.

- The Launiu will accrue $123.4 million in future county residential property tax revenues. This estimate is included at p. 23 of the PDP Application for The Launiu.

Over a 50-year period, The Launiu will accrue $194.6 million in present-value real residential property taxes based on historical volatility of home price appreciation.

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Ward Village Block A Economic Impacts

prepared by
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606 Ululani St.
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for
The Howard Hughes Corporation
March 25, 2023

Ward Village Block A Economic Impacts

by Paul H. Brewbaker, TZ Economics[1]
March 25, 2023

Executive summary

Ward Village Block A redevelopment delivers 486 new condominium housing units across a wide range of value points in continuing fulfillment of Howard Hughes' master plan for Kakaako urban renewal. This report summarizes economic impacts of Block A redevelopment in present values of constant, 2022 dollars, documents substantial permanent economic impacts, and appends some notes on macroeconomic conditions.

- Block A redevelopment is associated with $691 million in direct, indirect, and induced (total) output, peaking in 2025, with construction ending in 2028.
- Block A redevelopment is associated with $233 million in total workers' earnings.
- Block A redevelopment is associated with $42 million in total state tax receipts.
- An annual average of 565 jobs are associated with Block A redevelopment, with a peak annual impact of 967 jobs in 2025.
- Over thirty years beginning in 2028, in present values of constant 2022 dollars, Block A operations and maintenance will generate $189 million in future output, $63 million in earnings, $11 million in state tax revenues, and an annual average 22 jobs.
- Over thirty years Block A will accrue $123 million in the present value of future real property tax revenues. Over fifty years Block A will accrue $195 million in present value of real residential property taxes.

[1] This report was prepared by Paul H. Brewbaker, Ph.D., CBE, Principal, TZ Economics of Kailua, Hawaii for The Howard Hughes Corporation, extending and updating *Ward Village Economic Impacts* ((December 2014) and subsequent reports related to the development master plan, under planning assumptions available from the developer and 2022 and they, and the resulting analyses, are subject to revision.

1. Block A Economic Impacts: Introduction

Estimates of statewide economic impacts of Block A development of 486 housing units in the master-planned Ward Village of Honolulu's Kakaako area are reported, using the State of Hawaii's input-output (I-O) economic model.[2] Through interindustry linkages, final expenditure on private investment activity—capital formation—is directly associated with a variety of other economic activities. Investment outlay also is associated *in*directly with economic activity through derived demand for intermediate goods and services that support production. Earnings associated with the jobs created by these activities induce personal consumption expenditures which have additional economic impacts. Quantitative estimates of direct, indirect, and induced effects comprise total economic impacts attributable to Block A redevelopment.

Some economic consequences of Block A redevelopment are not quantified in this report. These excluded are certain costs of entitlement acquisition necessary for building, state conveyance taxes not itemized in the I-O model, and county property taxes paid prior to completion, as well as impacts of recent tax policy changes which may be pertinent but currently are not incorporated in the I-O model. No estimate of net external social costs—unintended, uncompensated by-products of development—is included in this report although fees often are justified partly to internalize privately social costs of negative externalities. Neither are estimates included of social benefits of positive externalities from urban agglomeration, through economies of scale, economies of scope, neighborhood valuations, or diminution of pecuniary externalities possibly associated with offshore investor demand for Oahu residential real estate assets.[3] Fourth no estimate of the project's contribution to conservation of natural resources is incorporated in this report.[4]

Economic impact estimates in this report are adjusted for 2.5 percent inflation, expressed in present values at a 3 percent discount rate from the standpoint of year 2022 taking into explicit account the impacts of the passage of time. The estimates account for net leakages from imported input requirements. They incorporate productivity growth in projected future job impacts consistent with implicit assumptions in the state's I-O- model regarding labor-saving productivity growth. Reporting emphasis here is on total impacts of direct, indirect, and induced effects through inter-industry linkages and via personal consumption expenditure consequences of earnings from the associated job creation. Output here comprises total value inclusive of intermediate goods and services, a broader measure than value-added (GDP) *per se*.

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[2] Research and Economics Analysis Division (READ), Hawaii Department of Business and Economic Development (DBEDT) (December 2020) *The Hawaii State Input-Output Study: 2017 Benchmark Report* (https://files.hawaii.gov/dbedt/economic/reports/IO/2017_state_io_study.pdf).

[3] In America, of course, Hawaii residents as with all others constitutionally may invest in any state.

[4] The State of Hawaii constitution directs that, "the State and its political subdivisions shall conserve and protect Hawaii's natural beauty and all natural resources" (Article XI, Section 1), and that, "the State shall conserve and protect agricultural lands" (Article XI, Section 3). These criteria widely are interpreted as intended to favor urban density in residential development over suburbanization of agricultural land. (The Rural District does not exist on Oahu in Hawaii's Land Use Law.) Ward Village fulfills to this implicit mandate through concentration of residential development within Honolulu's urban core. See League of Women Voters of Honolulu (https://www.lwv-hawaii.com/govt/constitution/art11.htm).

2. Development and construction economic impact estimates

Ward Village Block A development and construction economic impacts in 2022 dollars, over seven years inclusive, 2022-2028, predominantly towards the middle of this interval during the construction impulse, in present value terms, are as follows:

- Block A development and construction is associated with $470 million in direct and indirect impacts on output from interindustry consequences of development, construction and marketing and other management and administrative activities, and is associated with $691 million in direct, indirect, and induced (total) output including the expenditures arising from the incomes created directly and indirectly with the project.

- Block A development and construction is associated with $174 million in workers earnings directly and indirectly, and is associated with $233 million in direct, indirect, and induced (total) earnings.

- Block A development and construction is associated with nearly $32 million in state taxes directly and indirectly, and is associated with more than $42 million in direct, indirect, and induced (total) state tax receipts.

- An annual average of 391 jobs are associated directly and indirectly with Block A development and construction, and 565 average jobs including the full scope of total effects (direct, indirect, and induced) over seven years, with a peak annual count of 967 jobs—both on the project and as its economy-wide consequence—in 2025 at the height of construction.

The multi-year period of planning and development in ongoing delivery of the Ward Village Master Plan is quickly followed by a mid-2020s economic impulse of Block A development surging from 2024-2028 during the construction phase of the project before impacts dissipate upon completion. Contemporaneous economic impacts are illustrated in Figures 1 and 2, below, and are summarized in Table 1.

Figure 1. Block A development outlays adjusted for imports (million, present-value 2022$)

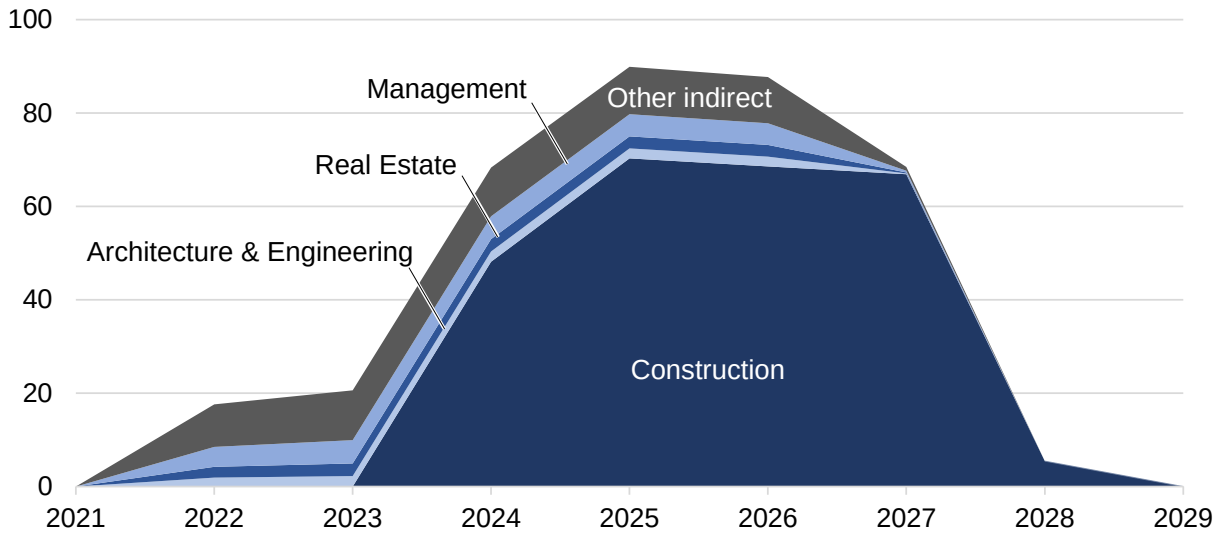


Figure 2. Block A macroeconomic impacts (million, present-value 2022$)

