

**Insurance without Kin?
Private-Order Institutions in Gold Rush California**

Preliminary and Incomplete

Karen Clay

Heinz School of Public Policy and Management
Carnegie Mellon University
Pittsburgh, PA 15213
kclay@andrew.cmu.edu

Mercy Chang

Carnegie Mellon University
Pittsburgh, PA 15213
mercy@andrew.cmu.edu

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During much of history, the primary form of insurance against negative health shocks and the related income shocks has been the extended family. This paper presents an economic institution that enabled miners in the California gold rush to pool the risk of a negative health shock in the absence of kin, despite the commitment problem inherent in such risk sharing. Risk sharing was governed by coalitions – economic institutions in which common expectations, risk sharing, and information-transmission supported the operation of reputation mechanisms in the midst of the gold rush. Historical records, census data on household structure, earnings, and real estate holdings, and a game-theoretic model are used to examine these institutions. By highlighting the conditions under which such institutions emerge, this work sheds light on the ability to mitigate risk of negative health shocks in other settings.

1. Introduction

During much of history and in many parts of the world today, the primary form of insurance against negative health and the related income shocks has been the extended family (Townsend 1994, Udry 1994, Gertler and Gruber 2002, Fafchamps 2003). Yet, in some settings kinship networks have had limited ability to insure against these shocks. The limited ability to insure against these shocks had potentially serious repercussions. For example, a man who fell ill in the mines or on the battle field, the existence of men who were willing to assist him often meant the difference between life and death (Costa and Kahn 2003, 2007). Assisting the ill was, however, often a costly endeavor. The question is: Why did individuals stay and care for the ill in instances where they easily – and more profitably – could have left? In this paper, we present evidence that private-order institutions called coalitions, which arose during the California gold rush to pool the risk of negative health shocks in the absence of kin, provided incentives for men to provide costly assistance to other members of the coalition.

The California Gold Rush was the most rapid non-military migration in United States history (Clay and Jones 2007). The risks associated with participating in this rush were twofold. First, the journey itself carried significant risk of sickness, disability, and death. Second, once in California, the payoff to mining had high variance, which induced thousands of men to move from place to place seeking big payoffs. Within this context, individuals again faced significant risks of sickness, disability, and death. These risks arose from poor diet, sanitation, and housing and from the hard physical labor in wet conditions that characterized mining.

Historical evidence suggests that many miners who fell ill were cared for by other miners, often at significant personal cost (Rohrbough 1997, Johnson 2000). While some of those caregivers may have been motivated by altruism, the death of others from lack of care suggests that altruism was not pervasive. Something else must have been at work. We begin by presenting a theoretical model of a coalition. A coalition uses a multilateral reputation mechanism to allow participants to overcome a commitment problem (Greif 1989, 1993, 2006, Clay 1997). In this case, the commitment problem was that individuals could promise *ex ante* to provide care for other sick miners but, absent a coalition, would have an incentive *ex post* not to provide costly care when called upon to do so.

For a coalition to operate effectively, membership must be well-defined, norms governing the behavior of members must be in place, information must be transmitted to members regarding the behavior of other members, and members who did not adhere to coalition norms must be punished. We present evidence from diaries and letters and from the 1850 Census of Population, which suggests that all four conditions were met. Membership appears to have been based on place of last residence. For example, men from Michigan would seek out other men from Michigan both as travel companions to California and as individuals to live and work with once in California. Men were expected to care for cabin mates if they fell ill. Evidence from letters and the census is consistent with many individuals receiving and providing care. Information traveled by letter and in person to other individuals from Michigan who were in California and to individuals in Michigan regarding miners behavior. The surviving evidence suggests that the threat of punishment in both locations induced them to provide care.

Given the apparent benefits of membership in a coalition, one question is why some individuals seem not to have belonged to coalitions. Several explanations are possible. Individuals may have discounted the risk of a negative health shock and so not joined a coalition. They may have fallen ill before ‘finding’ a coalition to join or may not have had the personality or social ties necessary to join. Or individuals may have been a member of a ‘failed’ coalition. That is, the threat of punishment may not have been sufficient to ensure that the relevant caregiver(s) would provide assistance.

Our results inform a number of literatures. By documenting how these coalitions operated, this paper adds to the literature on institutions (Greif 2006, North 1990, 2005, Greif, Milgrom, and Weingast 1994, McMillan and Woodruff 2000). Moreover, understanding the conditions under which these coalitions emerged has implications for understanding the conditions under which similar institutions will emerge in other settings. In addition, the coalitions that we examine bear many similarities to – and faced many of the same problems as – and later sickness funds offered by industrial employers, fraternal organizations, and labor unions during the nineteenth century and early twentieth century (Murray 2007, Emery and Emery 1999, Thomasson 2002).

The paper is organized as follows. Section 2 presents background information on the gold rush and discusses the puzzle of miners caring for sick companions. Section 3 presents a model of a coalition. Section 4 presents additional evidence on key assumptions related to the model. Section 5 discusses similarities and differences between these decentralized private-order institutions and later sickness funds offered by industrial employers, fraternal organizations, and labor unions during the nineteenth century and early twentieth century in the United States. Section 6 concludes.

2. The Gold Rush

On January 24th, 1848 James Marshall discovered gold at John Sutter's mill in Coloma.¹ Information about the discovery of gold took most of 1848 to disseminate, beyond California. In March, the *Californian*, a San Francisco newspaper printed a story about the discovery of gold. But the streets of San Francisco did not immediately empty. In May, Sam Brannan arrived in San Francisco and began to advertise the arrival of the gold rush. A store owner at Sutter's Fort and the publisher of the *California Star*, Brannan stood to gain from any increase in gold mining activity. Brannan was convincing, and this time the streets emptied. In June, 1848, an estimated four to five thousand miners were at work in the gold district. In August, the *New York Herald* printed a story on the discovery of gold. And in December, President Polk confirmed the rumors in his address to Congress. By late 1848, the whole American nation and many foreign countries knew about California gold rush.

By December, 1849, the number of gold miners had risen to 40,000. The number of gold miners would peak at 100,000 in 1852.² For the period, 1849-1852, arrivals by sea are conservatively estimated at 167,000. Overland migration over the same period is less well documented, but lower-bound estimates are more than 160,000.³ Overland migrants would often end in Placerville or Sacramento, while the sea travelers would land in San Francisco and head to Sacramento. Men would obtain provisions and equipment to pan for gold. Once equipped, miners would disperse up into the foothills of the Sierras.

¹ Much of this section draws on Clay and Wright (2005).

² These figures come from contemporary estimates, summarized in Paul (1947), p. 43.

³ Estimates of overland migration are summarized in Wright (1940) p. 342. Passenger arrivals by sea may be found on p. 341. Note that a substantially higher figure for 1849 immigration is presented in the *State Register and Book of Facts* (San Francisco, 1857). Total arrivals were as much as 50 percent larger than the recorded 1852 non-Indian population of 223,856, suggesting that many newcomers had already left.

Illness, both on trip to California and once in California, was common. The causes included poor diet, sanitation, and housing and the hard physical labor in wet conditions that characterized mining.