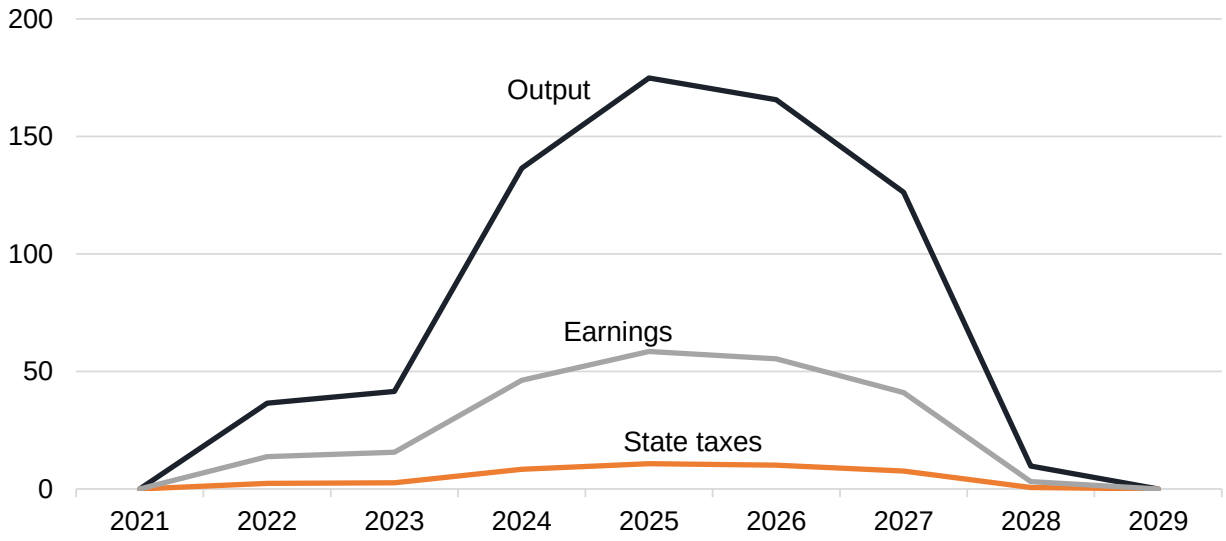


Table 1. Estimated economic impacts of Block A

BLOCK A DEVELOPMENT AND CONSTRUCTION IMPACTS

Million dollars of present value, or as noted				
	Direct + indirect impacts		**Total impacts**	
Output	$	508.6	**$**	**747.8**
Earnings	$	188.4	**$**	**252.3**
State tax*	$	34.3	**$**	**45.9**
Average annual jobs		391		**565**
Million constant (2022) dollars of present value, or as noted				
	Direct + indirect impacts		**Total impacts**	
Output	$	469.8	**$**	**691.0**
Earnings	$	174.3	**$**	**233.4**
State taxes	$	31.7	**$**	**42.4**
Average annual jobs		391		**565**
Peak annual jobs (2023)				**967**

*Aggregated income, excise, and other state tax revenue impacts

Development and construction outlay by economic activity Million dollars of present value			
		Planned	Import-adjusted
Construction	$	507.0	284.0
Architecture, engineering	$	14.2	11.4
Real estate	$	14.8	13.6
Management	$	30.0	25.2
Administrative (other indirect costs)	$	63.4	53.8
Total	**$**	**629.4**	**387.9**

3. Permanent, ongoing economic impact estimates

Completed condominium tower, grounds, and amenities in Block A require ongoing operations and maintenance of common areas and infrastructure, such as elevators and recreational spaces. These require annual collective outlays. Because they are aggregated and managed under a homeowner association, these outlays collectively comprise an independent, material and ongoing economic consequence of the development

Permanent and ongoing Block A economic impacts in 2022 dollars are reported below. Permanent operations and maintenance outlays required to secure the building's longevity also are associated through interindustry linkages with economic activity and related employment, incomes, and tax receipts. Like development, construction, and marketing activities arising from building the condominium, permanent economic activities associated with operations and maintenance give rise to imported goods and services which are excluded from onshore economic impact calculations.

Impacts of labor-saving productivity growth on employment over time are incorporated in the job impact calculations from permanent, ongoing activities, just as they are for contemporaneous development and construction. What happens to jobs because of productivity growth over several years of construction, while incorporated in the impact estimates, is less noticeable than what happens over several decades of maintenance. Job creation erodes as productivity increases and continues over longer sweeps of time. Upon initiation of operations and maintenance in 2028, for example, 30 jobs are associated with Block A, but after thirty years of productivity growth, the associated count is 15 jobs based on calibrations implicit in labor multipliers in the state's input-output model. We report the *average* job impact for the entirety of the 30 years. The state's published estimates of job multipliers for this sector, 2018-2026, based on the 2017 Hawaii Census of Industry, are extended to 2055 and beyond using a nonlinear regression model.[5]

As a result:

- Block A will be associated over thirty years beginning in 2028 with operations and maintenance outlays generating $189 million in the present value of constant, 2022 dollar future economic output, $63 million in the present value of future earnings, $11 million in the present value of future state tax revenues, and an annual average 22 jobs taking into account productivity growth, including direct, indirect, and induced economic effects, as summarized in Table 2.

[5] Because published estimates are available, 2018-2026, the impact estimates reported here stipulate to the officially published job multipliers for those years. To extend the multipliers, the natural logarithms of published multipliers are regressed on a time index, and then projected for the subsequent three decades. For repair and maintenance activities, this method estimated a 3.45 percent annual reduction in Type 2 job multipliers, each year.

Table 2. Continuing Block A economic impacts

BLOCK A PERMANENT ONGOING IMPACTS: MACROECONOMIC		
Million constant (2022) dollars or as noted		
Present value of operations, maintenance over 30 years @3%		
Direct, indirect, and induced		
Output	$	189.2
Earnings	$	62.7
State taxes	$	11.4
Jobs (average number)		22

4. Real property tax revenue estimates

Block A generates real property tax revenues for the City & County of Honolulu. Estimates of their present value, in constant 2022 dollars, over a 30-year and a 50-year horizon are calculated under current tax law. The baseline around which upper and lower bound estimates of future home price appreciation paths are used to calculate alternative property tax revenues assumes that Oahu existing homes appreciates at a nominal annual rate of 4 percent over time.[6] Other assumptions are designed to be conservative calibrations. Ownership patterns are adopted consistent with the "front-of-the-house" character of Block A and a spatial valuation gradient extending mauka from Ala Moana Boulevard with highest housing valuations at the development's makai location.[7]

[6] Under current tax law, assuming that old-age deductions are not pertinent, a homeowner's deduction of $100,000 from assessed value is included in the tax base. An effective residential tax rate of 0.0035 is applied to assessed value after the homeowner deduction, where appropriate. For investor-owned and second homes the first $1 million in assessed value is taxed at a rate of 0.0045 (the so-called Tier 1 rate), or $4.50 for each $1,000 of assessed value. Amounts of assessed value above the first $1 million are taxed at a rate of 0.0105 (Tier 2). Based on historical evidence summarized in the appendixes, taking into account the decline in background inflation during the forty years summarized by the median existing home price data upon which this benchmark calculation is based, price appreciation at the low end of the observed historical range of 4-5 percent annual appreciation rate is assumed to continue to raise assessed valuations over time, accordingly. From appreciated future values 2.5 percent inflation is removed each year, and then future values after inflation are discounted to a 2021 present value at a discount rate of 3 percent. (In light of recent Federal Reserve Board forward guidance, 3.5 percent may be a better discount rate.)

[7] Calibrated to nearby properties, the proportions of Block A units assumed to be held by owner-occupants (36.9 percent), held as investments (31.7 percent), and as second homes (31.4 percent) are distinguished by property tax rates (footnote 6). Block A has an unusually wide housing mix, so this owner-occupant share may be too low.

Over thirty years the contribution of Block A to City & County of Honolulu real property tax revenues is substantial, in constant-dollar terms and present values. Given Hawaii jurisdictions' good municipal bond ratings, the present values of *incremental* county property tax revenue are further accretive to the county's borrowing capacity.[8] The term structure of risk-free interest rates, from constant-maturity yields on U.S. Treasury securities, and projections of monetary policy by the Federal Reserve Board discussed in the appendix, are consistent with an expectation of subsiding borrowing costs during Block A's construction phase towards mid-decade. Interest rates rose suddenly in 2022 after pandemic re-opening—following covid vaccination—outpaced global supply chains in 2021. When combined with fiscal stimuli and geopolitical risks, a quadrupling of inflation led to rapid increase in the Fed's overnight interest rate target, probably culminating 5 percentage points than the near-zero rates upon pandemic onset in 2020.[9] .

Hypothetically, a private development of a new residential condominium tower worth $123 million in the present value of future property tax receipts, reserving 20 percent of that value to be conservative (as an "equity" tranche), adds $100 million in incremental borrowing capacity *today* for future long-term infrastructure investments by the city. Whether or not a 20 percent "haircut" is taken into account, hypothetical future property tax revenue generation augments the asset side of a jurisdiction's balance sheet, against which liabilities supported even when the investments associated with such borrowing are not revenue-generating. (For example, the incremental $100 million in present value also would secure $100 million in the present value of future public capital expenditures.)

The hypothetical $100 million in this example is essentially bankable for the jurisdiction's future physical and human capital formation. Of course, infrastructure investments themselves typically *are accretive to the productive capacity* of the economy, augmenting the jurisdiction's ability to pay. By raising productivity, infrastructure investments also contribute to the tax base indirectly even when such investments are not revenue-generating *per se*. Global sea rise associated with climate change rapidly has become a significant shared environmental risk and some coastal roadway alignments are exposed. Roadway and many other public infrastructure investments may not be self-funding (even when they could be). Even when public capital's social benefits unambiguously support investment, a political case may inhibit commitment. Augmenting the tax base with future property tax revenues relieves some budget constraint.

Essentially, Block A redevelopment is *securitizable* through a permanent present-value stream of annual real property tax revenues providing a basis for repayment and public debt-servicing. This is true even when public investments themselves do not generate revenue streams, as often is true when fulfilling social needs is a public investment objective. A jurisdiction like a city with a good municipal bond rating anticipating restoration of a steady-state interest rate environment benefits from the incremental present value of future property tax receipts generated

[8] These attributes were sourced from local municipal bond fund managers.

[9] This is detailed in the appendix, but the yield on 10-year U.S. Treasury Notes in early-August, 2021 was approximately 1.35 percent (https://www.federalreserve.gov/releases/h15/), and the median forecast of participants of the Federal Reserve Board's Federal Open Market Committee meetings is a longer-run neutral interest rate of about 2.50 percent (https://www.federalreserve.gov/monetarypolicy/fomcprojtabl20210616.htm).

by urban redevelopment. By design, a relatively modest level of associated public service is required in a master-planned community like in Block A in Ward Village.

Over 30 years real property tax revenues from Block A redevelopment are estimated below.

- Block A will be associated over thirty years beginning in 2028 with $123 million in the present value of future county residential property tax revenues, under the baseline assumptions grounded in historical housing appreciation rates.

- Because of the exportability of the City's Residential A property tax rates (footnote 6), approximately 80 percent of the baseline property tax revenue will arise from second-home and other investors, and about 20 percent from owner-occupants.

- An upper bound estimate of the present value of real property tax revenues from Block A over thirty years beginning in 2028 is $134 million; a lower bound estimate is $112 million, based on the historical volatility of home price appreciation over time.

Over 50 years the present values of future Block A property tax receipts are higher.

- Block A will be associated over fifty years beginning in 2028 with $195 million in the present value of future county residential property tax revenues.

- An upper bound estimate of the present value of real property tax revenues from Block A over fifty years beginning in 2028 is $211 million; a lower bound estimate is $178 million.

The Block A real property tax estimates' attributions under thirty- and fifty-year time horizons are summarized in Table 3, below.

Table 3: Present value of future Block A real property tax receipts

BLOCK A PERMANENT ONGOING IMPACTS: PROPERTY TAXES Million constant (2022) dollars or as noted		
Present value of residential property taxes over 30 years @3%	$	**123.4**
Present value of residential property taxes over 50 years @3%	$	**194.6**

5. Dynamic economic impacts

Development and construction and investment generally are distinguished from consumption activity by the fact that economic impacts of investment accrue over time. There are exceptions: consumer durables purchase of computers or motor vehicles give rise to consumption over time even when economic impacts associated with their purchase occur at a point in time. The convention in economic statistics is to take such considerations into account when possible, and to make distinctions where appropriate. Buildings have relatively long lives. Homebuilding is distinctive in that the productive capacity created generates streams of housing services over years or decades. This report explicitly takes into account the role of time, both in the *flow* of capital formation associated initially with development and construction, as well flows of maintenance services and property tax revenues associated with the *stock* of capital upon conclusion of the investment activity

This section details annual flows of investment outlays and the timing of associated economic impacts during development and construction of Block A. Delivery of individual Ward Village block redevelopments has been staggered over time. Each one is associated with a crescendo of development and related administrative and management activities culminating in a construction impulse concluding with a completed building. Because time is explicit in physical capital formation, economic impact estimates have been discounted to a common reference point, in this case the year 2022. Effects of inflation also have been adjusted to align with that reference point and an expectation of near- to medium-term convergence of inflation to the Federal Reserve's 2 percent policy goal.[10] Annual economic impacts of Block A redevelopment are detailed in Table 4, below, consistent with the summary impacts in preceding tables.

[10] Annual price inflation was 5.2 percent in the Urban Hawaii CPI-U in January 2023, down from 7.5 percent in March 2022.

Table 4: Annual Block A economic impacts

Block A development impacts (million 2022$ in present values,* job-years†, or as noted)

Direct and indirect	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**TOTAL**
Output (mil 2021$)	0.0	23.5	26.8	92.8	119.4	113.1	87.4	6.8	0.0	469.8
Earnings (mil 2021$)	0.0	10.2	11.6	34.5	43.7	41.4	30.6	2.4	0.0	174.3
State taxes (mil 2021$)	0.0	1.7	1.9	6.3	8.0	7.6	5.7	0.4	0.0	31.7
Jobs (average number)	0.0	213	242	542	661	629	420	32	0.0	391
Direct, indirect, and induced	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**TOTAL**
Output (mil 2021$)	0.0	36.5	41.5	136.5	174.8	165.6	126.2	9.8	0.0	691.0
Earnings (mil 2021$)	0.0	13.7	15.6	46.2	58.5	55.4	41.0	3.2	0.0	233.4
State taxes (mil 2021$)	0.0	2.3	2.7	8.4	10.7	10.1	7.6	0.6	0.0	42.4
Jobs (average number)	0.0	283	322	781	967	920	636	49	0.0	565

Block A state tax revenue impacts (million 2022$ in present values*)

Direct and indirect	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**TOTAL**
Individual income (mil 2021$)	0.000	0.519	0.589	1.683	2.120	2.008	1.467	0.113	0.000	8.500
GET (mil 2021$)	0.000	1.006	1.143	3.917	5.037	4.771	3.675	0.285	0.000	19.834
TAT (mil 2021$)	0.000	0.021	0.023	0.087	0.112	0.107	0.084	0.006	0.000	0.440
Other (mil 2021$)	0.000	0.166	0.189	0.580	0.737	0.698	0.522	0.040	0.000	2.933
Annual total	0.000	1.712	1.945	6.267	8.007	7.584	5.748	0.445	0.000	31.706
Direct, indirect, and induced	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**TOTAL**
Individual income (mil 2021$)	0.000	0.693	0.787	2.269	2.862	2.711	1.987	0.153	0.000	11.461
GET (mil 2021$)	0.000	1.337	1.519	5.032	6.448	6.108	4.664	0.361	0.000	25.469
TAT (mil 2021$)	0.000	0.041	0.047	0.156	0.200	0.189	0.145	0.011	0.000	0.789
Other (mil 2021$)	0.000	0.271	0.308	0.934	1.185	1.122	0.835	0.064	0.000	4.720
Annual total	0.000	2.342	2.662	8.391	10.695	10.130	7.631	0.590	0.000	42.439

Block A development outlays by econ. activity, adjusted for imports (mil. 2022$ in present values*)

Outlays (mil. 2021$)	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**TOTAL**
Construction	0.0	0.0	0.0	48.2	70.3	68.6	66.9	5.5	0.0	259.3
Architecture, engineering	0.0	1.9	2.3	2.2	2.1	2.1	0.2	0.0	0.0	10.8
Real estate	0.0	2.3	2.7	2.6	2.6	2.5	0.2	0.0	0.0	12.9
Management	0.0	4.3	5.0	4.9	4.8	4.6	0.4	0.0	0.0	23.9
Administrative (indirect)	0.0	9.1	10.7	10.4	10.1	9.9	0.8	0.0	0.0	51.1
Annual total	0.0	17.6	20.6	68.3	89.9	87.7	68.4	5.5	0.0	358.0

*Assumes 2.5% CPI inflation, 3% (risk-freee) discount rate, and trend productivity growth

†One job for one year; average annual labor requirement reductions from productivity growth 3% (*s.d.* 0.6-0.8 percentage points)

6. Discussion

Input-output models are linear. Changes in demand for interindustry goods and services translate directly into employment and output effects, mechanically, without changes to factor prices for labor and materials. The multipliers underlying the economic impacts of Block A redevelopment which have been estimated here imply that resources are adequate to enable production activities to engage according to the pattern of development investment outlays. In reality, labor may be scarce: Hawaii job openings are *twice* are numerous as unemployed persons in Hawaii. Sourcing non-labor inputs may be confounded by logistics and supply-chain disruptions. In a tight economic situation with low unemployment and high inflation, higher investment demand may warrant an alternative estimating approach in which input *and* prices are flexible, not fixed as linear production modeling. The developer's increased demand for inputs such as steel or concrete sourced partially or mostly from outside Hawaii are unlikely to affect input prices in a national or global input market. But the developer's increased derived demand for other inputs like labor skilled in specific tasks, or occupations, could bid higher the wage rates in a smaller geographic market. Adopting the State of Hawaii's input-output model as a framework for economic impact estimation implicitly assumes that these price effects, if they exist at all, are so muted as to be unobservable. Individual developer decisions do not have economy-wide input or output price impacts. This is a standard assumption. Because many pandemic disruptions were transitory in nature, the models are probably still apt. Even the post-pandemic legacy of a persistent, one-time increase remote work raised productivity, "costing" the economy nothing and, indeed, benefitting it.. No additional adjustments for price risk or uncertainty are undertaken.

Block A economic impacts began in the early-2020s in a macroeconomic environment clouded by uncertainty about incipient U.S. recession, following rare, sudden U.S. interest rate increases in 2022. The previous, 2020 pandemic recession was the sharpest and shortest ever recorded.[11] Subsequent economic recovery was characterized by unusual circumstances on which further observation is relegated to appendixes. Generally, Oahu's economic environment in early 2023 was characterized by a stable, full-employed labor market with unusually high (double the norm) ratios of job openings to unemployed persons, partly a legacy of many years of Oahu resident population decline, and of labor force detachment in the wake of the pandemic. Hawaii real output, however, has declined steadily since 2017, with a V-shaped crater marking covid during 2020. Economic recovery is forecast for Hawaii (*e.g.* by DBEDT and UHERO), but Hawaii was sixth poorest-performing state economy since 2019. Three years after covid, U.S. monetary policy tightening and induced disinflation nationwide are bound to restrain growth at a time when capital formation is needed in Honolulu both for long-term (housing shortages) and short-term (countercyclical) reasons.

[11] See footnote 11, and National Bureau of Economic Research (https://www.nber.org/research/data/us-business-cycle-expansions-and-contractions), *Business Cycle Dating Committee Announcement July 19, 2021: Determination of the April 2020 Trough in US Economic Activity* (https://www.nber.org/news/business-cycle-dating-committee-announcement-july-19-2021), and *Business Cycle Dating Committee Announcement June 8, 2020: Determination of the February 2020 Peak in US Economic Activity* (https://www.nber.org/news/business-cycle-dating-committee-announcement-june-8-2020).