Nearly every diarist and letter writer mentioned illness, typically more than once.⁴ James De Pue wrote to his wife in January of 1850 ““I do believe I have friends here that would not see me suffer if I should be sick but I hope I may not have to trouble them. But I do not know how soon I may be sick. I have seen more sickness since I have been here than I ever saw before.”⁵ In March 1850 S. Shufelt wrote to his cousin: “Wm Ramsdell & Cooke of our party were sick with the scurvy & could not work. This is the worst disease that we have to contend with here ... Some are also troubled with diarreah, others with ague & fever & various other diseases incident to all new countries. It is quite sickly here & every person ought to be very careful & not expose himself more than is necessary.”⁶ The physician Israel Lord wrote in his diary in May 1850 that “Mr. B. states that the Granville (Ohio) Company, to which he was attached, had 32 members, all of whom came through safe, and now more than one-third are dead.”⁷ In September 1850, Lord wrote “The mortality among the immigrants is much greater than last year, and hundreds of the sick.”⁸

The importance of sickness is underlined by evidence from sources other than letters and diaries.⁹ The first source is mining district constitutions, which were established to

⁴ In some cases, overland companies would stop for a day or two to allow the sick person to recover. Spooner (1849), p. 11. Headley (1849), p. 11 Cone (1849), p. 33

⁵ De Pue (1850).

⁶ Shufelt (1944), p. 17.

⁷ Lord (1999), p. 251.

⁸ Lord (1999), p. 294.

⁹ See also James Pratt’s December 1849 letter in Cumming (1974), p. 71; D. C. Downer and D. T. M’Collum’s letters in September 1849 and October 1849 in Bidlack (1960) and Baur (1949).

govern property rights in specific geographic areas. Of the 60 mining district constitutions written between 1850 and 1854 in the data set compiled by Clay and Wright (2005), fifteen constitutions explicitly exempted sick miners from work requirements. Given that miners were not required to mine every day to maintain property rights, additional provisions for sick miners suggest sickness was common and frequently prolonged. Further these provisions indicate that the miners were willing – at least in principle – to protect the property rights of the sick.¹⁰ The second source is the surviving written bylaws of mining companies (groups of miners who entered into partnership together). Stillman Churchill recorded the laws of the Oskaloosa Company. These laws were written in California after the company had been mining and so were likely to reflect actual practice. “Article 6th in case any member of the Co-y shall be sick while the Co-y are mining, he shall draw from the treasure one ounce a day until the Co-y can procure a hand to fill his place said hand shall be paid out of the members funds for who he shall labour & said member shall receive an equal propotion of all the earnings of the Co-y after such hand is procured.”¹¹

Caring for sick companions was costly. Caregivers faced high opportunity costs in terms of lost wages or earnings from mining. Losing even a half of a workday was significant, especially in light of the high costs of food. Further, the caregiver faced the risk of catching whatever the sick person had. According to the mortality statistics from the 1850 Census, the most common killers were cholera, diarrhea, fever, and dysentery.¹² All were communicable.

¹⁰ See also Zerbe and Anderson (2001, p. 132), who consider this both fair and efficient.

¹¹ Churchill (1849), p. 44

¹² Only 905 individuals are listed as having died within the last year in California by the census. This number almost certainly understates the overall death rate, however, since the question only asked about

Sick miners strongly desired care. What we know, both from the foregoing evidence and from evidence that we present later, is that men wanted to have someone to care for them when they were sick. Although there is no direct evidence on this point, if a miner had someone to nurse him when he was sick, his probability of survival would likely have been increased. For example, individuals with caregivers may have been less likely to have experienced dehydration or starvation. Even if it had no effect on survival, having someone to provide care made the experience less unpleasant for the sick miner.

Despite the high cost of providing care, men typically cared for sick male companions. For example, when Gordon Cone contracted typhus fever “I directed one of my men how to make some gruel and ... [told them] feed me once in fifteen minutes during the night.”¹³ George Evans noted that one of his friends “Mr. Parker, [was] an excellent and attentive nurse in sickness.” Jean-Nicholas Perlot in 1852 records in considerable detail his sickness, the sickness of several companions and neighbors, and nursing services that he and his companions provided for one another.¹⁴

The puzzle is why men stayed and cared for their companions given that one could abandon them and either continue to mine locally or move on to a new location. We examine four hypotheses regarding their behavior. These hypotheses are that incentives for cooperation (care for the sick) arose from: i) altruism, ii) a market for services, iii) friendship (a bilateral implicit contract), or iv) coalition (a multilateral implicit contract).

individuals who died in that location during the year ended June 1, 1850. Of these, 596 of the dead are listed as having lived in Sacramento county. Further, many of the mining counties list zero deaths, despite evidence from diaries and newspapers of sickness and death being common. On dysentery, see Bonniwell (1850).

¹³ Cone (1849), p. 187.

¹⁴ Perlot (1985), p. 142.

Altruism appears not to have been pervasive, and so at best explains a small fraction of the outcomes. William Daingerfield hints in a letter to his mother of the problem: “I pity the poor devil who is sick here without money. All come here to make money and the kindly sympathies are left behind them.”¹⁵ The historian Milton Quaife describes the situation as follows “The principle of “every man for himself” was most strictly followed out, and a sick man seemed to be looked upon as a thing to be avoided, as a hindrance.”¹⁶ William Taylor, a Methodist minister, spent time caring for the sick and dying in the San Francisco City Hospital in 1849. His description was grim: “There [at the hospital] are husbands and sons and brothers thousands of miles from sympathizing kindred and friends dying in destitution and despair.”¹⁷ These quotes and many other letters and diary entries suggest that altruism was not the norm. In a setting where the majority of men were altruistic, all of these men would have found individuals to nurse them.

The market for nursing services to a first approximation did not exist. Harvey Chapman’s letter to his wife illustrates the nature of the market for nursing services for the sick. Chapman wrote that when he was sick, “I had no one to stay with me in the tent and could hire no one.” Desperate, he enquired if there was a Mason in the crowd at the eating house and one man, being a fellow mason, agreed to nurse him until breakfast the next morning.¹⁸ Some doctors existed in the mines, but their knowledge was limited and their prices were high.¹⁹ Moreover, doctors would make brief visits, but they would not take on the tasks of a nurse such as feeding, cleaning, and comforting the patient.

Women represented about 3 percent of the population in the mining counties, so there

¹⁵ Quoted in Rohrbough (1997), pp. 319-320.

¹⁶ Quaife (1949), p. 63.

¹⁷ California Council of Humanities (1997), p. 238.

¹⁸ Quoted in Rohrbough (1997), p. 77.