Conclusion

Ward Village Block A development and construction of 486 new condominium housing units continues Howard Hughes' master plan for Kakaako urban renewal. This report has summarized economic impacts of Block A redevelopment in present values of constant, 2022 dollars. Block A's initial development phase will transition to a construction phase from 2024-2028 with peak impacts in 2025. Its permanent economic legacies are substantial.

- Block A development and construction is associated with $470 million in direct and indirect impacts on output, and with $691 million in direct, indirect, and induced output.
- Block A development and construction is associated with $174 million in earnings directly and indirectly, and $233 million in direct, indirect, and induced earnings.
- Block A development and construction is associated with $32 million directly and indirectly, and with $42 million in direct, indirect, and induced state tax receipts.
- An annual average of 391 jobs directly and indirectly, and 565 jobs including direct, indirect, and induced effects, are associated with Block A development and construction, with a peak annual count of 967 jobs in 2025.

Permanent, ongoing economic impacts of Block A redevelopment accrue from operations and maintenance outlays as well as real property tax revenues accruing to the City & County of Honolulu. Adjusted for inflation, their constant-dollar approximate values range from $189 million for operations and maintenance over thirty years, to $123 million in property tax receipts over fifty years.

- Over thirty years beginning in 2028, Block A will be associated with operations and maintenance outlays generating $189 million in the present value of constant-dollar future economic output, $63 million in the present value of future earnings, $11 million in the present value of future state tax revenues, and an annual average 22 jobs taking into account productivity growth, including direct, indirect, and induced economic effects
- Block A will be associated over thirty years beginning in 2028 with a baseline estimate of $123 million in the present value of future county residential property tax revenues. Exportability of the Residential A property tax rate implies an 80:20 split between property tax revenue from second-home and other investors *vs*. owner-occupants.
- An upper bound estimate of the present value of real property tax revenues from Block A over thirty years beginning in 2028 is $134 million; a lower bound estimate is $112 million, based on the historical volatility of home price appreciation over time.

- Block A will be associated over fifty years beginning in 2028 with $195 million in the present value of future county residential property tax revenues.

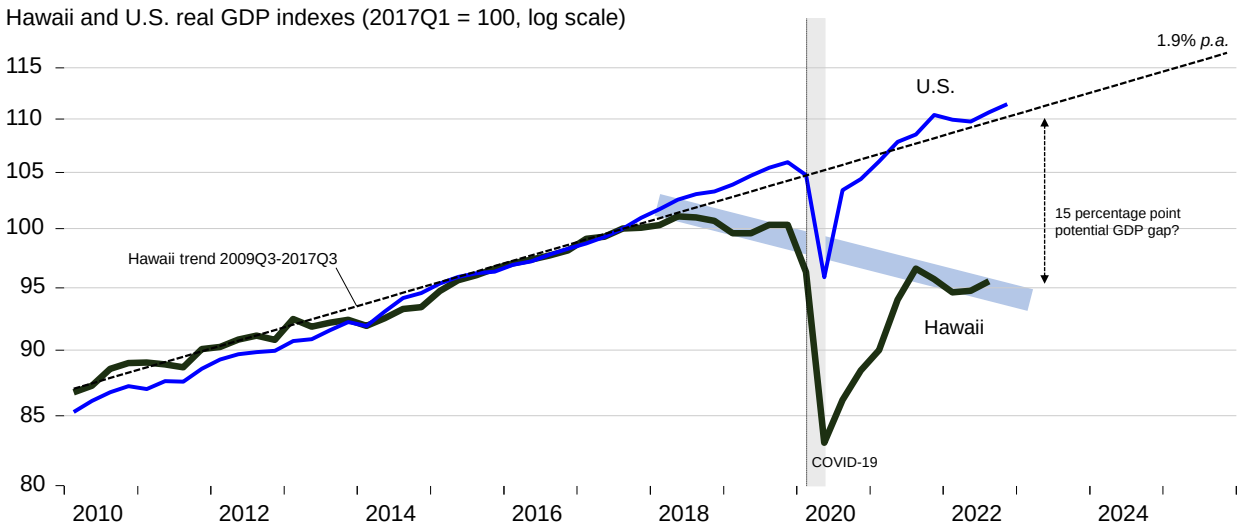
- Taking into account volatility, an upper bound estimate of the present value of real property tax revenues from Block A over fifty years beginning in 2028 is $211 million; a lower bound estimate is $178 million.

Block A redevelopment anchors Ward Village's Ward Avenue gateway to Ala Moana Boulevard—The Front of The House—with residential condominiums appropriate to the spatial valuation gradient of Honolulu's urban core and configured over a wide range of housing types and market values.. Block A redevelopment supports area amenities as well as public open space development commitments to the community. Block A redevelopment makes a substantial contribution through the stimulus of private capital outlays to sustaining uneven economic recovery since the 2020 pandemic recession, and offers some certainty about economic benefits in an uncertain mid-2020s Hawaii outlook. Block A's permanent economic legacy includes a substantial and bankable addition to the present value of the city's future property tax receipts and to ongoing economic activity arising from building operations and maintenance.

Appendix 1. Hawaii's economy after COVID-19

Hawaii economic recovery from the COVID-19 pandemic, a disease caused by spread of the novel coronavirus SARS-CoV-2, has been weak and incomplete. As of third quarter 2022, two-and-one-half years after the start of the U.S. covid recession in 2020Q1,[12] Hawaii real GDP was still only 95 percent of what it was at the end of 2019, pre-pandemic. Only five other states exhibited weaker recoveries than Hawaii. The best state, Idaho, had seen its real GDP grow 15-20 percentage points *more* than did Hawaii's, the Hawaii equivalent of *doubling* the absolute size of tourism-related Hawaii GDP within the same period. Hawaii output had been declining in real, inflation-adjusted terms for two years *prior* to the pandemic, and its post pandemic decline further widened that gap below Hawaii's pre-pandemic potential real GDP (unlike the U.S.).

Figure A1-1. Hawaii real GDP in 2022 was 15 percentage points below potential, approximately the equivalent of the entire contribution of tourism to value-added (GDP)



Sources: U.S. Bureau of Economic Analysis (https://www.bea.gov/data/gdp/gdp-state), re-indexing and 2010s Hawaii trend regression estimate by TZ Economics.

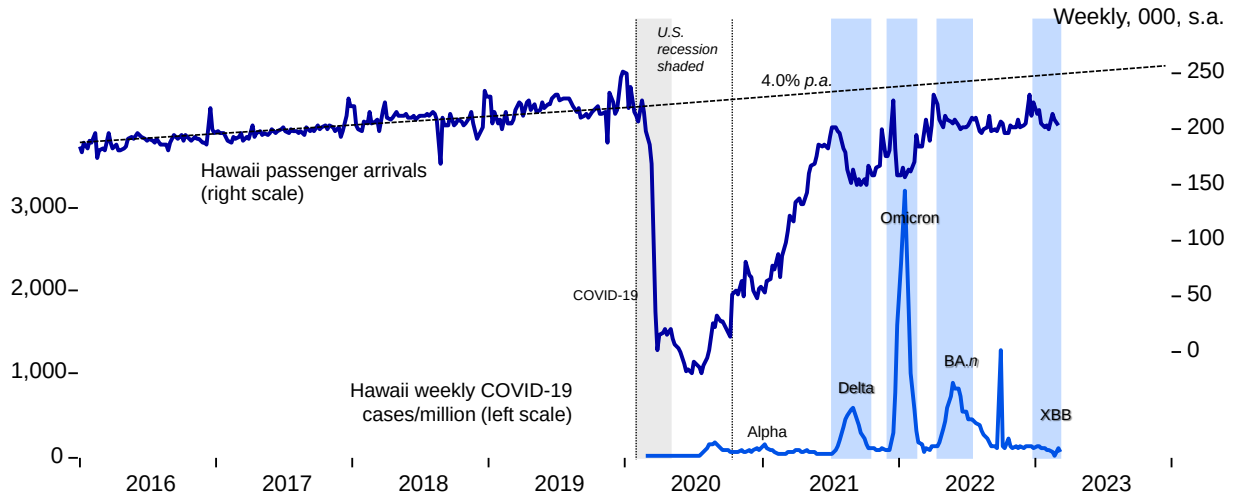
State government tourism and legislative officials ignored Hawaii's predicament. From 2020-mid-2022, Hawaii had the lowest COVID-19 mortality rate in the country,[13] but some officials

[12] National Bureau of Economic Research (https://www.nber.org/research/data/us-business-cycle-expansions-and-contractions).

[13] Thomas J. Bollyky, *et al* (March 23, 2023) "Assessing COVID-19 pandemic policies and behaviours and their economic and educational trade-offs across US states from Jan 1, 2020, to July 31, 2022: an observational analysis," *The Lancet* (https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(23)00461-0/fulltext).

conflated successful public health policy interventions with successful countercyclical economic policy. In fact, Hawaii's recovery is among the weakest nationwide. New covid variants and sub-variants weighed on Hawaii's travel and tourism recovery in 2021-2022. International travel to Hawaii remained nearly absent at end-2022. Impairment in total weekly Hawaii transpacific passenger arrivals data illustrated below, seasonally-adjusted, display uneven recovery. Each major covid variant wave in Hawaii—Delta (summer 2021) and Omicron (winter 2022)—were equivalents of 9/11-style adverse shocks to Hawaii arrivals volumes, *twice* within a one-year period. Omicron sub-variants impaired the travel recovery less in 2022, but the XBB sub-variant in spring 2023 remained the most contagious variant ever. By 2023, weekly Hawaii travel data showed no sign of extending tourism recovery higher than in 2021. Had Hawaii air travel trends from the 2010s continued in the 2020s, volumes would be 25 percent higher than pre-pandemic.[14] Tourism is not leading the Hawaii economy.