¹⁹ Lord (1999), p. 195

were not many women who could have taken on the duties of nursing miners. Further, most women – even married women with children – worked as cooks, seamstresses, laundresses, or boarding house owners. Given their high earnings, they were unwilling to act as nurses for anyone except their immediate family. Miners could also go to a hospital, but there were relatively few hospitals. Crowded and hugely understaffed, the hospitals may well have increased the probability of death by exposing the sick to a variety of other diseases.²⁰

Given the limited supply of altruism and the virtually nonexistent market for nurses, men turned to friends, forming implicit and occasionally explicit contracts regarding mutual assistance. Some of the foregoing quotes provide evidence on these implicit and explicit contracts. In his social history of the mines, Malcolm Rohrbough states, “The mining company as a unit of work and living offered support in case of sickness and even in case of death. Here were the companions who would sit up with the ill miner, fetch the doctor, and make the soup.”²¹

The question is how these implicit contracts were enforced. Although in theory the contract could have been bilateral, bilateral contracts had two problems. The first problem was that a healthy caregiver might quickly face a situation where the present value of the future gains to the friendship if the individual survived were smaller than the opportunity costs of continued care and exposure to the disease. Thus the caregiver would abandon the sick friend. The problem is that the point at which abandonment occurred might well be premature in the sense that with continued care the miner might have recovered with reasonable probability. Altruism might cause the caregiver to stay

²⁰ Lord (1999), pp. 292, 296. On hospitals, see Bancroft (1884) and Lovell (1943).

²¹ Rohrbough (1997), p. 77.

longer than the purely economic calculus would suggest, but premature abandonment was still likely. A second problem with a bilateral contract was that it did not lead to optimal risk sharing. Two miners might easily become sick at the same time and so be unable to care for one another.

A multilateral contract addressed these problems by ensuring that premature abandonment would be punished by others and that risk could be shared among a larger group. In the next section, we provide a model of a coalition – a private order institution that overcomes the commitment problem by credibly threatening to impose multilateral punishment for failing to adhere to the terms of the contract. In section 4, we provide additional historical evidence to support the key assumptions of the model.

3. Model

In random matching models, pairs of individuals are randomly matched in each period and play a prisoners' dilemma game. Cooperation can be sustained in settings with perfect information and also in settings with limited but accurate information (Kandori 1992a).

Consider the following random matching game. In each period, two individuals (miners) are randomly matched. In each period, each miner decides chooses an action (care, abandon). Nature randomly chooses one of the players and that player gets sick with probability p . If both players remain healthy, both work and each receives a payoff e , where e is earnings from mining. If one player gets sick, the healthy miner either cares for him or abandons him. If the healthy miner cares for the sick miner (and so cannot work), the healthy miner receives a payoff of 0, while if he abandons the sick miner he receives a payoff e . Thus, the healthy miner would always prefer to abandon the sick

miner. If a sick miner is abandoned he receives a payoff $-s$, whereas if he is cared for he receives utility $-c > -s$. Thus a sick miner would always prefer to receive care. (One could allow for the slightly more complex version in which each player gets sick with probability p . If both get sick, then neither receives care and both receive $-s$.) If we assume that $-c > w - s$, this creates the following prisoners dilemma in expectation.

		<i>Miner 2</i>	
		<i>Care</i>	<i>Abandon</i>
<i>Miner 1</i>	<i>Care</i>	$w-wp-0.5pc, w-wp-0.5pc$	$w-wp-0.5ps, w-wp+0.5p(w-c)$
	<i>Abandon</i>	$w-wp+0.5p(w-c), w-wp-0.5ps$	$w-wp+0.5p(w-s), w-wp+0.5p(w-s)$

It is straightforward to show that in an environment with perfect information or limited but accurate information, an equilibrium can be sustained in which miners care for one another.

What actually happened in the gold mines departed from the game we just sketched in a number of ways. First, contracting in practice appears to have involved groups that were larger than two. This is slightly more complicated, but improved risk sharing, by diminishing the probability that all miners were sick simultaneously. If the probability of illness in each period is p and there are N miners, then the probability of all miners being sick simultaneously is p^N . In reality, the probability of being sick was not independent across miners, but as long as the probability of there being at least one healthy miner was increasing in group size, then there were benefits to larger groups. Group size will

ultimately be limited by coordination and communication costs and by the free rider problem. Within each group, one person was typically responsible for care of the sick miner, thus the pair wise interaction can be maintained.

Second, players were likely to match within a coalition, because within coalition information networks were relatively dense, whereas information networks outside of the coalition were sparse. For example, men who had most recently lived in Michigan may match with other men who had most recently lived in Michigan. This is permitted under random matching models. The game is partitioned into a number of smaller random matching games.

Third, within the coalition, matching (and rematching) was probably not random. The initial match, the propensity to rematch, and later matches were likely to have been endogenous. For example, among the set of men from Michigan, one might choose to match with an acquaintance or a friend of a friend rather than a stranger. Nonrandom matching may be permissible in random matching games under a variety of circumstances. (Skyrms 1994, 1996)

Fourth, miners' survival may have depended in part on the history of play. Although we modeled receiving care as only affecting utility, miners' chances of surviving may have increased if they received care when they were sick. For example, if a miner was abandoned he might die with probability 1, whereas if he was cared for, he might die with probability $a < 1$. Random matching games can accommodate finitely lived players (Kandori 1992b), but allowing the sequence of play to affect lifespan tends to make the game non-stationary. Hence we will continue to model survival as affecting utility but not survival.

4. Coalitions

For coalitions to operate, a number of conditions must hold. Membership must be well defined, norms regarding the behavior must be in place, information networks must inform coalition members of other members' behavior, and punishments for violation of norms must be defined. In this section, we present evidence showing that all four conditions held in California during the gold rush.

Coalition Membership

Coalition membership seems to have been related to birthplace or more likely to the state or country of last residence. This is not surprising given that travel companions were often from the place of last residence. This pattern is not, however, entirely explained by continued interaction with the original travel group. Re-matching with individuals outside the original travel group was common for a variety of reasons including personality, preferred location, preferred occupation, decision to return home, and death. We begin by presenting examples from diaries and then use data from the 1850 Census of Population to show that individuals were much more likely to live with individuals from their state or country of birth than we would expect if household formation were random.²²

Although some men would mine with their traveling companions, it was quite common to find new companions once in California. Usually the process began by dissolving the existing group. One recently arrived Argonaut wrote that his company "has

²² It is useful to keep in mind that the writers of diaries were clearly not a random sample of the population. Kenneth Owen notes: "Men and women from New England and its cultural hinterlands – particularly upstate New York, Western Pennsylvania, and the upper Midwest – tended more frequently to write letters, keep journals and diaries, and set down reminiscences than their fellow gold seekers from other countries and other parts of the United States. ... The same cultural impulse also made it likely that such records would be preserved and that a substantial number of these accounts would, sooner or later, appear in print." (Owens (2002), p. 10.) Yet, their experiences can still inform us about the gold rush.

all smashed up . . . I believe that every company that came out here has broke up.”²³

Benjamin Dinsmore noted that of his group “Four of the boys stopped at the City and the rest all started for the northern mines but James and I. We left the City at 4 o’clock p.m. for the south mines on the steamer S .B. Wheeler.” Charles Ross Parke and two companions from the overland trip, Captain Sampson and William Lorton, worked together for a while until Parke and Sampson decided to return to Illinois, leaving Lorton behind in California.²⁴ Horace Ladd wrote to his wife in late 1849, shortly after his arrival, “Our company are most of them scattered up and down this river at work mining.”²⁵

Social historian Malcolm Rohbough writes: “Not surprisingly, the 49ers once again tended to seek companions from the same town or county or, if necessary, the same state.” He provides two examples, a man from Boston who went to the mines with two others from Massachusetts whom he had met in California and a man from New York who found new companions from New York.²⁶ William Swain, a Michigan man, wrote to his brother George on January 6, 1850 of his mining companions. Three were from the group he had traveled with and two more were new additions.

He [Mr. Hutchinson], Mr. Bailey, myself, and Mr. Samuel J. Moore of Calhoun County, Michigan, a Methodist preacher; and Lt. Franklin Cannon of Manchester, Michigan, have agreed to work in the mines on the joint principle.^{27 28}

We now turn from the diary evidence to the 1850 Census of Population, which recorded the birthplace of the men by household, where household was defined by

²³ Rohrbough, p. 75.

²⁴ Parke (1989), p. 86.

²⁵ Cumming (1974), p. 68. See also, Boyle (1949).

²⁶ Rohrbough, p. 76.

²⁷ Swain (1850). <http://www.pbs.org/weta/thewest/resources/archives/three/swain2.htm>

²⁸ Additional evidence on the dispersion of old groups and formation of new groups will be presented when we discuss the information network.

individuals who lived in the same dwelling.²⁹ It is useful to begin by discussing about the determinants of household size. During this period, the available evidence suggests that household size was usually determined by the size of the mining company. Mining companies most often groups of men who worked together as partners. Partnerships tended to include three to six men with the optimal size being determined by technology. As early as 1848, miners began to use a “rocker” or “cradle,” with which three or four men working together could process a larger volume of “dirt” in a day. During the winter of 1849-50, the “long tom” was introduced. This instrument was an outgrowth of the cradle, but still larger, with two twelve-foot sections operated by three to six men, and requiring a continuous stream of water.³⁰ Larger groups had multiple cradles or long toms or had taken on tasks such as turning a river. Men in mining companies frequently lived together in a single dwelling or in multiple dwellings. More successful miners sometimes lived in hotels, which offered amenities such as food and a greater degree of privacy.

The data are 100 percent samples from the 1850 Census of Population for five mining counties – El Dorado, Mariposa, Sutter, Tuolumne, and Yuba. The sample includes 43,866 people living in 12,178 households. The median person in the full sample lived in a household with 5 people and 90 percent lived in households with 12 or fewer people.³¹ Table 1 presents summary statistics for the sample and various subgroups. The average person lived in a household with nearly seven people. Because there are some very large

²⁹ In some locations, there were multiple households living in the same dwelling, such as an apartment building. This was extremely rare in California.

³⁰ This discussion draws on Paul (1947), pp. 50-66. Quartz mining began as early as 1849, and enjoyed a speculative boom during 1850-52, followed by a collapse in 1852-53. As placer deposits became exhausted, quartz mining gained as a share of the total; but even in the 1860s, 90 percent of the state’s gold production derived from placers. *Ibid.*, pp. 286-7.

³¹ The median dwelling had 3 occupants and 90 percent of dwellings had 7 or fewer occupants.

residences, probably hotels, in the sample, the average number of people in a household is larger than the median. Only 14 percent of people lived in completely homogenous households (where everyone had the same birthplace), but 59 percent of people in the sample lived in households where at least half of the people were from the same birthplace.

We compute the household HHI, which is the sum of the squares of the shares of each birthplace within a household.³² It is useful to say something about the predicted range for the household HHI. If sorting were complete and we could observe the place of last residence, we would expect all HHIs to be 1. If sorting were random and we could observe the place of last residence, we would expect the average HHI would be relatively close to 0.125, since the median household size was eight and the probability that two or more people from any state would randomly live together, given that the largest state has only a 13 percent share, was relatively small. The fact that we can only observe birthplace and not the place of last residence will tend to depress HHIs, since even perfect sorting on place of last residence will not uniformly generate households where all individuals are from the same birthplace. The fact that the mean HHI was 0.48 and the median HHI was 0.39 suggests that significant sorting took place. The mean HHI for foreign born miners was 0.56, and the mean HHI for native born miners was 0.45.

In Table 2, we regress an individual miner's household HHI on his personal characteristics, the characteristics of his household, and in some instances his mining district. It is necessary to control for household size, because HHI is negatively related to

³² The HHI is the sum of the squares of the shares of each birthplace within a household. In a five person household, if all of the members were born in different states, the HHI would be $5 \cdot (0.2^2) = 0.2$. If they were all born in the same state, the HHI would be 1.

household size.³³ We restrict attention to the 32,751 individuals who were male, reported their occupation as miner, and lived in households with at least one other person. In these and all later regressions, we use robust standard errors and cluster standard errors by mining district. In column 1, we see that younger miners and foreign born miners lived in statistically significantly more homogeneous households. Being foreign born increased HHI by about six-tenths of one standard deviation at the median household size. The magnitude of the coefficient on foreign-born miners from English speaking countries is roughly the same as the magnitude to the foreign-born coefficient but of opposite sign. This implies that foreign born miners from English speaking countries were more similar to native born miners in terms of their household homogeneity.

In column 2, we add controls for the share of individuals in these counties who were from the miners same place of birth and a dummy variable for whether the household was all male to the variables in column 1. Having a greater share of individual from your place of birth could have made it marginally easier to form a homogeneous household. For all but the very smallest birthplaces, however, individuals could have formed a homogeneous household if they were so inclined. Both suggest that the coefficient on share birth is likely to be positive but small. Indeed, the coefficient is positive and statistically significant, but small. A one standard deviation increase in share birth at the median household size (5) yields one-tenth of a standard deviation increase in HHI. The coefficient on the dummy variable for an all male household was positive and significant, but small.

³³ For example a two person household with 2 people from different states would have an HHI of 0.50, while a ten persons household with 10 people from different states would have an HHI of 0.10.

In column 3, we add controls for district fixed effects to the variables in column 2. A district is the county for Mariposa County and a geographic district within a county for the other four counties. The effects are qualitatively similar. In column 4, we divide the share of birth variable into two variables, the share that came directly from their state of birth and the share that came indirectly via another state or country.³⁴ The effect of a one standard deviation increase in direct at the median household size (5) yields about two-tenths of a standard deviation increase in HHI. The effect of a one-standard-deviation increase in indirect at the median household size yields less than a one-tenth of a standard deviation decrease in HHI.

What we find is that the mean and median HHIs (0.48, 0.39) were large given that an HHI for a household with 8 randomly chosen individuals would be close to 0.125. Further, of the 33,062 male miners who lived in households of two or more people, 5,055 lived in households where everyone had the same birthplace (an HHI of 1). The marginal effects of being foreign born were substantial, in the sense that foreign miners lived in households that were about six-tenths of one standard deviation more homogeneous than native born miners. The marginal effects of other variables were typically small, however. This suggests that most miners found it useful to sort into relatively homogeneous households, irrespective of their personal characteristics.