Figure A1-2. Weekly Hawaii passenger arrivals, seasonally-adjusted, repeatedly stifled by incoming covid variants and subvariants



Source: Hawaii DBEDT (https://dbedt.hawaii.gov/visitor/daily-passenger-counts/); seasonally-adjusted by TZE using an STL Decomposition, projected from non-stationary trend component 2010-2019, and Hawaii DOH, Johns Hopkins University (https://raw.githubusercontent.com/CSSEGISandData/COVID-19/master/csse_covid_19_data/csse_covid_19_time_series/time_series_covid19_confirmed_US.csv).

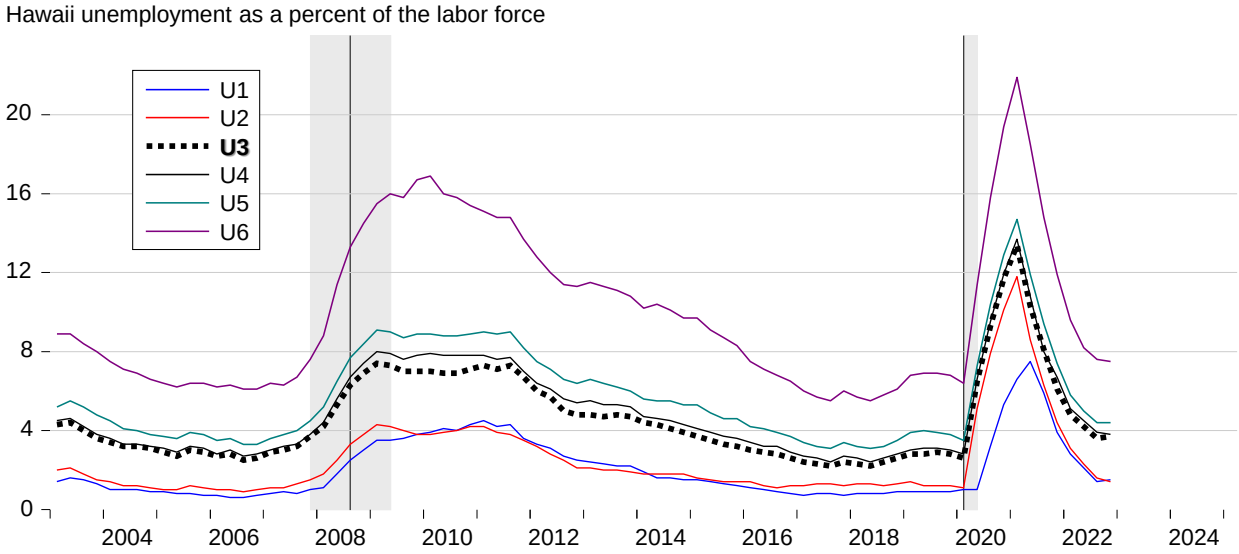
[14] Commercial passenger air carriers flying at high load factors are an artifact of a decrease in scheduled air seats to Hawaii between 2019 and 2023. Passenger counts include returning an intended residents, but tourists dominate shares of travelers (typically four-fifths tourists). *Domestic* transpacific scheduled air seats *rose* 26 percent between the first quarter of 2019 and 2023, but international seats *fell* by 38 percent, dragging down the net total by 1.8 percent. Foregoing higher-spending international tourists carries an even bigger opportunity cost measured in tourism receipts (https://dbedt.hawaii.gov/visitor/air-seats/).

Appendix 2. Unemployment and state fiscal anomalies

The macroeconomic consequence of tourism recovery falling short of its potential, and of state and local government failure to timely deploy federal pandemic relief funding (resulting in a fiscal surplus(!)), when state tax revenues were falling and Hawaii resident population loss beginning in the 2010s continued after pandemic onset, was a broader Hawaii economy falling short its potential, as well.

- Hawaii shares with the U.S. economy a tighter labor market, post-pandemic, than the one at the end of the 2010s, pre-covid. At one point during the last two years, Hawaii had the highest monthly *quit* rate in the country. Remote workers found new opportunities, older workers exited a workforce exposed to respiratory infectious disease risk, women reduced labor force participation because of shrinking day care options and pandemic-induced remote schooling, at least for a while. In early-2023 there were still two job openings in Hawaii for each unemployed person in Hawaii, an extraordinary gap that was *twice* the historical norm of the prior twenty years. (Customarily, at full employment, job openings roughly equate numbers of unemployed persons because of *frictional* mismatches of skills and occupational tasks.)

Figure A2-1. Alternative measures of Hawaii unemployment (U3 is customary benchmark)[15]



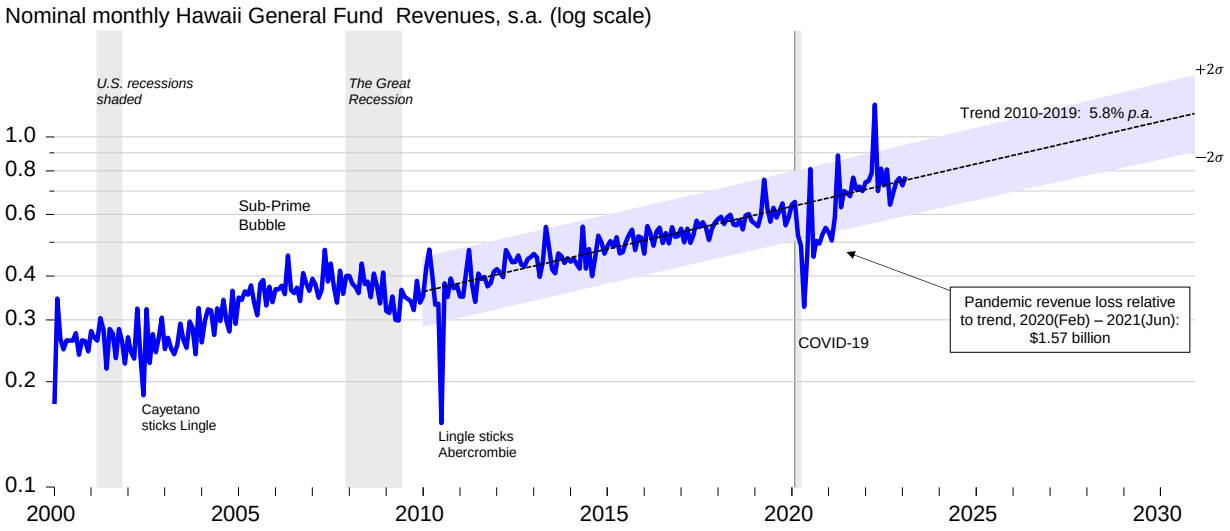
Source: U.S. Bureau of Labor Statistics (https://www.bls.gov/lau/stalt22q4.htm and earlier postings).

[15] Definitions may be found at U.S. Bureau of Labor Statistics (January 27, 2023), *Alternative Measures of Labor Underutilization for States, 2022 Annual Averages* (https://www.bls.gov/lau/stalt.htm).

- Hawaii's unemployment rate subsided from its pandemic high, settling just above 3.5 percent, slightly higher than the pre-pandemic 3.0 percent (Figure A2-1). The gap between U6 and U5 measures of unemployment, signifying the portion of the workforce employed part-time for economic reasons, also returned to pre-pandemic magnitudes. Post-pandemic changes in the *structure* and *patterns* of employment are more persistent, but various general "barometric" measures of labor market balance—such as the various unemployment rates in Hawaii—have returned to a full-employment.

- One curious anomaly of the post-pandemic recovery, characteristic of both county and state governments in Hawaii, was failure to fully deploy—contemporaneously—federal pandemic relief funds. This resulted in a projected increase in the State of Hawaii's General Fund ending cash surplus from $1.00 billion in fiscal year 2021 (the first pandemic year) to $2.62 billion in fiscal year 2022.[16]

Figure A2-2. How does a state government forego $1.6 billion in pandemic revenue and accumulate $2.6 billion surplus? By not spending federal stimulus funds



Source: Hawaii Department of Taxation (https://tax.hawaii.gov/data-dashboard/).

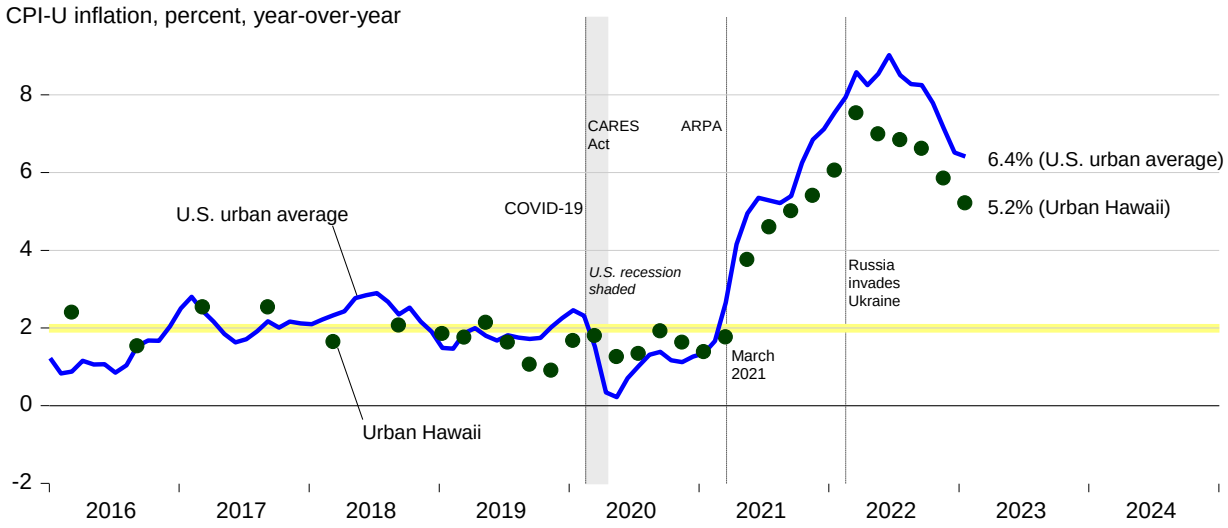
[16] State of Hawaii Department of Budget and Finance (October 19, 2022), *General Obligation Bond Prospectus*, Table 15, "Appendix B: Financial Information about the State of Hawaii" (https://investorrelations.hawaii.gov/dbf/wp-content/uploads/sites/3/2022/10/HIState01a-FIN.pdf). See also Kevin Dayton (November 20, 2022), "Ige Closes Out His Tenure With A Record-Setting Surplus Of More Than $2.6 Billion," *Civil Beat* (https://www.civilbeat.org/2022/11/ige-closes-out-his-tenure-with-a-record-setting-surplus-of-more-than-2-6-billion/).