Norms

The norms regarding care for sick miners appear to have been fairly clear. Miners were expected to care for companions if they were too sick to care for themselves. This norm is alluded to by James de Pue in his discussion of friends taking care of friends. It

³⁴ These shares are imputed based on the transition paths reported in the 1852 Census of Population, which asked individuals to report their state of birth and their state of last residence.

was also hinted at in some written contracts. A Wisconsin company wrote in their bylaws prior to departure for California “In case of sickness or accident, it shall be the duty of every other member of the company to take care of the sick or otherwise disabled member.”³⁵ William Ryan, a Englishman in the American military who happened to be in California in the fall of 1848 gold rush listed in his journal the rules by which the various groups of former military men agreed to be governed. “7. That no sick man shall be abandoned, but every possible means adopted to restore him to health.”³⁶ The norm was also illustrated fairly forcefully by an incident recounted by Susan Johnson in her book Roaring Camp. In 1849 a group of miners from the Sandwich (Hawaiian) Islands tried to offload the care of a sick miner in their group onto another miner, William Miller, who was also from the Sandwich Islands and lived nearby. Miller refused, telling them that the sick man was their responsibility. He wrote in his journal” “It is D-D [damned] hard ... If people ... that are in Partys together And have Sick men Amongst them that they Should be Unwilling to take Care of them.”³⁷

Two norms appear to have made it easier to support care. The first norm was financial transfers from healthy miners in the group to the caregiver. These transfers took place in the context of group profit sharing. The caregiver, and sometimes the sick man, continued to have a claim on group profits. Often the weakest man was chosen to be the caregiver, because his absences had the least impact on group productivity.³⁸ These transfers did not fully mitigate the cost to the caregiver, however, because total profits were lower and the caregiver still faced an increased risk of infection. The second norm

³⁵ Herrmann (1940), p. 172

³⁶ Ryan (1850), p. 212.

³⁷ Johnson (2000), pp. 128-129.

³⁸ Johnson (2000), p. 128.

was financial transfers from the sick miner to the caregiver. Much of the evidence for the second norm comes from claims against dead miners' estates for nursing and other expenses. These transfers almost certainly did not fully mitigate the cost either, since many of these bills probably went unpaid. Finally, it is worth noting that neither norm was universal – the terms of the implicit contract varied regarding issues such as the sick miner's share of the earnings and who should pay for the doctor and any extended nursing.³⁹

Information network

For a reputation mechanism to link past behavior and future payoff, an information network must be present. The information network that transmitted information among miners – including information about how miners treated sick companions – operated at a minimum of three levels: within a mining district in California, between mining districts in California, and between California and miners' home states. Within the mining district, miners could often directly observe how the sick were treated or would hear about it firsthand.

Although miners could not observe what happened across mining districts, the information networks among men who were from the same state of last residence were strong. Historian Malcolm Rohrbough describes the process by which information flowed. "The seasonal relocation of Argonauts in response to the arrival of winter in the diggings further dispersed camps and local mining companies. That men circulated from one camp to another, and sometimes in the winter into the growing villages and cities of the gold country, including San Francisco, created random encounters with other

³⁹ Rohrbough, pp. 77-78.

members of the home community. These chance meetings led to letters of collective information.”⁴⁰

The extent of the information network both among miners in California and between California and friends and family back home is suggested by a letter that S. A. Colvin wrote to his wife back in Missouri on October 6th, 1850 which was reprinted in the Louisiana, Missouri Democratic Banner.

I found here a number of my old acquaintances who came out last year; to wit: ROBERT SHAW, DUDLEY PHEARS, HARVEY WILSON, ISAAC and JOEL RIPERDAN, MARCUS OCHEL TREE and C. F. KIRTLEY, of Palmyra, Mo. I also saw GEORGE OGLE, D. J. ALMOND, HENRY CROW AND DR. B. F. TODD, who came this year. They were all in good health, except Ogle, who looked quite badly, but he was able to work. George told me he had seen T. FORD a few days before on the Yuba River, he was well, but had had bad luck; he bought some cattle to sell again and had them driven off by Indians.

As there are many here who had relations and friends in Pike and adjoining counties, who may be anxious about them, I wish you to send a copy of this to THE BANNER and RECORD, at Louisiana, and have it published, and keep the original yourself. I will tell you their names and places of abode at present, so far as I know: Mr. Crow & Co. are at the mouth of Feather River with their cattle. J. Z. & T. H. JAMESON of Lincoln County, Mo. are on Yuba river, 25 miles distant, Z. W. and ROBERT BROWN, all of the same county, are on Bear River, 15 miles; EPHRAIM CULLOP, DENNIS GRANDFIELE, B.A. WILLIAMS, H. C. REEDS, JOHN F. MCNUTT, WM. COFFEE, GEORGE HAMMOCK and J. T. MYERS, of Lincoln, on the Yuba. I will now give the names from Pike; J. P. PATTERSON, of Paynesville is here, JOHN WORTHLEY and WILLIAM F. JACOBS, are on Bear River, 15 miles. LEONARD PECK went on with CROW to Mt. Vernon at the mouth of Feather river, also JAMES T. EASTIN, T. C. JOHNSON, WILLIAM DOAKE, and RICHARD FICKLIN. FRANCIS and WILLIAM MCMANAMA, from Scotland County went with CROW. J. W. GILLUM of Lincoln is at Steep Hollow.⁴¹

⁴⁰ Rohrbough, p. 85.

⁴¹ S. A. Colvin letter reprinted in the Louisiana, Missouri Democratic Banner, December 30, 1850. Available at http://freepages.genealogy.rootsweb.com/~crow2000/CAgold_rush.htm#colvin. See also James C. Cooper letter of June 6, 1850. Available at http://www.tngennet.org/lewis/gold_rush_letters.htm F. E. Weston letter of December 13, 1849, reprinted in the Chester Herald and Commercial Advertiser, Chester (Randolph County) Illinois on March 2, 1850. Available at <http://www.cagenweb.com/cpl/letter1.htm>. Russell K. Roger's letter of May 23, 1852 mentions the large number of Vermonters in California (Bonfield (2006), p. 8).. E.S. Camp letter of February 1850 listing the activities of many men from Marshall Michigan in Cumming (1974), p. 119.

The letter went on to mention several other friends and acquaintances as well. Colvin's letter was unusual for the number of people mentioned. This probably reflected the fact that he had asked his wife to have the letter published.⁴²

Another Missourian, Edward Murphy sent a letter from California dated September 2nd, 1849, which was reprinted in the Missouri Whig, Palmyra. Murphy also passes along much information on friends and acquaintances:

I have heard that Mr. Muldrow's company broke up and went home--that their oxen were too young to stand the trip; and again, that he traded all his young oxen off for older ones, and that he was still on the road. I hear of Jas. Dudley and his mess. They are far, far behind, with the finest and fattest cattle on the route; but I am afraid they will suffer a great deal before they get through. Hazelip, Hart and Winlock are now in California; However I have not seen them. I beat them through. James Morell, with the Hannibal company, are here. I have not seen Morell, Gen Willock I saw but a few days ago at Suter's Mill. ... Gen W. has been a little unwell within the last few days, but is now much better. I heard from him to-day. Hiram Taylor is within twelve miles of me. I heard of him through Gen. W. He is sick at present at a place he owns at Green Springs. Taylor is the son of Colonel Taylor, who lives near Palmyra. He has plenty of gold.⁴³

Many other surviving letters provide information on friends and acquaintances.⁴⁴ Not all of the information was positive – some letters reported misdeeds.⁴⁵

Punishment

For a coalition to work, the threat of punishment must be credible. On the equilibrium path, if the punishment is credible, however, we will see very little punishment. One of the few instances of attempted abandonment of a sick companion that we observe is the case in which the group of miners from the Sandwich Islands tried to force William

⁴² It was common for newspapers to reprint miners' letters home. Local newspapers also printed lists of departing miners and the death notices of miners who died in California.

⁴³ Edward Murphy letter September 2, 1849, published in Missouri Whig, Palmyra November 29, 1849. Available at: http://www.rootsweb.com/~momarion/sept2_a.htm. The Missouri Whig reprinted many letters, which are available at <http://www.rootsweb.com/~momarion/goldrush.htm>

⁴⁴ See Rohrbough pp. 84-6. Fairchild (1931), pp. 120-121. Palmer (1947), p. 256. Delano (1952), pp. 42-43. Spooner (1849), pp. 26.

⁴⁵ Rohrbough, p. 321.

Miller to take care of the sick companion. Miller refused, but we know nothing about the subsequent fate of the sick miner. The threat of sanctions by nearby miners, by other miners from the same state, and by friends and family back home was likely credible for some men, because we see many examples of men caring for sick.

Further, there is indirect evidence from the 1850 Census of Population that is consistent with miners caring from their friends. What we will show is that individuals in more homogeneous households (higher HHIs) had slightly lower levels of earnings and wealth. This may have arisen in two ways. First, individuals who had lower wealth or earnings may have sorted into more homogenous households to mitigate the risk of having low earnings or being unable to work due to sickness or accident. Second, because they sorted into more homogenous households, individuals in these households may have had to expend both time and money helping household members, which could have adversely affected their earnings and possibly their wealth.

Table 3 examines the relationship between household composition and average daily earnings from mining and the relationship between household composition and real property holdings. In columns 1-3, we examine the determinants of daily earnings from mining. These data were collected by the enumerator for El Dorado County, California and were not part of the standard set of census questions. About 40 percent of individuals in El Dorado County reported positive earnings. In Clay and Jones (2007), we examine the characteristics of those likely to report earnings and do not find any evidence of selection biases. Those not reporting earnings appear to have been recent arrivals who had not mined for very long. The median individual who reported positive

earnings stated that they were making \$4 per day. This value is in line with other contemporary evidence on earnings from mining.

In column 1 of Table 3, we examine the determinants of earnings. The coefficient on HHI is statistically significant and negative. A one-standard deviation increase in household HHI translated into earnings that were about 4 percent (\$0.16) lower. One thing to keep in mind is that although the magnitude of the relationship between HHI and earnings is relatively small, the increased utility associated with a greater likelihood of care when sick may have been large. None of the coefficients on the other variables is statistically significant and the fit is poor. In column 2, we add district fixed effects to the variables that we used in column 1.⁴⁶ HHI remains statistically significant and negative, but the effect is considerably smaller. A one-standard deviation increase in household HHI translated into earnings that were about 1.6 percent (\$0.06) lower. In addition to the coefficient on HHI, the coefficient on foreign born is negative and statistically significant. Controlling for HHI, individuals who were foreign-born had average daily earnings from mining that were about 7 percent lower than individuals who were native born. In column 3, when we control for household size in addition to the variables in column 2, the coefficient on HHI remains negative, but is no longer statistically significant.

In columns 4-6, we examine the determinants of reporting positive real estate wealth. Because real estate wealth was a standard question on the 1850 Census of Population, the sample covers all five counties.⁴⁷ Only about 10 percent of the sample reported positive

⁴⁶ In an unreported regression with district fixed effects, the effect of HHI on real property was negative but insignificant.

⁴⁷ Ideally, we would have a more relatively precise measure of wealth, but the 1850 Census of Population only asked about the gross value of real estate holdings. What was real estate wealth really measuring?

real estate wealth, so the question is not as much how HHI affected the level of real estate wealth, but rather how HHI affected the probability of reporting a positive value. The coefficient on HHI in column 4 is, surprisingly, positive and statistically significant. In column 5, when we control for district fixed effects in addition to the variables that we controlled for in column 4, coefficient on HHI remains positive, but is now small and statistically insignificant. In column 6, when we control for household size in addition to the variables that we controlled for in column 5, the coefficient on HHI is now negative, small, and marginally statistically significant ($p=0.135$).

In sum, Table 3 shows that living in a household with a higher HHI – that is, living in a less diverse household – may have been associated with slightly lower earnings and wealth. This is consistent with individuals using household homogeneity to insure against risk, particularly health risks in which a member of the household would forgo work in order to nurse the sick individual. Although the magnitudes of the effect were relatively small, the increase in utility associated with the insurance may well have been large.

We have presented evidence that the necessary elements were in place for a private-order institution, a coalition, to provide incentives for men to care for sick companions. Not all men were members of coalitions, nor is it necessarily the case that all members of coalitions had the appropriate incentives. Those who did not want to live or work with others from the same place of residence in the future or to return home may well have

Real estate wealth is a complicated metric in this context, for a number of reasons. First, it was almost certainly true that individuals who owned real estate were less likely to migrate. Second, those who owned real estate may have sold it to finance trip. Third, if the holding was in California, prices were fluctuating daily, so the accuracy of the reported value was likely to be lower than in other parts of the U.S. Fourth, much of the real estate that individuals reported owning in California may have represented ownership of use rights to mining claims.

abandoned their companions. Yet what we observe is that men consistently chose to live with others from the same state or country of birth, that many sick miners were cared for despite the high cost to the caregiver, and that more homogenous households had slightly lower earnings and real estate wealth, which is consistent with them expending resources to care for companions.

5. Later Developments in Insuring against Sickness

During most of history, individuals have used precautionary saving, children, and extended family to insure against sickness. Family members usually provided two distinct services: nursing and financial support. In principle, individuals could have been hired to nurse the sick, but absent monitoring by someone other than the patient, nursing was likely to be subject to moral hazard. Relatives, if the relationship with the patient was positive or if reputation within the family was important, had an incentive to expend the resources necessary to help the patient recover. Although the family members providing nursing services could coincide with the family members providing financial support, the two groups were often distinct. Close female relatives acted as nurses, whereas older children and more distant male relatives often provided financial support. Financial support took two forms – payment for doctors and payment for everyday living expenses such as food, shelter, and clothing. Until the mid twentieth century, payments for doctors and medicines were a relatively small share of the cost of being sick or disabled. The more significant issue, at least for adult males, was the lost wages.

Family was, however, often not the ideal unit to provide insurance. For instance, outcomes within the family were often positively correlated, and benefits and obligations were not clearly defined, leading to distorted incentives. Under these conditions, one

might expect a market to arise to address these problems. A market did arise, but prior to the emergence of a full-fledged market, we observe the rise of private organizations that were designed to address the moral hazard and adverse selection problems inherent in the market for sickness insurance.