Appendix 3. Inflation and The Great Re-opening.

Monetary policy interest rates effectively at zero, 3 percent mortgage interest rates, and more than $5 trillion in three federal fiscal stimuli between March 2020 and March 2021, cumulated to ignite a recovery in aggregate demand which outstripped supply responses, both globally in scope. After covid vaccination became widespread in 2021, persistent supply-chain pandemic disruptions throttled producers' ability to get to market, while many producers remained shut down by public health concerns. Higher aggregate demand and sluggish aggregate supply response combined to generate an inflation surge after March 2021.

The resulting inflation led to an abrupt shift towards monetary policy tightening. In 2022 the Federal Reserve moved vigorously, starting with ¼ and ending with ¾ of one percent successive overnight target rate increases in its regularly scheduled monetary policy meetings. Mortgage interest rates jumped from 3 to 7 percent within-year 2022, the fastest in more than forty years. Policy rate increases tapered at 2022 year-end as the overnight rate approached 5 percent. Inflation abated after mid-2022 from global supply chain restoration and from softening aggregate demand, particularly in interest-sensitive sectors like housing.

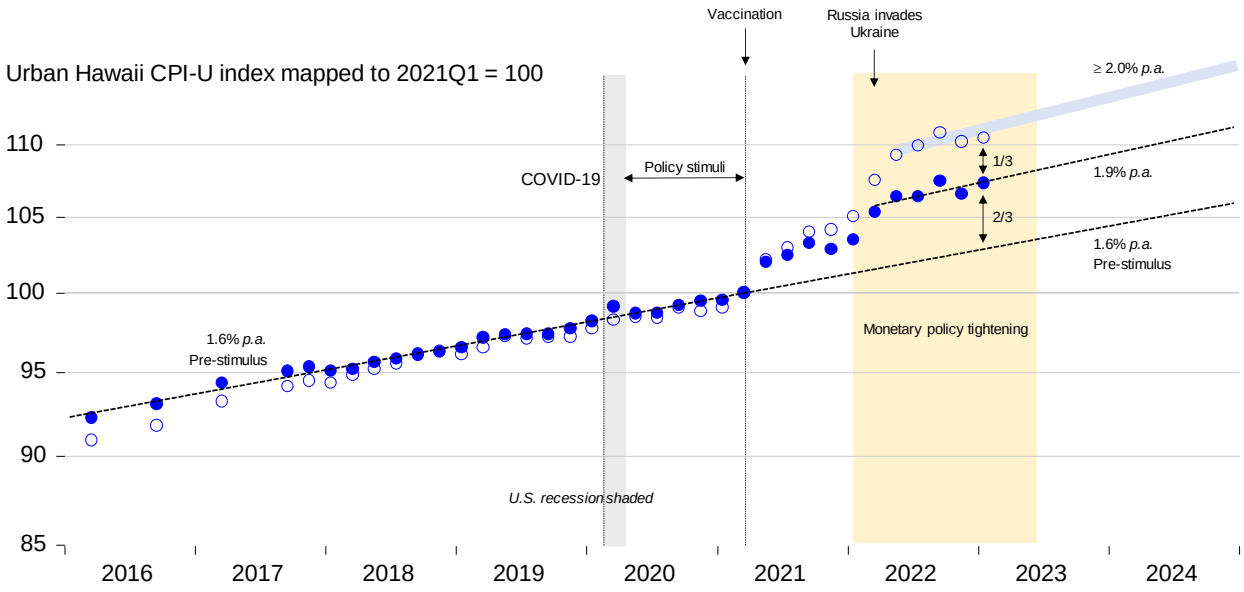
Figure A3-1. Urban Hawaii inflation followed U.S. inflation up *and down* from March 2021through January 2023



Source: U.S. Bureau of Labor Statistics (https://data.bls.gov/cgi-bin/surveymost?r9), to facilitate comparison semiannual inflation rates for 2017 and most of 2018 are included with the newer year-over-year inflation estimates for Urban Hawaii inflation at bi-monthly frequencies; U.S. monthly data and Hawaii bi-monthly data through January 2023.

Core inflation in Hawaii's consumer price index, less food and energy components, stabilized back around 2 percent in 2022, and in spite of Russia's 2022 invasion of Ukraine, resulting in higher energy and commodity prices (e.g. grains), headline inflation later decelerated towards the Federal Reserve's 2 percent goal. About two-thirds of the surge in prices after first quarter 2021, concluding one year later, was in the core ("demand")—excluding food and energy—while a remaining third ultimately was associated with volatile food and energy components affected by global supply chain recovery impediments, and Russia's invasion of Ukraine.

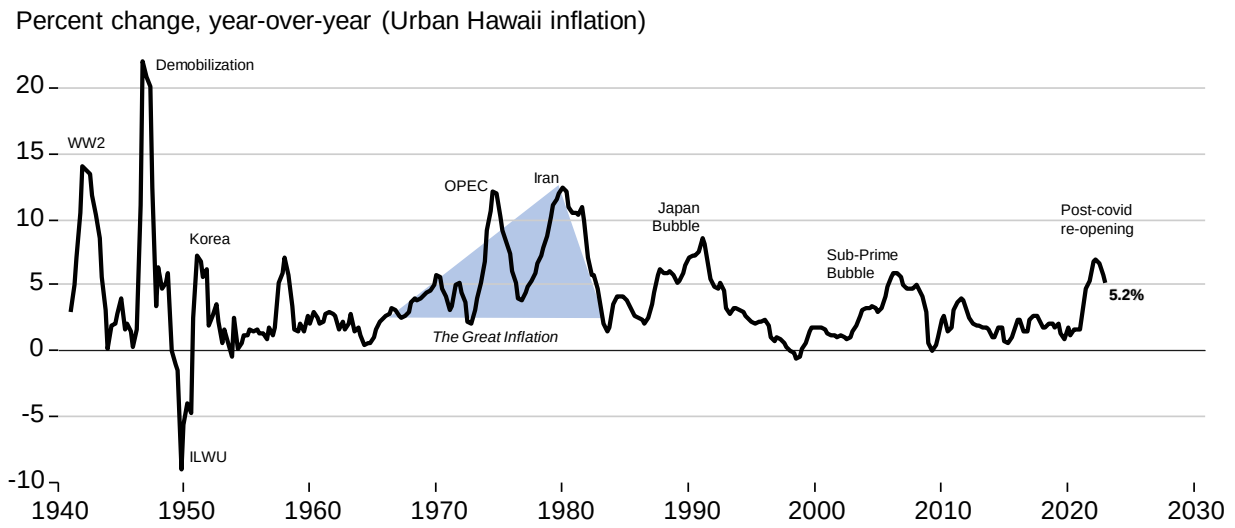
Figure A3-2. Urban Hawaii consumer price indexes for all urban consumers "Headline" and core indexes, in natural logarithms (slopes are percent changes)



Source: U.S. Bureau of Labor Statistics (https://www.bls.gov/data/home.htm), rebased to 2021Q1 by the author.