The coalitions that emerged in the gold rush to insure against sickness are an early and somewhat unusual example of such organizations. The coalitions are unusual in that they provided both nursing services and financial services, whereas most contemporary and later organizations only provided financial services.⁴⁸ Coalitions are also unusual in their ability to combat adverse selection and moral hazard. Because coalitions formed privately, individuals could simply refuse to live with or form economic enterprises with other men who seemed sick or weak at the outset. Thus, the adverse selection problem was in some ways less severe than it would be in later settings, whether fraternal or industrial. In the gold rush, men who were sick or weak simply sought other jobs, often jobs that carried a lower risk of further sickness or injury than mining. In these jobs, they may have had both less need of insuring against sickness and less ability to insure against sickness than miners. Moral hazard could arise if a miner found it advantageous to fake sickness or exaggerate existing sickness to avoid work. Faking sickness while living with the insurers may have been difficult, however. Further, sick miners did not always share in the daily profits, so while a lazy miner might get fed, he would hardly get rich. Further, sickness was expected to be temporary, and individuals who were sick but not bedridden were often given the chore of cooking for the other miners.

⁴⁸ A few organizations did send individuals to help the sick person, but this appears not to have been very common.

Industrial, union, and fraternal organizations that provided sickness insurance in the late nineteenth and early twentieth century took many of the same approaches to mitigate adverse selection and moral hazard. Sick and old members were not allowed to join, or if they were, sickness due to pre-existing conditions was not covered.⁴⁹ Waiting periods applied. If a claim was made, benefits were typically low, with replacement rates averaging around 60 percent, and were only guaranteed for a fixed number of weeks, often about 13 weeks. Often members or physicians monitored patients to guarantee that they were not malingering or engaging in activities likely to prolong their illness (such as going to bars). Coverage was also limited to sickness and in many cases excluded certain types of sicknesses or accidents.

Interestingly, many individuals with access to sickness insurance chose not to participate, preferring instead to self-insure. Emery and Emery (1999) show that participation in fraternal insurance was a life-cycle phenomenon. Younger men with young families tended to participate, because they had not yet built up enough assets to self insure, nor were their children old enough to provide substantial income. Even at firms with sickness insurance, in 1908 only 48 percent of employees chose to participate.⁵⁰ The low participation rate may also reflect the fact that men in some states were covered for industrial accidents through workmen's compensation.⁵¹

Today, many employers in the United States (and many governments in other countries) both provide and require disability and medical insurance. Medical insurance has become prevalent as medical technology has improved, increasing both the cost and the quality of the outcomes. In the nineteenth and early twentieth century, medical care

⁴⁹ Much of this discussion draws on Murray (2007).

⁵⁰ Murray (2007), pp. 93, 118.

⁵¹ See Fishback and Kantor (2000).

was not particularly effective, so expenditures yielded few benefits. Required participation mitigates some of the adverse selection problems for both types of insurance. Monitoring continues to be used to mitigate the moral hazard problem.

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Appendix: Data Quality Issues for the 1850 and 1852 Censuses of Population in California

The 1850 census in California has suffered from a number of criticisms, including the loss of data, under enumeration, duplicate enumeration, and at least implicitly the possibility of falsification. The first criticism is correct – according to the census the returns for Contra Costa, Santa Clara, and San Francisco Counties were lost or destroyed by fire.⁵² Given the rapidity with which people were arriving, the second criticism, under enumeration, is also almost certainly accurate. Specific locations were only enumerated once and so provide information on who was there at the time of enumeration. Because enumeration occurred over the course of a year, later arrivers could have been missed, as could individuals in more remote locations. We indirectly control for this issue by including the date of enumeration in some regressions.⁵³

The third criticism is duplicate enumeration. For an individual to be enumerated twice in our sample, they would have to be present in locations in multiple counties where the census was being taken. To check this, we examined every 28 year old man who was born in Massachusetts who showed up either in our data set or in the IPUMs set in California. Twenty-eight was the most common age and Massachusetts was the second most common birthplace. Of the 95 men who listed their age as 28 and their birthplace as Massachusetts, there was only one possible first name last name match, B. Wright and B. Y. Wright. They each lived with one other man and those men had different names, suggesting that these were probably – although not definitely – different men. This by no

⁵² <http://www.census.gov/prod/cen1990/cph2/cph-2-6.pdf>

⁵³ Most districts or towns were enumerated over the course of a few days.

means exhausts the possibility of duplicate enumeration, but it does suggest that it probably was not extremely prevalent.

The fourth criticism is falsification of the census. The quality of the enumerators appears to have varied. The enumerator for El Dorado County was unusually diligent in that his returns are complete and even have additional data on earnings of miner. The enumerator for Yuba County appears to have been less diligent. For example, he appears to have omitted literacy measures entirely. Although there is no way to directly check for falsification, all of the returns showed substantial variation both within and across pages in names, birthplaces, ages, occupations and the number of individuals per dwelling and household. Further, the census was taken during two time periods – the spring and the fall – suggesting that the enumerators were miners who were working for the federal government in the off season. This gives us greater confidence that the enumerators were actually out in the field conducting the enumeration.

As long as the 1850 Census provides an approximately random sample of people who were in California at the time, it can shed new light on the gold rush. Because most of the focus will be on native born men, any problems of under enumeration of foreign-born men will have little impact on the results. In fact, we only need the 1850 Census to be an approximately random sample of native born men who were in California. This appears to be the case.

The 1852 Census of Population suffers from a number of deficits including under enumeration of the foreign-born and the destruction of the original census returns after they were transcribed by a WPA project.⁵⁴ As with the 1850 Census, because we are not

⁵⁴ See Index to the 1852 California Census (2005), Introduction for specifics on the problems with the 1852 Census.

focusing on the counts, all that we need is that the transcribed records were approximately a random sample of native born men who were in a particular location (El Dorado County). To the extent that they were, we can use the information in the 1852 Census to impute states of last residence based on birthplace for the richer 1850 data.