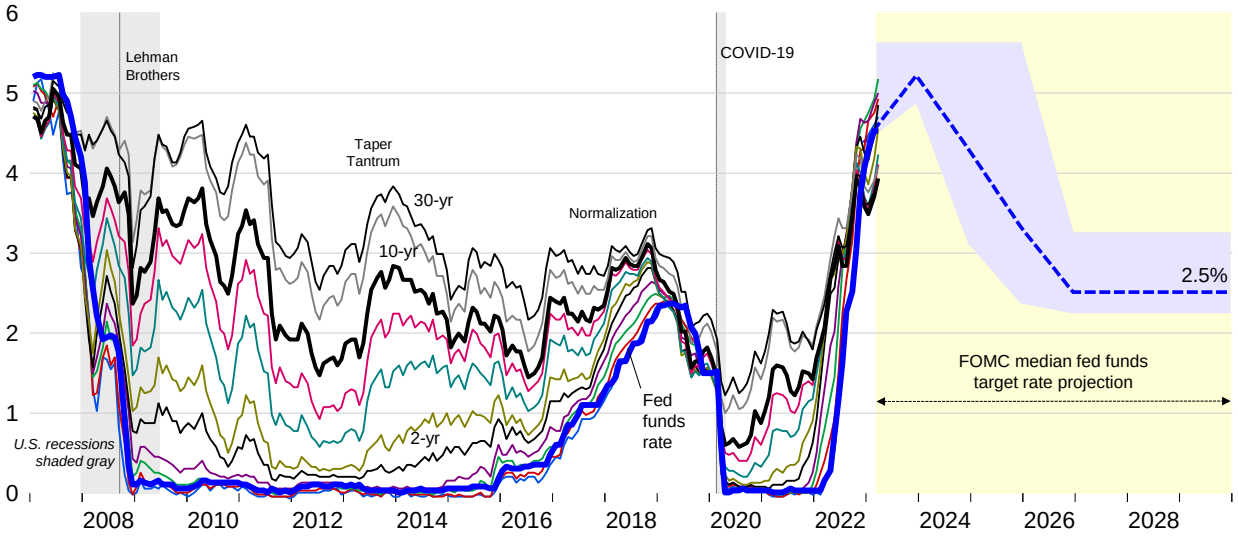
Transitory aggregate supply shocks—Russia's Ukraine invasion; Avian flu—combined with decisive Federal Reserve monetary policy response to unanticipated aggregate demand pressures unleashed by pandemic fiscal stimuli, have been perceived in financial markets as credible. No lasting change in inflation expectations, beyond magnitudes consistent with a higher inflation *risk premium*, characterized the "break-even inflation rate" measured as the difference between nominal and real U.S. Treasury yield. Inflation in January 2023 in Hawaii was 5.2 percent, down from 7.5 percent in March 2022. Inflation until March 2021 in Hawaii was ≤ 1.8 percent *per annum*. A neutral overnight rate of 2.5 percent would be consistent with a longer-term, 10-year U.S. Treasury Note yield around 3.0 percent by the mid-2020s. U.S. 10-year T-Note yields were around 3.5 percent in March 2023. Federal Reserve forward guidance suggests that tightening will conclude in 2023, followed (e.g. 2024) with gradual reduction of the Fed's overnight policy rate to a neutral rate around 2.5 percent.

Figure A3-3. Urban Hawaii consumer price inflation rates since the 1940s



Source: BLS (https://data.bls.gov/cgi-bin/surveymost?r9), Robert C. Schmitt (1977) *Historical Statistics of Hawaii*, UH Press; quarterly interpolations of varying-frequency underlying data by the author.

Figure A3-4. Federal Open Market Committee Summary of Economic Projections (SEP) forward guidance on the Fed's expectation for future policy interest rates

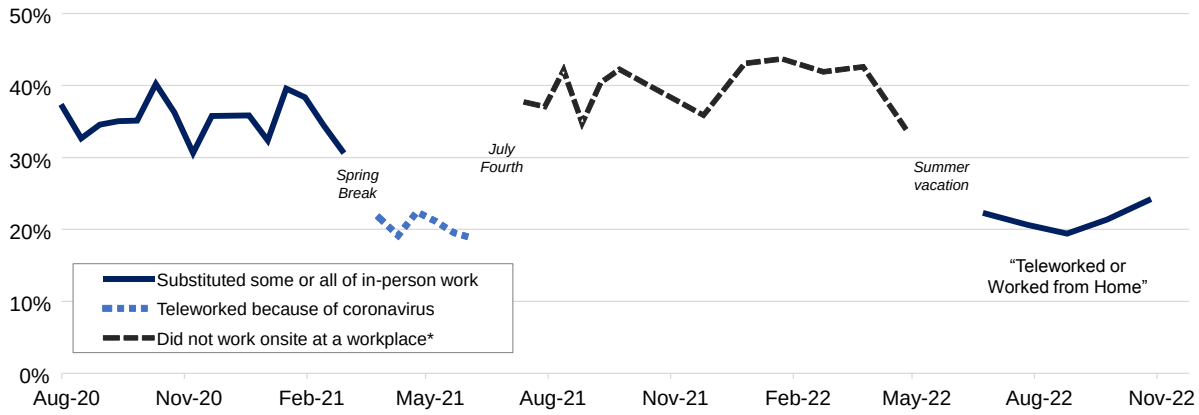


Source: Board of Governors of the Federal Reserve System (https://www.federalreserve.gov/datadownload/), FOMC (December 14, 2022) *Summary of Economic Projections* (https://www.federalreserve.gov/monetarypolicy/fomcprojtabl20221214.htm).

Appendix 4. Remote work and housing

Uniquely in the aftermath of the covid pandemic was an unprecedented workforce behavior shift, a substantial rise in proportions of workers permanently substituting work remotely or from home for work in a conventional workplace. The shift is an example of a phenomenon known as *hysteresis*, in which a change thought temporary turns out to be permanent. Simultaneously, global embrace of remote work in spring 2020 was a necessary response to pandemic onset, prior to vaccine availability and amidst early uncertainties about treatment approaches and about the effectiveness of non-pharmaceutical interventions. But in the transition to normalcy, higher proportions of remote workers have persisted as the new normal, with implications for housing. Prior to the pandemic, less than 11 percent of U.S. workers *ever* had worked from home, and less than 4 percent did so full-time.[17] In second half 2022, at least 20 percent of Hawaii households surveyed had at least on person who "teleworked or worked from home in the last 7 days."[18]

Figure A4-1. Hawaii households in which someone teleworked or worked from home



Source: U.S. Bureau of the Census, Household Pulse Survey (https://www.census.gov/programs-surveys/household-pulse-survey.html). Surveys before April 2021 defined "Percentage of adults living in households where at least one adult has substituted some or all of their typical in-person work for telework because of the coronavirus pandemic." From April-June 2021 surveys defined "Percentage of adults living in households where at least one adult has teleworked because of the coronavirus pandemic in the last 7 days." Beginning in July 2021, surveys defined "Percentage of adults in households where someone worked onsite at a workplace in the last 7 days," *i.e.* 65.8% between April 27 and May 9, 2022, about two-thirds, or one-third who did not. Surveys July 1 through November 14, 2022 identified households where someone "Teleworked or Worked from Home in the Last 7 Days."

[17] U.S. Bureau of Labor Statistics (September 24, 2019), *Job Flexibilities and Work Schedules Summary* (https://www.bls.gov/news.release/flex2.t03.htm#cps_jf_table3.f.1).

[18] U.S. Bureau of the Census, Household Pulse Survey (https://www.census.gov/programs-surveys/household-pulse-survey.html).

These pattern shifts are global in character. Like Long Covid, so-called "Long Social Distancing" became widespread in the early-2020s. Surveys show that only about 40 percent of employers expected complete return to the pre-covid workplace, 30 percent substantial return, while 16 percent expected only partial return, and 13 percent expected no return. The pandemic induced a simultaneous, unplanned, universal shift in working arrangements. In one international sample, hybrid work arrangements tended towards 1-2 days working at home within a 5-day workweek. Surveys estimated the option value of hybrid work 2-3 days/week at about 5 percent of pay, with higher option values for women, parents, and those with long commutes. The BLS Commissioner observed in 2021 that "changes already are noticeably permanent in certain areas." Subsequent research found that "near- and medium-term effect[*s*] on firm-level TFP (total factor productivity) was more likely to be positive for firms where more of the work can be done from home."[19]

In Hawaii, post-pandemic work from home (including hybrid work) shifting from 10 percent to 20 percent of workers has been influential in explaining higher office vacancy rates, lower retail and recreational establishment utilization (people stop on the way home from work, unless they are already at home), and combined with e-commerce additional patter shifts for consumer goods and service delivery. The focus here is on housing market outcomes, which were immediately striking.

- As early as in second half 2020, peaking in spring 2022, Oahu median single-family home prices experienced an asset pricing bubble which was *not* observable in (multifamily) condominium median prices.

- The widening in the spread between median prices for detached dwellings and those for condominiums had a spatial expression consistent with hypothesized "Donut Effects," in which demand shifts towards suburbs and exurbs, away from the urban core.[20] A "backwash effect" later also was evident in Honolulu, as the *relative* decrease in condo valuations later attracted buyers back to urban core housing.

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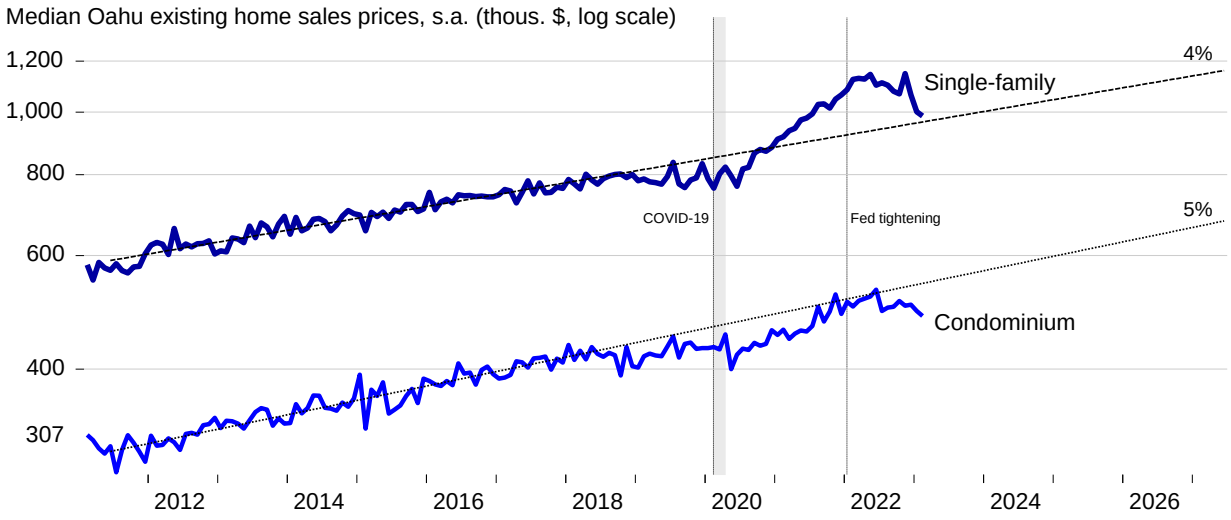
[19] Jose Maria Barrero et al (April 2022), "Long Social Distancing" WFHResearch.com (https://wfhresearch.com/wp-content/uploads/2022/04/LongSocialDistance_v11_forwebsite.pdf), Cevat Giray Aksoy et al (August 2022), "Working from home around the world," prepared for the *Brookings Papers on Economic Activity* (https://wfhresearch.com/wp-content/uploads/2022/09/Working-from-Home-Around-the-World-23-August-2022.pdf), Nicholas Bloom *et al* (July 2022) "How hybrid working from home works out," *NBER Working Paper 30292* (http://www.nber.org/papers/w30292); comments of William Beach, Commissioner, U.S. Bureau of Labor Statistics, at the National Association for Business Economics 2021 Economic Measurement Seminar (August 9-11, 2021), 31:41 of panel discussion on "Maintaining the Quality and Integrity of U.S. Government Data" (August 11, 2021); John Fernald and Huiyu Li (August 8, 2022) "The Impact of COVID on Productivity and Potential Output" (https://www.kansascityfed.org/Jackson%20Hole/documents/9032/JH_Paper_Fernald.pdf), presented at the Jackson Hole Economic Policy Symposium: Reassessing Constraints on the Economy and Policy (Thursday, August 25, 2022).