Figure 1: Map of Area Covered by Counties in Sample

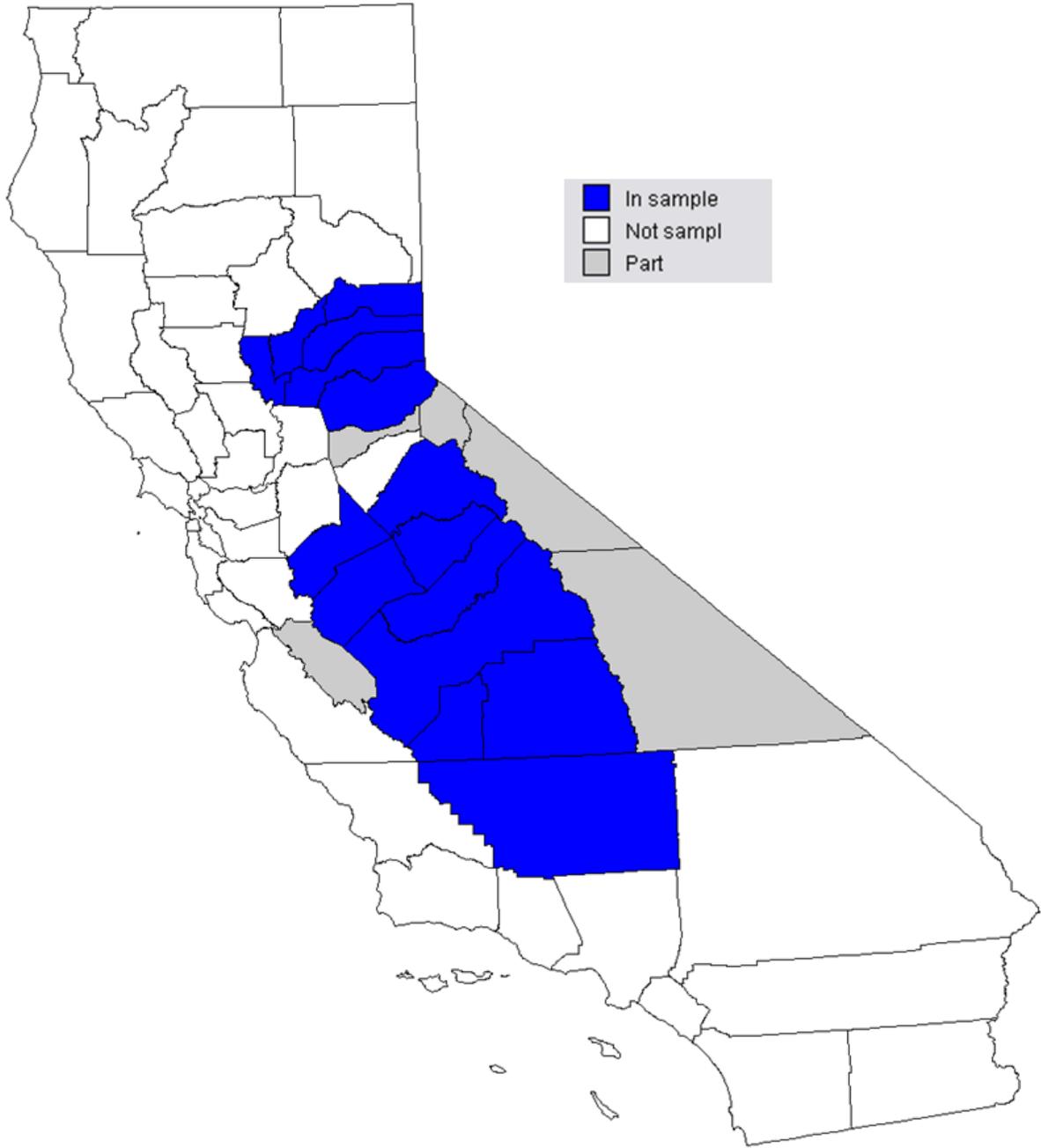


Table 1: Households of two or more in El Dorado, Mariposa, Sutter, Tuolumne and Yuba Counties

	Observations	Share of sample	Mean Household size	Share living in homog. birthplace household	Share in hhlds where ≥ 0.5 from the same birthplace	Household HHI
All	40,629	0.94	6.8	0.14	0.59	0.47
Male	39,113	0.90	6.8	0.14	0.59	0.47
Male miner	32,707	0.75	6.7	0.14	0.60	0.47
Native born male miner	25,472	0.59	6.6	0.11	0.57	0.45
Foreign-born male miner	7,235	0.17	7.1	0.26	0.70	0.57
FB male miner, English-speaking	2,480	0.06	5.7	0.16	0.60	0.48
FB male miner, non English-speaking	4,755	0.11	7.9	0.31	0.75	0.62

Notes: The sample includes 43,866 people in total.

Table 2: Determinants of the HHI of an Individual's Household

	(1)	(2)	(3)	(4)	(5)
Dependent Variable	HHI	HHI	HHI	HHI	HHI
Age	-0.000798*** (0.00025)	-0.000782*** (0.00025)	-0.000970*** (0.00023)	-0.000529** (0.00024)	-0.000568*** (0.00019)
White	0.0206 (0.025)	0.0162 (0.021)	0.00379 (0.019)	0.00389 (0.016)	-0.00293 (0.016)
Fborn	0.183*** (0.023)	0.193*** (0.021)	0.201*** (0.023)	0.197*** (0.018)	0.190*** (0.019)
Fbornenglish	-0.165*** (0.024)	-0.158*** (0.022)	-0.162*** (0.022)	-0.123*** (0.019)	-0.119*** (0.019)
Shbirth		0.632*** (0.092)	0.727*** (0.084)		
All male household		0.0410** (0.016)	0.0335* (0.019)	0.0281 (0.017)	0.0190 (0.015)
Direct				2.212*** (0.28)	2.198*** (0.29)
Indirect				-0.654*** (0.22)	-0.635*** (0.21)
Household size FE	Yes	Yes	Yes	Yes	Yes
District FE	No	No	Yes	Yes	Yes
Occupational FE	Only miners	Only miners	Only miners	Only miners	Yes
Constant	0.299*** (0.032)	0.259*** (0.033)	0.203*** (0.026)	0.184*** (0.023)	0.181*** (0.022)
Observations	32,751	32,751	32,751	32,401	38,424
R-squared	0.21	0.22	0.29	0.30	0.30

Notes: The sample includes all male miners living in households of at least 2, except individuals who did not report age (311 individuals). The standard errors are reported in parentheses. All regressions use robust standard errors clustered by mining district. The level of significance is denoted as follows: *** p<0.01, ** p<0.05, * p<0.1.

Table 3: Average Daily Earnings from Mining and Real Estate Wealth

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	larnings	larnings	larnings	posprop	posprop	posprop
HHI	-0.191*** (-0.061)	-0.065* (-0.035)	-0.059 (-0.040)	0.090*** (-0.027)	0.0009 (-0.0065)	-0.018** (-0.0077)
Age	0.00077 (-0.00088)	0.000376 (-0.00068)	0.000277 (-0.00073)	0.00693*** (-0.00150)	0.00714*** (-0.00150)	0.00710*** (-0.00150)
White	-0.0416 (-0.1000)	0.0969 (-0.0630)	0.0933 (-0.0560)	0.0771*** (-0.0180)	0.0630*** (-0.0170)	0.0615*** (-0.0170)
Fborn	0.029 (-0.032)	-0.0694*** (-0.0190)	-0.0706*** (-0.0190)	-0.0772*** (-0.0200)	-0.0429*** (-0.0120)	-0.0410*** (-0.0120)
Fbornenglish	-0.0688 (-0.0610)	-0.00776 (-0.03200)	-0.00623 (-0.03400)	0.0701*** (-0.0200)	0.0204* (-0.0120)	0.0171 (-0.0110)
District FE	No	Yes	Yes	No	Yes	Yes
Household Size FE	No	No	Yes	No	No	Yes
Observations	9,040	9,040	9,040	32,751	32,751	32,751
R-squared	0.01	0.29	0.30	0.05	0.16	0.16

Notes: Earnings were only collected for El Dorado County, and only individuals reporting positive levels of earnings are included. Positive property includes all male miners living in households of at least 2, except individuals who did not report age (311 individuals). The standard errors are reported below the coefficient. All regressions use robust standard errors clustered by mining district. The level of significance is denoted as follows: *** p<0.01, ** p<0.05, * p<0.1.