[20] Arjun Ramani & Nicholas Bloom (May 2021), "The Donut Effect of Covid-19 on Cities," NBER Working Paper 28876 (https://www.nber.org/papers/w28876) and "Nick Bloom on Working From Home...Will it Persist?" Bendheim Center for Finance (Princeton) webinar (https://bcf.princeton.edu/events/nick-bloom-working-from-home-will-it-persist/). Contrast that with Edward Glaeser (October 2021), "Survival of the City," Bendheim Center for Finance (Princeton) webinar (https://bcf.princeton.edu/events/edward-glaeser-on-triumph-of-the-city-the-future-of-urban-life-and-work/).

Figure A4-2. Mostly *single*-family Oahu median home sales prices "bubbled," 2021-22



Sources: Honolulu Board of Realtors, Hawaii DBEDT (http://dbedt.hawaii.gov/economic/mei/); monthly data through February 2023, seasonally adjusted by the author. Trend regressions from mid-2011 through mid-2018, projected forward through a period of soft valuations immediately prior to the pandemic.

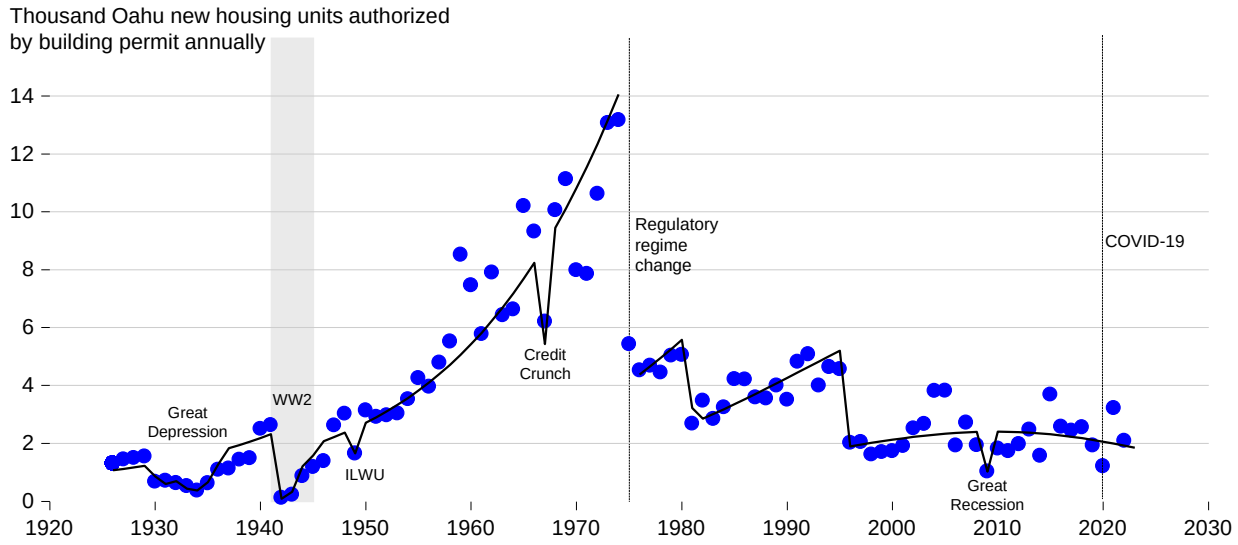
Housing market impacts of covid telework were national in character. One line of research suggested that *one-half* of U.S. annual home price appreciation in 2020-21 was attributable to remote work.[21] General technology (personal computing and connectivity) enabled distributed work. Productivity latent in that technology was catalyzed by pandemic response (*e.g.* Zoom). Up to 1/3 of U.S. workforce is capable of working remotely, full-time or hybrid, up from 1/10 pre-pandemic. Hybrid work expanded the spatial footprint of the labor market: suburban and ex-urban pecuniary spillovers accompanied the one-time shift. Rising interest rates since 2022 either stifled further adjustment, or validated the housing demand shift's conclusion.

Oahu housing supply has not responded to the rotation in housing demand following the onset of COVID-19. Regulatory process prevents more than an average 2,500 new housing units from being built on Oahu in any given year for a quarter century. The onerous burden of housing regulation in Hawaii is well-documented.[22] Indeed, most of the observed surge in homebuilding on Oahu during 2021 was the result of Castle & Cooke finally being allowed to build at Koa Ridge after more than 20 years of litigation and two Hawaii Supreme Court decisions. Koa Ridge had no model home: Castle & Cooke went virtual because of the pandemic.

[21] John Mondragon and Johannes Wieland (May 2022), "Housing Demand and Remote Work" *NBER Working Paper* No. w30041 (https://www.frbsf.org/wp-content/uploads/sites/4/wp2022-11.pdf).

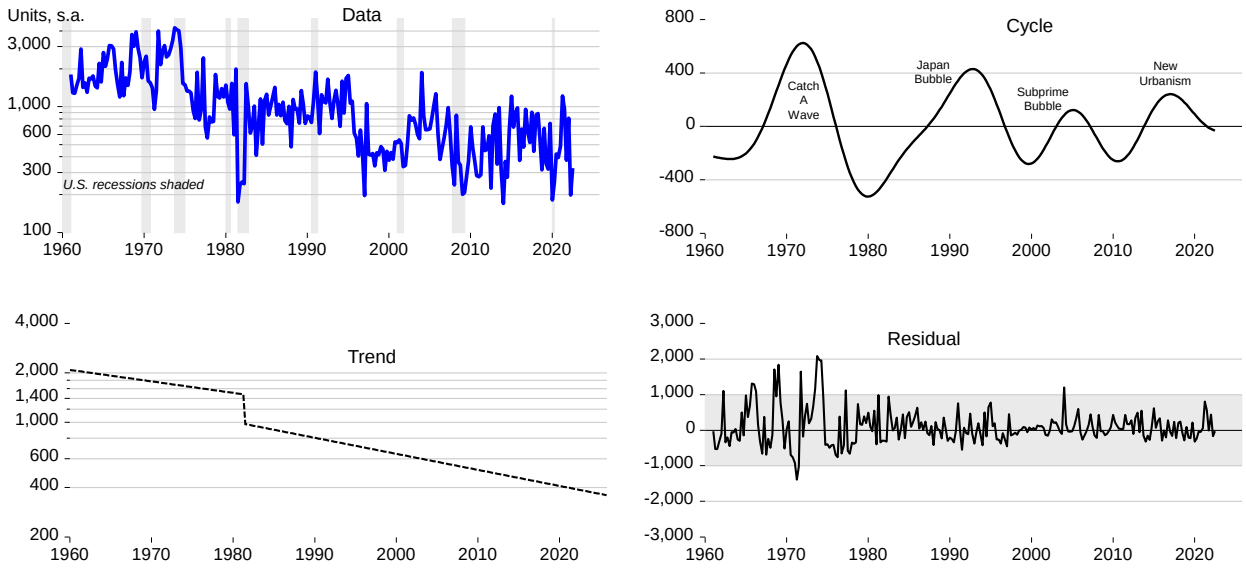
[22] Rachel Inafuku, Justin Tyndall, and Carl Bonham (April 2022), "Measuring the Burden of Housing Regulation in Hawaii" *UHERO Brief* (https://uhero.hawaii.edu/wp-content/uploads/2022/04/MeasuringTheBurdenOfHousingRegulationInHawaii.pdf).

Figure A4-3. Annual new Oahu housing units authorized by building permit: less is more



Sources: Honolulu Department of Planning and Permitting, Bank of Hawaii, Robert C. Schmitt (1977) Historical Statistics of Hawaii, UH Press, Hawaii DBEDT (http://dbedt.hawaii.gov/economic/qser/selected-county-tables/); nonlinear trend regression with endogenous breaks and dummy variables for extreme events.

Figure A4-4. Declining quarterly Oahu homebuilding outpaced demographic changes



Sources: County building department, Bank of Hawaii, Hawaii DBEDT (http://dbedt.hawaii.gov/economic/qser/selected-county-tables/); seasonal adjustment using Census X-13 ARIMA filter, pre-COVID-19 decomposition using Christiano-Fitzgerald asymmetric band-pass frequency filter assuming stationarity, and nonlinear regression with endogenous break by the author.